Action Plan for the Conservation of the Danube Clouded Yellow *Colias myrmidone* in the European Union

final draft
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THE N2K GROUP
European Economic Interest Group

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Preface/Introduction

Species Action Plans answer the acute risk of extinction of a species and represent one of the last chances of conservation when simpler solutions fail. The implementation of action plans is a great challenge for conservation biologists, as effective saving of a threatened species is based on fast, well-coordinated removal of threatening factors, most often large-scale and complex unfavourable changes in the environment of the species concerned. This is the case of the Danube Clouded Yellow, one of the fastest-disappearing European butterfly species. The species is confined to Central- and Eastern-Europe, where it inhabits landscapes traditionally managed by extensive pasturing. This type of management is, for reasons of socio-economic reasons, being gradually replaced by more intensive systems. With the disappearance of the traditional land use, the Danube Clouded Yellow quickly vanishes, and with it a whole complex of extremely valuable plant and animal species requiring the same biotope type.

In response to the rapid decrease of *Colias myrmidone*, this Species Action Plan, supported by the European Commission, was prepared to avert the extinction of the species in the EU.

The aims of the plan are:

- to gather information on the ecology, status and claims of *C. myrmidone*
- to identify the most important factors threatening populations of this species
- to define the necessary steps to preserve *C. myrmidone* in the EU and subsequently to achieve its favourable conservation status

The information and solutions presented within this action plan are the result of a thorough review of available literature, the involvement of a majority of experts in the species, and the compilation of their extensive and often unpublished knowledge and experience.

Summary

The Danube Clouded Yellow *Colias myrmidone* is a large orange-yellow butterfly with conspicuous black wing margins. It is one of twelve European representatives of the worldwide distributed and species-rich genus *Colias*. *C. myrmidone* inhabits a mosaic of warm, traditionally managed meadows, pastures, orchards, open forests and woodland margins in the belt of forest-steppes running from central Europe to western Siberia. Larvae develop only on young and re-sprouting twigs of different *Chamaecytisus* species. Older branches are not used. Because of this specialism, *C. myrmidone* is highly sensitive to cutting or grazing of host plant in all its developmental stages (eggs, larvae, pupae). In order to survive, the butterfly inhabits a mosaic landscapes and has highly mobile adults, which are capable of locating suitable habitat areas with young growth. It thus occurs as metapopulations covering large areas and requires conservation at the landscape scale.

The European Union species range is limited to central Germany, northern Poland, Slovenia and Romania. Occasional records also exist beyond these borders in the past (Bulgaria, Latvia, NW Germany). The range continues through Belarus, Ukraine and southern parts of European Russia to north-western Kazakhstan. *C. myrmidone* is one of the fastest disappearing butterflies in the EU. Out of eleven EU member states with former populations, it now survives only in Poland, Romania and Slovakia, where the dramatic population declines and range contractions still continue.

*C. myrmidone* is
- listed on Annex II of the Habitat Directive
- in an “unfavourable bad” conservation status in the Czech Republic, Hungary, Slovakia and Slovenia. In Poland it is “unfavourable inadequate” conservation status, all other MS do not list it in their reference list.
- listed as Critically Endangered within the EU 27 and Endangered in Europe as a whole in the new Red List of European Butterflies (Van Swaay et al., 2010)

Threatening factors have been recognized on three distinct, but overlapping spatial scales:

- Global scale – climate change is the most important factor on this scale. *C. myrmidone* is regarded as a species extremely threatened by climate change.
- Landscape and population scale – large scale changes of agriculture and forestry caused by socio-economic changes in the countryside over recent decades, especially the transition from small grain mosaic management to more uniform and intensive types systems. These factors disrupt the proper functioning of the species’ metapopulations.
- Habitat scale – factors affecting core breedings areas:
  - Intensification of management – uniform and comprehensive mowing of meadows, intensive grazing of pastures, loss of open forest and wood pasture systems. This leads to the elimination of the species developmental stages, suitable host plants and nectar sources for the adults.
  - Abandonment and insufficient management – lead to overgrowing of meadows and pastures with bushes and trees, vegetation structure changes and subsequent loss of host plants.
  - Complete change of land use – such as afforestation or conversion to arable land, with catastrophic loss of habitat.

The ultimate goal of this Action plan is to “Restore the Danube Clouded Yellow *C. myrmidone* to a favourable conservation status within the European Union”. The goals consists of two overarching elements:
- to stop the decline in distribution and the decrease in population size of all remaining populations.
- to secure the status of the species by restoring populations in regions and countries where it became extinct in recent years.

**Action is needed urgently to conserve the last remaining populations in the European Union and maintain and improve suitable land-use and management.** Declines of populations and local extinctions are still being regularly observed.

The main objectives of the plan are as follows:
- Ensure proper management of all localities that still hold *C. myrmidone*.
- Fill the gaps in knowledge of the habitat requirements and ecology of *C. myrmidone* and its host plants.
- Restore viable metapopulations at a landscape scale, based on the last remaining populations.
- Reintroduce *C. myrmidone* in suitable regions or countries, where it has become extinct.
- Improve land use policies and legislation at EU and local levels to ensure appropriate support mechanisms to maintain *C. myrmidone* and its habitats.
- Involve key stakeholders in the conservation of *C. myrmidone*.

**Species’ functions and values**

*C. myrmidone* is an exceptionally valuable species acting as a both biological and socio-economic indicator. Due to its specific habitat requirements, it is an excellent indicator of fine-grained mosaics of extensively managed habitats, especially gradients from meadows to broad forest edges and open forests. These are managed by extensive grazing and/or patchy mowing. This fundamental land-use is not profitable under present economic conditions, and its maintenance will require the co-operation of local people, farmers, and foresters. Moreover, these sites represent some of the most important areas for the conservation of European biodiversity, supporting many other endangered species and species protected by European nature conservation directives. Because of these attributes, *C. myrmidone* is also a good indicator of the effectiveness of funding systems available for conservation.
*C. myrmidone* is a large and attractive species. At the same time it is probably the most rapidly declining butterfly in Europe where it is now classified as being Endangered (van Swaay et al., 2010). For these reasons it has considerable potential for environmental education and awareness-raising, and for transferring ideas of nature conservation to the general public. Other functions and values of this species are secondary. *C. myrmidone* is a primary consumer, but given its low numbers, it probably does not alter the environment where it lives and is not an important food source for predators. *C. myrmidone* is thus not a key-stone species, but a highly valuable umbrella species for the conservation of a wide range of other species.

**Action plan geographical scope and target audience**

Within the EU this plan is intended for implementation in: Austria, Bulgaria, Czech Republic, Germany, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia.

Information has also been compiled for Belarus, Bosnia-Herzegovina, Croatia, Kazakhstan, Russia, Serbia and Ukraine.
1. Biological information and status review

1.1 Description of the species

Taxonomy

The Danube Clouded Yellow *Colias myrmidone* is a representative of the species-rich genus *Colias* (Family Pieridae, Order Lepidoptera), inhabiting all continents, except for Australia and Antarctica (Yagi & Omoto 1959). Out of the total number of about 200 known species and numerous synonyms (Grieshuber & Lamas 2007), 12 are present in Europe, all of them also in the European Union territory (Lafrenchas 2004).

Within the *C. myrmidone* species, two subspecies are distinguished: *C. m. myrmidone* occurring in the western part of the species range (from Germany to Caucasus and SW Russia), and *C. m. ermak* Grum-Grshimailo, 1890 occurring in S. Urals, SW. Siberia, NW. Kazakhstan (http://www.funet.fi/pub/sci/bio/life/insecta/lepidoptera/ditrysia/papilionoidea/pieridae/coliadinae/collas/index.html). Recently Grieshuber (2006), however, synonymized all subspecies based on reassessment of the morphology of specimens from different species range.

Description

*C. myrmidone* is a large and brightly coloured butterfly species. It has a wingspan of 40–60 mm; the colour of the wings in males is dark yellow to orange with black margin. In contrast to the common *C. crocea* the veins in this black margin are not yellow. The wings of the females are yellow with a regular row of pale (yellow to whitish) submarginal spots in or along the black marginal border, while there are less submarginal spots in *C. crocea* (Lafranchis 2004, Higgins & Riley 1971). Caterpillars are green with a whitish lateral line.

In the Balkan Peninsula (from Bosnia-Herzegovina to northern Greece and Bulgaria, Lafranchis 2004) another similar *Colias* species occurs very locally. It was originally described by Rebel as *C. myrmidone* ssp. *balcanica* (Grieshuber & Lamas 2007). This is a mountain butterfly (while *C. myrmidone* inhabits lowlands), which is now either considered as a species on its own (*Colias balcanica*) or mostly as a subspecies of *Colias caucasica*. Caused by the history of the original description as *C. myrmidone*, some of the older records of *C. myrmidone* in Bulgaria and all records from Bosnia-Herzegovina in fact concern *Colias caucasica balcanica*. They are not considered in this Action Plan.

1.2 Species life history, ecology and habitat requirements

Habitat requirements:

The Danube Clouded Yellow inhabits large traditionally managed patchworks of forest-steppes containing open habitats, calcareous grasslands, sparse scrublands, scattered trees and very open woodlands. The butterfly prefers rugged and heterogenous habitats, and avoids large open habitats. All habitats have a more or less transitional character. If a broad definition is applied, *C. myrmidone* can be considered a woodland species of sparse woodlands (Settele et al. 2009). The key factors for its survival are thriving populations of host plants (genus *Chamaecytisus*) with large amount of young re-sprouting shoots in different successional stages and a rich supply of nectar plants as food source for adults.

Typical breeding habitats are the herb-rich meadows maintained by extensive grazing or patchy mowing, often with scattered bushes and trees. Ovipositing females select large patches of host plants (Romstöck-Vökl et al. 1999) but avoid flowering twigs (Dolek et al. 2005). Regular management stimulates re-sprouting of *Chamaecytisus* easily and is the only way to remove old, unattractive shoots and provide the desired young growth. However, all developmental stages (eggs, larvae and pupae) are extremely sensitive to cutting and grazing by large herbivores, as they are typically situated near the tip of the shoot. This conflict can only be solved by large supplies of host plant patches and mosaic management, increasing the chance that a part of the butterfly generation is not affected by the management.
Apart from breeding habitats, adult butterflies use nectar sources growing in a wide range of habitats, including herb-rich meadows, mesophilous meadows, broad forest edges and very open forests. The character of the preferred habitats of *C. myrmidone* changes gradually along the NW-SE gradient. For breeding it generally prefers sheltered, warm (thermophilous) habitats, although this seems to be more pronounced in the north-west. Most likely, the habitat choice for breeding compensates for the different macroclimatic conditions. Especially in the south-east, adults are observed in a wider range of habitats searching for nectar.

In the north-western part of its range (Czech Republic, Germany) the Danube Clouded Yellow is considered a thermophilous species and it used to inhabit warm south-exposed especially calcareous hillsides, sun-exposed clearings in broad-leaved and pine lowland and hilly-country forests, heath-steppes, open heath-forests, secondary xeric grassland communities of grazed flat slopes and xeric valleys with oligotrophic grassland communities (Beneš et al. 2002, Dolek et al. 2005).

In Poland it inhabits thermophilous habitats along woodland margins, roadsides and railway embankments in pine forests, clearings under electricity lines and above gas pipelines and other early-succession biotopes of pine forests such as burned areas. Similar to the Czech Republic and Germany, xerothermic grasslands on slopes and hills (especially related to calcareous or loess soils) are also reported, but the butterfly has not been observed there in the past several years (Sielezniew pers. comm.).

From the eastern parts of the Czech Republic (the White Carpathians) eastwards and south-eastwards the butterflies are observed in more mesophilous habitats, and the species never inhabits the genuine continental or sub-mediterranean xerothermic habitats. Nevertheless, the habitats are sun-exposed and warm.

In this part of its range the species prefers a large mosaic type of landscape on various soil types (chalk, clay, acidic forest-soils on metamorphic foundation), with open areas available for nectaring (herb-rich mesophilous meadows) but also with forest patches and scrubby habitats scattering the landscape. The habitats share few common attributes: they are large (several thousands of hectares); covered by a mosaic of grasslands, open and more closed woodlands; and all grazed for centuries. It is uncertain, if enhanced (air-)humidity plays a role in the habitat choice in these south-eastern countries.

There is no information on the *C. myrmidone* habitat preferences from the eastern part of the species range (Kazakhstan, Russia).

**Life history**

*C. myrmidone* is bivoltine (V-VI and VII-IX), with partial third generation (Mayer 1916). Generations may even overlap and all stages may be found together in places from March to October. The first generation is usually recorded in low numbers, while the second generation is more numerous. The host plants are various species of *Chamaecytisus* (see table below). For some *Chamaecytisus* species there are uncertainties if they are used as host plants and under which conditions (e.g. *C. nigricans*).

<table>
<thead>
<tr>
<th>Country</th>
<th>Host plant species</th>
<th>Source and/or comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Czech Republic</td>
<td><em>C. austriacus</em> (White Carpathians)</td>
<td>Konvička et al. 2008</td>
</tr>
<tr>
<td>Germany</td>
<td><em>C. ratisbonesis</em></td>
<td>Dolek et al. 2005</td>
</tr>
<tr>
<td>Hungary</td>
<td><em>C. supinus</em> (western Hungary), probably <em>C. austriacus, C. ratisbonesis</em> (central Hungary)</td>
<td>Sáfián pers. comm.</td>
</tr>
<tr>
<td>Poland</td>
<td><em>C. ruthenicus</em> (Knyszyn Forest)</td>
<td>Sielezniew pers. comm. It is unknown whether other larval host plants reported in the literature i.e. <em>C. ratisbonesis</em> and <em>C. nigricans</em> were/are used in Poland (Buszko &amp; Masłowski 2008)</td>
</tr>
<tr>
<td>Romania</td>
<td><em>C. ratisbonesis</em>, <em>C. supinus</em></td>
<td>Szekely, 2008</td>
</tr>
</tbody>
</table>
Females oviposit (about 150 eggs) on young sprouts of a host plant, usually at the top end of the shoot on the upper side of the leaf. *Chamaecytisus* plants are well adapted to extensive pasture and easily re-sprout from dormant buds situated near the ground (Konvicka et al. 2008). Flowering or fruiting sprouts of a host plant are avoided (Dolek et al. 2005, but sample size is only 28 eggs). In Romania and the White Carpathians eggs were laid approximately 20 cm above the surface (Szentirmai pers. comm. sample size 31 eggs; Dolek et al. 2005, sample size 8 eggs). The caterpillars live on end leaves of the host plant (Dolek et al. 2005). Young caterpillars hibernate in follicles, attached to a host plant or the leaves under a host plant. The pupa is attached to a host plant (Weidemann 1995, Beneš et al. 2002), however Szentirmai et al (pers. comm.) in Romania found that nearly half of the pupae were attached to plants other than the host plant (host plant – *C. triflorus* 56.7% of cases, *Oreganum vulgare* 13.3 %, *Calamagrostis villosa* 13.3% and others 16.7%, sample size 30 pupae). Pupae are positioned twice as high in the vegetation as eggs (app. 43 cm above the surface).

**Behaviour**

*C. myrmidone* is a very strong flier and old isolated records may derive from migrating individuals. There are old records as far north as the Baltic Republics (Warnecke 1929, Menhofer 1938). Similar observations of good flight abilities have been made for other *Colias* species. However, in one Mark-Release-Recapture study in Germany, *C. myrmidone* was shown to be extremely sedentary (Kudrna & Mayer 1990): There were no movements between patches with a distance of about 1-3 km and no differences between sexes are reported. But these results were obtained on the last German population that was already declining and only few individuals could be marked and recaptured. Nevertheless, the result proves that a marginal population (which is what we find at present in many of the remaining localities) might lose its ability to maintain a metapopulation network over large areas.

In western Hungary, a study of the landscape structure proved that formerly connected sub-populations became increasingly isolated during the 20th century due to conversion of diverse dispersal corridors into hostile arable land (Sáfián 2009). The metapopulation theory corresponds well with old observations referred to in Bálint (1996) that local colonies changed their area of occupancy from time to time utilizing a larger extent of suitable landscape. If a formerly large structured population or a metapopulation is reduced to small (sub-)populations, the speed of extinction may be enforced by a lack of mobility amongst the few remaining individuals.

The historical evidence suggests that the species inhabits extensive landscapes, being highly mobile. The centre of its populations may even shift in the landscape in subsequent years (Bálint 1996 referring to old, possibly unpublished records). In contrast, recent observations from Romania show a rather sedentary behaviour. The mobility and metapopulations structure of the species needs far more research.

There are no reports on the choice of nectar plants and behaviour of flower visiting adults of *C. myrmidone*, and also no in-depth information on mating behaviour, behavioural differences of the generations, etc.

**1.3 Distribution, populations size and trends**

**Species range**

The species range extends as a belt from Germany (München and Leipzig being on the western border) through Central Europe, the Pannonian lowland and Ukraine to the north-west of Kazakhstan (see Map 1). In the north, it extends up to Kaliningrad (Königsberg) and in the south to central Bulgaria. Since the beginning of the 20th century, the species has been extinct in Bulgaria and Lithuania and recently it also became extinct in Austria, the Czech Republic, Germany, Hungary,
Slovenia, and Serbia. In the EU territory, *C. myrmidone* is still surviving in Slovakia, Poland, Romania, and outside the EU territory in Belarus, Ukraine and Russia (Dolek & Hager 2008). The species status is uncertain in Croatia, Kazakhstan and Moldova.

**Map 1 – *Colias myrmidone* range.** (Data source: Kudrna 2002, Grieshuber 2006 and adapted)

### EU member states with current occurrence

#### Slovakia
In the past the species was locally numerous, especially in the lowlands of the south-western Slovakia (Borská lowland, Malé Karpaty, Myjavská and Chvojnická hill country, Biele Karpaty, Trnávská hill country, Považský Inovec, area of Nitra up to the southern foothills of Strážovské hills). An isolated occurrence was also observed at the southern foothills of the Vihorlat mountains, close to Spišská Nová Ves and one male was observed at the Rudné pri Suchej Hore peat-bog. Currently the species occurs very rarely, being difficult to observe, in the Borská lowland, in the northern part of Malé Karpaty and the southern Javorníky mountains. Only slightly more numerous remnants of the disappearing population can be found in Central Biele Karpaty and two sites at Považský Inovec (www.lepidoptera.sk).

#### Poland
The northern range limit of the species runs across Poland from SW to NE. After 1986 it has been recorded from nearly 100 squares (10km$^2$) of UTM grid (Buszko 1997 and unpublished). However, in some areas probably only migrating specimens were observed (e.g. Masurian Lake District, Toruń and Poznań areas).

In recent years, its presence has been confirmed only in the Knyszyn Forest (Klimczuk & Twerd 2000, Sielezniew unpublished) and in the Białowieża Forest (Buszko et al. 1996, Sielezniew unpublished, B. Jaroszewicz pers. comm.).

Some local extinctions can be explained by the disappearance of larval host plants (Dziekańska & Sielezniew 2008). However, *C. myrmidone* has also disappeared from areas were host plants are still present, such as the Lublin Upland (K. Palka pers. comm.).
Romania

*C. myrmidone* was probably widespread in the whole country, even though only few scattered populations were known. This probably just reflects our patchy knowledge of the situation. A dramatic decline in quantity of some colonies was observed (Cuvelier & Dinca 2007). At present, colonies are known from central and northern parts of the country (see Annex 1). However, more exact data on the state of the species populations and trends at the Romanian territory are not available.

A survey carried out by the Butterfly Conservation (UK) European Interest Group in August 2009 failed in finding *C. myrmidone* in Cluj County where it had formerly occurred (S. Spencer, pers.comm.). Another survey carried out by Hungarian researchers investigated 10 formerly occupied places (near Rimetea, Bük Forest near Cluj Napoca, Torda Gorge, Tür Gorge, near Liteni and Savadisla, near Foieni, near Brasov, near Sfântu Gheorghe and near Gheorgheni (I. Szentirmai pers. comm.). *C. myrmidone* was however, found at only one out of the 10 sites. The butterfly is still present in large numbers at a locality near Gheorgheni at an altitude of about 1000 m.

**EU member states with extinct populations**

Austria

*C. myrmidone* was widespread in Austria especially in the states of Burgenland, Lower Austria, Styria, Upper Austria and Vienna. Most of the sites vanished prior to 1960. The species survived longest in Lower Austria (Höttinger & Pennerstorfer 1999, 2005). The last observations after 1980 were from Wachau, especially Jauerling, from the surrounding of Krems and from Kamptal near Altenburg (Höttinger & Pennerstorfer 1999). In 2000-2001 Geyer et al. (unpubl.) checked the last observations from the data-bank ZOODAT by asking observers (Zöchner, Tschinder). All localities were considered as extinct, mostly due to massive habitat changes. Currently, *C. myrmidone* is extinct in Austria (Dolek & Hager 2008).

Bulgaria

There are only three records of individuals of the species known from the surroundings of Sofia from the beginning of the 20th century (Abadjiev 2001). Recently, the species is probably extinct (Dolek & Hager 2008). In 2008 it was sought incidentally in the old sites near Sofia, but without success.

Czech Republic

In the Czech Republic the *C. myrmidone* used to be present throughout most of the country (see Annex 2). It disappeared gradually from all the sites, surviving longest in the White Carpathians (Blíé Karpaty), where a numerous colony still flourished at the end of the 1990s. Then, within a few years, the species disappeared completely and only occasional individuals have been observed since (Konvička et al. 2008, Konvička pers. comm.).

Historically, *C.myrmidone* was found in 97 grid squares (11.1 x 12 km each) all over the country. The species was known from nearly the whole of Moravia and central and southern Bohemia and the distribution was continuous in colonized areas before 1950. At that time, 36 grid squares were occupied in Bohemia. In the next period (1951-1980) only four grid squares were still occupied, whereas 31 squares remained in Moravia. The distribution was still quite continuous there. For the period between 1981 and 1994, no record is available from Bohemia and the Moravian distribution started to be very patchy (17 grid squares) with the exception of the White Carpathians which still had numerous populations. The decline continued and only seven grid squares remained after 1994, six of them in the White Carpathians. The trend by 1994 was -82.5 %. The latest population development of this area was presented by Konvička et al. (2008). The fairly good (but declining) number of sightings comes from the years prior to 2002. After this year, the decline has accelerated: year 2004 – 26 individuals seen, 2006 – only two butterflies.

Another well-documented extinction of *C. myrmidone* comes from the locality of Lipno in southern Bohemia. The butterfly was common there during the 1950s and 1960s when forest clearings, wide road verges and power-lines that benefited the species were widespread due to a dam construction. After the dam was completed, these habitats disappeared due to vegetational succession and the species rapidly decreased to become extinct in 1975. Open clearcuts favoured the *Chamaecytisus*, which was plentiful there until the 1960s, but the host plant has since decreased to only a few plants (Konvička et al. 2008).
Very recently, two individuals were observed in the White Carpathians in 2009, most likely migrating from Slovakia (Beneš pers. comm.).

**Germany**

The species mainly inhabited Bavaria (Dolek & Hager 2008), further observations are from Saxony, Saxony-Anhalt, Hessen, and Northrhine-Westphalia (Reinhardt et al. 2007). Its last strongholds were in Bavaria near Regensburg and München. All populations around München became extinct before 1960 and by this date, 20 sites remained around Regensburg (50 % of former maximum distribution). Between 1980 and 1989, only 5 sites were left whereas in 1996 only three remained. The species became extinct in 2001 (Freese et al. 2005). Land-use changes, habitat losses and possibly climate change play a major role in the extinction.

Menhofer (1938) cites Uffeln (1913/14) that in 1911 with large numbers of migrating *C. edusa* also a few *C. myrmidone* and *C. chrysotheme* were collected near Münster. Uffeln expects them to have migrated from areas in the south.

**Hungary**

*C. myrmidone* is presumed to be extinct. In the past, the species had several central colonies mainly in the western and north-western part of Hungary, around Budapest and the calcareous sand dunes of Kiskunság (Great Plain, see Annex 3). Stray specimens were recorded from several other sites. The extinction of the species probably began with the disappearance of the species from the Great Plain due to extensive drainage and intensification of agriculture and forestry. The decline of the western populations started with the complete cessation of the traditional animal husbandry, when natural succession has taken over the originally forested habitats. There were still several records from Kőszeg, Sopron and Northern Bakony Hills in 1960–1980 and the species was present in the Órség area in the 1990s. The last specimen was recorded in 2004 (Ábrahám 2004, unpublished report).

**Latvia**

According to Tolman & Lewington (1998) *C. myrmidone* was recorded once in 1949. Kudrna & Mayer (1990) provide a map with a doubtful observation near Riga. Menhofer (1938) mentions Wolmar in Livland and Kurland, both dots in his map are in Latvia and adds that the observations from Warnecke (1929) in Baltic states also refer to migrating individuals.

**Lithuania**

There are only old data available from Lithuania (Dolek & Hager 2008). It is listed by Ivinskis (1998) as “rare”.

**Slovenia**

The species was present in the central and eastern Slovenia in alpine and continental biogeographical regions. The oldest known data are from 1893 (Höfner, 1895), and the latest from 1993 (Predovnik & Verovnik, 2004). In central Slovenia (vicinity of Ljubljana) the species has probably gone extinct before 1940. However, in north-eastern Slovenia, in the eastern parts of Pohorje Mts., the species was observed as late as in the 1980s (Jež, 1983). Some populations were known to exist also in Koroška, Kozjak, Slovenske gorice and Goričko.

The last known population was observed in 1990 in the vicinity of the village Leše in Koroška region. The last known specimen was found in 1993 in Gorenjska region. Between 2003 and 2006 the species was intensively but unsuccessfully searched in the areas of historical distribution. It was concluded, on the bases of analyzing historical data, that the species was present in 32 locations in 18 squares of the UTM network (10×10 km). The extinction of *C. myrmidone* in Slovenia is presumed to be due to the loss of the species’ habitats (destruction, fragmentation) and climate change.

**Non-EU states with recent populations**

**Belarus**

The *C. myrmidone* inhabited the whole Belarus (Dovgailo et al. 2003 in Dolek & Hager 2008). Over the last few years it has not been observed in the northern part of the country. Recent observations
come from the central Belarus and it has also expanded in south-eastern part of the country (Kulak, pers. comm. in Dolek & Hager 2008).

Ukraine, Russia and Kazakhstan
Up to date proven information on the distribution and state of the populations of the C. myrmidone is not available from these countries. However, it is likely that the species still occurs in them (Dolek & Hager 2008).

Non-EU states with extinct populations or unclear status

Croatia
The status of C. myrmidone in the country is uncertain. The species was distributed in continental part (Jakšić, 1988). The data base comprises 15 UTM squares. Some of these areas have been heavily modified and the species has vanished. There are two areas of the country (Podravina and Baranja) where the species has been confirmed during late 1980s’ and middle 1990s’ (Kranjčev 1985; Krčmar 2002). These areas should be checked properly. Based on the temporary knowledge of the distribution trend, it has decreased by more than 30% since 1999 (Van Swaay et al., 2010).

Bosnia and Herzegovina
The present situation of C. myrmidone is unknown. All the records from BiH are from the mountains in S and C part of the country where C. caucasica is found. In the recent publication of butterflies of Bosnia and Herzegovina this species is not considered a member of the country’s fauna (Lelo, 2008). There is no genuine record for C. myrmidone in BiH. (Dolek & Hager 2008).

Serbia
The butterfly was present in different parts of Serbia, but has not been confirmed for the past 10–15 years. Despite considerable efforts, no specimen was observed in recent years (Djuric, pers. comm. in Dolek & Hager 2008, Jakšić, 2008).

Table 1.

<table>
<thead>
<tr>
<th>Country</th>
<th>Population size</th>
<th>Date of estimation</th>
<th>Data quality</th>
<th>Trend**</th>
<th>Period for estimation of pop. trend</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>EU countries</td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>Austria</td>
<td>Extinct last observ: after 1980</td>
<td></td>
<td></td>
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<td>ZOODAT</td>
</tr>
<tr>
<td>Bulgaria</td>
<td>Extinct last observ: beg. of the 20th cent.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Abadjiev 2001</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>Extinct last observ: 2006 (but see text)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Konvička et al. 2008</td>
</tr>
<tr>
<td>Germany</td>
<td>Extinct last observ: 2000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Freese et al. 2005</td>
</tr>
<tr>
<td>Hungary</td>
<td>Extinct last observ: 2004</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Sáfián 2009</td>
</tr>
<tr>
<td>Latvia</td>
<td>Extinct last observ: 1949</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Tolman &amp; Lewington 1998</td>
</tr>
<tr>
<td>Lithuania</td>
<td>Extinct</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poland</td>
<td>several localities in two main areas</td>
<td>2008-2009</td>
<td>M</td>
<td>decreasing</td>
<td>2008-2009</td>
<td>Sielezniew pers.comm.</td>
</tr>
</tbody>
</table>
There are only few detailed studies on *C. myrmidone*. In several countries it had already (or almost) disappeared when it attracted more attention (Germany, Czech Republic, Hungary, Slovenia). However, the main mechanisms causing the decline of the species are basically known and are closely linked to the habitat requirements of the species. The species operates at a landscape scale with very specific requirements for quantity and quality of larval host plants, nectar resources, and microclimate. Climate change may also have contributed to the loss of the westernmost populations (Dolek et al. 2005, Freese et al. 2005).
In all countries, the main negative factor is a transition from a fine-grained and highly variable traditional landscape management to more uniform methods applied at one time at much larger areas. These changes are caused by the loss of traditional management activities connected with the socio-economic changes as a result of the technological development in the 20th century. Here we organize the threats identified along a scale from global via regional (landscape and population) to local (habitat and individual). Nevertheless, we must be aware, that threats of all scales interact in various ways.

**Global scale:** The most important factor affecting the species across its range is climate change.

*C. myrmidone* is regarded as a species extremely threatened by climate change (Settele et al. 2008). This modeling study assigns *C. myrmidone* the highest threat category: HHHR - extremely high climate change risk. In this category more than 95% of the grids with currently suitable climate may no longer be suitable in 2080 under at least one of the three calculated scenarios. The GRAS scenario (Growth Applied Strategy; maximum change) fulfills this condition, the BAMBU scenario (Business As Might Be Usual; intermediate change) just misses it with 91%. Additionally, the present distribution can be explained by climatic variables at least to a moderate extent. This information shows that *C. myrmidone* is clearly a species that is extremely dependent on the climatic conditions of its sites. The extinctions at the western edge of its distribution were already suspected to be due to climate change (Dolek et al. 2005, Freese et al. 2005).

Although some aspects of climate change may seem unstoppable, the authors of the climatic risk atlas also summarize some ways to mitigate some of the negative impacts (Settele et al. 2008). These include:

1. Maintaining large populations in diverse habitats
2. Encouraging mobility across the landscape
3. Allowing maximum time for species adaptation

These three possibilities all are influenced on other scales (landscape and population scale, habitat scale) and are addressed in the actions of this plan.

**Landscape and population scale:** Under this heading we consider factors that act regionally and influence the species on the population and metapopulation level. The most important factors on this scale are the diverse aspects of general land-use and their changes in the landscape.

All known populations of *C. myrmidone* inhabit or inhabited very diverse landscapes including pastures, hay meadows, arable land, fallow land, scrubland, open woodland and forest. These fine-grained landscapes were created during the past centuries by traditional extensive land-use and provided all necessary resources in time and space. During the last century, several changes in land-use due to technical improvements and political changes have occurred. They all resulted in more homogenous landscapes, large plots with a single land-use, reduction of multi-use areas (e.g. wood production and pasture) and loss of gradients. This shift to uniformity is thought to be a major factor in the decline of the species. *C. myrmidone* depends on several resources that have to be available simultaneously in close proximity. These are especially the larval host plants (*Chamaecytisus* spp.) with young re-growth, the nectar plants, and the appropriate microclimatic conditions. These partly contrasting needs cannot be provided for the usual two generations under one land-use on one plot. This makes a diverse and dynamic land-use in the wider landscape essential in order to provide all the necessary resources for each generation, over successive years. As a consequence, the population centre may move in the landscape over the years, which seems to be supported by old observations (Bálint 1996).

Although Kudrna & Meyer (1990) found no movements of butterflies between neighbouring habitats, this was a small sample from an already small and depleted population. From the general descriptions above and old observations of new populations and individuals far away from source populations, a high mobility can be expected under certain circumstances. There is thus strong evidence of the former existence of large structured populations or metapopulations covering a wide area. The collapse of such dynamic metapopulations has probably led to the extinction of *C. myrmidone* in several countries, including Hungary, Slovenia and Austria. The fragmentation and isolation of the subpopulations has strengthened the influence of other factors including stochastic effects.
Recently the negative landscape changes have continued due to the EU agricultural subsidy system which favours large scale highly intensive and highly productive farming. Although recent CAP reform should in theory be helping to maintain more diverse agricultural landscapes (small scale farming) it is far from being implemented (and is coming too late for *C. myrmidone*).

**In summary, the threats on this scale are from the intensification and homogenization of agriculture and forestry in the landscape with the loss of multi-use plots, gradients, and fine-grained land-use differences as well as the lack of financial support to maintain such diverse landscapes.**

**Habitat scale:** Under this heading we consider factors that act locally on a single plot and influence the species on an individual level. Most important are the intensification of management, land abandonment, and complete changes of land-use.

1) **Intensification of management (meadows, pastures, forests)**

In the Czech Republic, the habitat of *C. myrmidone* was maintained in the past by light-grazing and hand mowing with scythes. In the middle of the 1990s, this small-scale management was replaced by mechanised grassland mowing, which is usually carried out in a short period on large-scale meadow areas. As a result, there is 1. mortality of eggs, larvae and pupae, 2. host plant damaging by mowing (*Chamaecytisus* plants are intolerant for machine mowing) and 3. homogenization of mowed grassland. Since 2004, the new agri-environment scheme applied at large grassland areas required two cuts per year. The negative effect of this mowing regime to larvae, pupae, adults and host plants is described in the chart below (Konvička et al. 2008). *C.myrmidone* quickly became extinct after this intensified management was applied.

The intensification of pastures is also detrimental. When grazing is too intensive, larval host plants are damaged and are not able to re-grow. With intensive grazing, nectar sources for the adults are destroyed as well.

In forests, changes in management have led to loss of open forests through planting of gaps and inner margins. Areas with host plants disappear following this more intensive use, but the butterfly probably disappears long before the plant as its microclimatic requirements are no longer met.

| week - month | 1-V | 2-V | 3-V | 4-V | 1-WI | 2-WI | 3-WI | 4-WI | 1-VI | 2-VI | 3-VI | 4-VI | 1-VII | 2-VII | 3-VII | 4-VII | 1-VIII | 2-VIII | 3-VIII | 4-VIII | 1-IX |
|--------------|-----|-----|-----|-----|------|------|------|------|------|------|------|------|-------|-------|-------|-------|-------|-------|-------|-----|
| mowing       |     |     |     |     |      |      |      |      |      |      |      |      |       |       |       |       |       |       |       |     |
| larvae, pupae on host shoots mortality |     |     |     |     |      |      |      |      |      |      |      |      |       |       |       |       |       |       |       |     |
| adults nectar depletion |   |    |    |    |   |   |   |   |   |   |   |   |   |       |       |       |       |       |       |     |
| sprouting of *Chamaecytisus* stumps destroyed shoots cut | | | | | | | | | | | | | | | | | | | | |

The chart shows likely effects of repeated whole-area mowing on the developmental cycle of *Colias myrmidone*, and its host plant *Chamaecytisus austriacus*, on the Czech slopes of the White Carpathians. Adapted from Konvička et al. 2008

2) **Abandonment and insufficient management**

When mowing ceases, habitats quickly become overgrown with shrubs while increased input of nitrogen from air pollution causes changes in grassland structure that negatively influence microclimatic conditions. After abandonment, the average height of vegetation increases radically. This leads to the disappearance of host plants as well as important nectar sources. Long before the host plants disappear, unsuitable microclimatic conditions influence the host plant quality and make it impossible for females to find suitable conditions for oviposition.

In some areas, the cessation of management of meadows also leads to rapid overgrowth by invasive plant species. In Hungary, the introduced goldenrod species (*Solidago gigantea*) is a serious plant pest in the Orség National Park. After abandonment of a meadow, these plants appear and invade the entire area within 10 years, while the original vegetation disappears completely. More than 70% of the Orség area is infested by invasive plants (see images in appendices).

When meadows are abandoned for a longer period of time, they gradually change into a forest. In Hungary the Scots Pine (a fast growing pioneer tree species in the Orség area) has probably overtaken several hundred hectares of *C. myrmidone* habitats. After abandonment, Scots Pine is the first forest tree to appear and it can completely close the meadow in just 10–15 years.

The negative influence of succession after abandonment was observed in several countries on different sites (e.g. Germany: Freese et al. 2005; picture from Slovakia in Dolek & Hager 2008).
Termination of pasturing in forests and at their margins influences negatively the abundance and vitality of the host plants (Chamaecytisus spp.). In Hungary, only very few patches of host plants remained in the Őrség National Park, mainly because the forest edges are no longer grazed and the host plant cannot grow in closed forest.

3) Complete change of land use
The habitat of the species is threatened by changes in land use when the current way of management is not profitable. Most often, the extensive meadows and pastures are afforested or converted into arable land.

Afforestation was the cause of extinction at several sites in Germany (nutrient-poor meadows and open pine stands with rich herb layer, Freese et al. 2005). Similarly, in Hungary, some sites were destroyed by afforestation. The climate of the Őrség is favourable for growing coniferous garden plants such as the Norway Spruce (Picea abies), which is widely used in Central Europe as a Christmas tree. Many local land owners sacrificed their meadows to plant conifers and gain alternative income from selling Christmas trees. Probably several hundred hectares of C. myrmidone habitats have disappeared following the planting of conifers on meadows. A large transfer of meadows to arable land took place after the collapse of the agricultural cooperatives when there was no need for grazing meadows in Hungary. Hundreds of hectares of meadows were ploughed after 1990 just in the Őrség area. These are now managed intensively and provide no habitats for biodiversity.

In summary, on the habitat scale many detrimental changes have occurred on many former localities, but they have one thing in common: growing conditions for the host plants under suitable microclimatic conditions have been destroyed. The habitat mosaics essential to the survival of C. myrmidone may be achieved by different methods (mowing, grazing, managed woodlands), but it is easily destroyed. Too much management is just as bad as untimely, unfavourably changed or no management at all. The butterfly reacts quickly and becomes extinct, as the Czech example shows.
Table 2: Identified threats for EU member states (Bulgaria, Latvia and Lithuania are not shown because of marginal occurrence of *Colias myrmidone* in these countries)

<table>
<thead>
<tr>
<th>Threat</th>
<th>AT</th>
<th>CZ</th>
<th>DE</th>
<th>HU</th>
<th>PL</th>
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<tbody>
<tr>
<td><strong>Global scale</strong></td>
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<tr>
<td>Climate change</td>
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<tr>
<td><strong>Landscape and population scale</strong></td>
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<tr>
<td>Isolation and fragmentation of habitats, loss of connectivity,</td>
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<td>C</td>
<td>C</td>
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<td>C</td>
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<td>C</td>
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<tr>
<td>collapse of metapopulation system</td>
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<tr>
<td><strong>Habitat scale</strong></td>
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<tr>
<td>Abandonment of extensive pasture</td>
<td>I</td>
<td>I</td>
<td>VI</td>
<td>I</td>
<td>I</td>
<td>C</td>
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<tr>
<td>Afforestation of pastures</td>
<td>I</td>
<td>VI</td>
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<td>VI</td>
<td>VI</td>
<td>VI</td>
<td>C</td>
<td>C</td>
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<tr>
<td>Overgrowing of pastures with trees</td>
<td>?</td>
<td>VI</td>
<td>I</td>
<td>VI</td>
<td>I</td>
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<tr>
<td>Overgrowing of pastures with invasive plants</td>
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<td>Afforestation of pastures</td>
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<td>VI</td>
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<tr>
<td>Conversion of pastures into arable land</td>
<td>I</td>
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<td>I</td>
<td>VI</td>
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<tr>
<td>Other change of use of pastures</td>
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<tr>
<td>Leaving grasslands without management</td>
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<td>Overgrowing of grasslands with trees</td>
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<td>VI</td>
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<td>Overgrowing of grasslands with invasive plants</td>
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<td>VI</td>
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<tr>
<td>Conversion of grasslands into arable land</td>
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<td>Other change of use of grasslands</td>
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<tr>
<td>Introduction of intensive management</td>
<td>C</td>
<td>I</td>
<td>?</td>
<td>I</td>
<td>C</td>
<td>C</td>
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<tr>
<td>Mechanised whole-area mowing of grasslands</td>
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<tr>
<td>Intensive pasture</td>
<td>C</td>
<td>VI</td>
<td>VI</td>
<td>?</td>
<td>C</td>
<td>C</td>
<td></td>
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<tr>
<td>Fertilization of grasslands</td>
<td>C</td>
<td>I</td>
<td>VI</td>
<td>?</td>
<td>C</td>
<td>C</td>
<td></td>
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<tr>
<td>Changes in forests management</td>
<td>AT</td>
<td>CZ</td>
<td>DE</td>
<td>HU</td>
<td>PL</td>
<td>RO</td>
<td>SI</td>
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<tr>
<td>Disuse of selective logging</td>
<td>I</td>
<td>C</td>
<td>?</td>
<td>?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intensive forestry (large clearings)</td>
<td>I</td>
<td>VI</td>
<td>?</td>
<td>?</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Disuse of forest grazing</td>
<td>I</td>
<td>VI</td>
<td>C</td>
<td>VI</td>
<td>?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loss and/or improper management of forest margins</td>
<td>VI</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>?</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Notes:  
C – Critical; VI – Very Important; I – Important; Empty cell - not applicable; ? - Not enough information
2. Species conservation and legal status across its geographic range

2.1 International status

**EU Habitats Directive**
The species is listed in Annexes II and IV

**Bern Convention**
Not included.

**CITES**
Not included.

**IUCN Red List**
Not included.

**Red Data book of European butterflies (van Swaay et al. 2010)**
Red List Category and criteria Europe: EN A2c
Red List Category and criteria EU-27: CR A2c

**EU conservation status (from Article 17 reporting) on biogeographical level and Member States.**

The *C. myrmidone* conservation status is reported in only five MS and three biogeographical regions. Other MS with former *C. myrmidone* populations did not include it in their reference lists.

<table>
<thead>
<tr>
<th>MS</th>
<th>Region</th>
<th>Conservation status assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>SI</td>
<td>ALP</td>
<td></td>
</tr>
<tr>
<td>SK</td>
<td>ALP</td>
<td></td>
</tr>
<tr>
<td>CZ</td>
<td>CON</td>
<td></td>
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</tbody>
</table>
The biogeographical assessment is completely 'unfavourable-bad' for the Alpine and Pannonian biogeographical regions and 'Unfavourable-inadequate' for the Continental region because of Polish report covering more than 82% of distributional area.

**NATURA 2000 network**

*C. myrmidon* is listed among Habitats Directive Annex II species. The most valuable sites for the species should be covered by Sites of Community Importance (SCIs) according to article 4 of the Directive.

Only seven out of eleven EU member states where this species has occurred have mentioned the species on reference lists and have designated proposed SCIs. Altogether 44 SCIs were established (see table and map in Annex 2).

### 2.2 National status

**Table 3.**

<table>
<thead>
<tr>
<th></th>
<th>National law</th>
<th>National Red List</th>
</tr>
</thead>
<tbody>
<tr>
<td>Austria</td>
<td>strictly protected (&quot;gänzlich geschützt&quot;), NÖ Artenschutz-VO 2005 (for Lower Austria, the most relevant state)</td>
<td>CR (Höttinger &amp; Pennerstorfer 2005)</td>
</tr>
<tr>
<td>Bulgaria</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Croatia</td>
<td>strictly protected (Official Gazette of RC 99/09)</td>
<td>CR (Šašić et al, in press)</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>Strictly protected, classified in category Strongly endangered (Governemental regulation No. 395/1992)</td>
<td>CR, Critically Endangered (Beneš et al. 2005)</td>
</tr>
<tr>
<td>Germany</td>
<td>strictly protected (&quot;besonders geschützt&quot;)</td>
<td>CR (Pretscher 1998)</td>
</tr>
</tbody>
</table>
### THE N2K GROUP

European Economic Interest Group

<table>
<thead>
<tr>
<th>Country</th>
<th>Status and Source</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hungary</strong></td>
<td>protected species, Decree of Ministry of Environment 13/2001 (KöM 2001)</td>
<td>CR, Critically Endangered, presumed extinct (Sáfián in prep)</td>
</tr>
<tr>
<td><strong>Poland</strong></td>
<td>protected species, Rozporządzenie Ministra Środowiska w sprawie gatunków dziko występujących zwierząt objętych ochroną (deecree of the Ministry of the Environment about protected species of animals) 28.09.2004 Dz. U. z 2004 r. Nr 220, poz. 2237</td>
<td>VU, Vulnerable (Buszko &amp; Nowacki 2002). The statement that “The species is common in the eastern and southern parts of Poland” (Głowaciński &amp; Nowacki 2004 see <a href="http://www.iop.krakow.pl/pckz/opis.asp?id=85&amp;je=pl">http://www.iop.krakow.pl/pckz/opis.asp?id=85&amp;je=pl</a>) is not up-to-date. Recent decline suggests that the status should be rather upgraded to EN, Endangered or even to CR, Critically Endangered</td>
</tr>
<tr>
<td><strong>Romania</strong></td>
<td>OUG 57/2007</td>
<td>VU, Vulnerable (Rákosy, 2003)</td>
</tr>
<tr>
<td><strong>Slovakia</strong></td>
<td>Annexes 4b and 6b of Governmental regulation No. 24/2003</td>
<td>EN, Endangered</td>
</tr>
<tr>
<td><strong>Slovenia</strong></td>
<td>Protected species, Uredba o zavarovanih prosto živečih živalskih vrstah (Uradni list RS, 2004)</td>
<td>EN, Endangered, Pravilnik o uvrstitvi ogroženih rastlinskih in živalskih vrst v rdeči seznam (Uradni list RS, 2002)</td>
</tr>
</tbody>
</table>

#### 2.3 Existing conservation actions and identified priorities

Despite its dramatic decline, *C. myrmidone* has been almost entirely overlooked by nature conservationists. It became extinct in most countries several years ago, when species-oriented conservation projects were rare. The speed of extinction of remaining populations is so fast that the responsible institutions failed to respond adequately to this trend. Thus the actions targeting this species are scarce and completely insufficient. Even the detailed species ecology research is still at a very early stage.

At present this species is receiving greater attention in some countries in connection to their obligations under the Habitats Directive. Most often it is the introduction of regular monitoring as a result of reporting obligations under Article 17 of the Directive.

**Reintroduction projects:**

In the Czech Republic, an unsuccessful experimental reintroduction project took place in 2002, when 10 females were released at a site with the host plant. The project was not prepared in a very professional manner, the main problem being that there was not a suitable habitat provided of a sufficient quality and scale (Konvička 2005).

Preparation for reintroduction has started in the Őrség National Park in western Hungary. Acquisition of land hosting host plant stands is a priority, habitat restoration and rehabilitation has begun with shrub removal, reintroduction of grazing, opening of butterfly corridors etc.
Species monitoring

Monitoring of *C. myrmidone* habitats in Slovenia in 2009

The monitoring was commissioned by the Ministry of Environment and Spatial Planning of the Republic of Slovenia and was carried out by the Faculty of Biotechnology of University of Ljubljana (Rudi Verovnik, PhD). The project took place in the whole area of Slovenia in 2008 and 2009 but no *C. myrmidone* were found. It included several protected butterfly and moth species listed in Annex II and IV of the Habitats Directive.

For *C. myrmidone*, the monitoring of habitats was carried out in 2009 and 50 locations were checked within the historical distribution range of the species. In 66% of the locations, the host plant (*C. supinus*) was found. In 14%, the state of the habitat was found appropriate. Monitoring will be continued in five-year intervals. The next monitoring will be held in 2014 in four areas in northeastern Slovenia: Pohorje, Haloze, Slovenske gorice and Goričko.

In the Czech Republic, annual monitoring of the species in Bílé Karpaty mountains (south-east Moravia) was launched in 2006.

2.4 Gaps in knowledge

The current state of knowledge is sufficient to start activities aimed at saving the species, although it is necessary to gather new data and deepen the knowledge currently available.

The priority areas of further research include:

**Mapping and monitoring:**
- inventory of the species (its presence and state of the populations) in Poland, Romania, and Slovakia and launch of regular monitoring
- mapping of the presence of the species in non-member states, particularly in countries with existing populations (Belarus, Kazakhstan, Russia, and Ukraine), and checking the state of the species in Croatia, Moldova, and Serbia.

**Ecology of *C. myrmidone***:
- research on the minimal viable population sizes and habitat extent,
- research on the reproductive and mortality rates,
- research on the habitat use and movements of imagoes between habitat patches.

**Habitat and host plant management:**
- research on the methods of creating suitable habitats, with emphasis on working out exactly how the dilemma of the necessity of management and the vulnerability to the management can be solved and what needs to be done to get *Chamaecytisus* to flower,
- research on the importance of the seedbank, seed longevity, response to grazing by different types of livestock and modes, and response to various cutting regimes.

3. Framework for action

3.1 Goal

**Restore the Danube Clouded Yellow *C. myrmidone* to a favourable conservation status within the European Union.**

*C. myrmidone* is presently considered the worst case of a decline of a butterfly on a European scale (Dolek & Hager 2008). It has already disappeared from most countries within its European distribution and if actions are not taken immediately, the species will be lost from Europe completely. The goal can only be achieved if the few remaining populations survive. Actions are therefore needed urgently to preserve the last localities in Poland, Romania, and Slovakia. Any further delay decreases the chances to preserve the species in the European Union considerably. Thus, the goal of restoring a favourable conservation status of the species in the EU has two parts:
- To stop the decline in distribution and the decrease in population size of all remaining populations.
- To secure the status of the species by restoring populations in regions and countries where it became extinct in recent years.

3.2 Objectives

Objective 1: Ensure proper management on all localities that still hold *C. myrmidone.*
Immediate action is needed on all known colonies within the next three years while surveys are required to identify other remaining sites in Poland, Romania and Slovakia. Management must be based on the present knowledge of the habitat requirements, while research and monitoring should allow fine-tuning in subsequent years.

Objective 2: Fill the gaps in knowledge on habitat requirements and ecology of *C. myrmidone* and its host plants.
Good quality data are needed on the ecology of the species to improve the management on existing localities. These data will also be crucial for the restoration of the sites from which the species has disappeared. Research must include management experiments to learn more about real-world reactions of the species to land-use options. Results have to be implemented in the management of the localities immediately. Preparation for this objective should start within one year, but it should be planned as a long-term study to follow management experiments.

Objective 3: Restore viable metapopulations based on the last remaining populations.
Individual populations have to be stabilized by restoring metapopulations and providing adequate habitat size and quality at a landscape scale. This includes directly adjacent areas as well as habitat patches that may be reached by the butterfly. Within five years, the suitable habitat should increase considerably in all localities.

Objective 4: Reintroduce *C. myrmidone* in suitable regions or countries, where it became extinct.
The reintroduction of *C. myrmidone* should be considered in all countries and regions where it has become extinct in recent years. As soon as habitat quality and size is considered adequate and enough knowledge on the species’ ecology is gathered a reintroduction should be attempted within five to ten years.

Objective 5: Improve land use policies and legislation at EU and local level to ensure appropriate support mechanisms to maintain *C. myrmidone* and its habitats.
The priority is to develop and support agricultural and forestry systems that maintain open forests and fine-grained and variable habitat management in all remaining landscapes and in landscapes where the species has recently become extinct. Actions are needed at EU level to support appropriate systems of High Nature Value farming, as well as at local level to ensure flexible agri-environment schemes that deliver complex habitats. Actions are also needed to stop harmful, uniform management that is currently being encouraged under schemes.

Objective 6: Involve key stakeholder in *C. myrmidone* conservation.
Stakeholders are key players in the species conservation effort and need to be provided with all relevant information concerning the species ecology and its sites management principles. Training workshops are needed as well as species factsheets explaining the species and the required habitat management in simple terms.
### 3.3 Actions

<table>
<thead>
<tr>
<th>Connected to Objective number</th>
<th>No.</th>
<th>Action</th>
<th>MS</th>
<th>Priority</th>
<th>Time scale</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>1.1. Ensure suitable management of remaining localities (e.g. very extensive pasture, patchwork mowing) by appropriate policy mechanisms (e.g. adapted agri-environmental schemes, direct financial and practical support)</td>
<td>PL, RO, SK</td>
<td>Essential</td>
<td>Immediate to short</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>1.2. Ensure proper management or restoration of the habitats in vicinity of existing populations to enlarge the total area of potentially suitable habitat at least by a factor of five</td>
<td>PL, RO, SK</td>
<td>Essential</td>
<td>Short</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>1.3. Restore suitable habitat patches to provide corridors and stepping stones linking the core populations.</td>
<td>CZ, PL, RO, SK</td>
<td>High</td>
<td>Short to medium</td>
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<tr>
<td></td>
<td>3, 4</td>
<td>1.4. Prepare habitat patch networks for reintroduction in the countries where the species has recently become extinct</td>
<td>AT, CZ, DE, HU, SL</td>
<td>High</td>
<td>Medium to long</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>2.1. Develop guidelines for reintroduction of the species to the prepared sites within its natural range</td>
<td>all MS</td>
<td>High</td>
<td>Short</td>
</tr>
<tr>
<td></td>
<td>2, 4</td>
<td>2.2. Reintroduce the species (including preparation, e.g. ecology, breeding)</td>
<td>AT, CZ, DE, HU, SL</td>
<td>High</td>
<td>Medium to long</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>3.1. Develop a monitoring scheme and implement a regular each-year monitoring during both generations</td>
<td>all MS</td>
<td>Essential</td>
<td>Permanent</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>3.2. Map the existing populations and record potentially suitable habitats in the vicinity.</td>
<td>PL, RO, SK</td>
<td>Essential</td>
<td>Immediate to short</td>
</tr>
<tr>
<td></td>
<td>1, 2, 3</td>
<td>3.3. Conduct surveys of areas where the butterfly was recorded in the</td>
<td>all MS</td>
<td>Medium</td>
<td>Long</td>
</tr>
</tbody>
</table>

1 Priority: Essential, High, Medium, Low.  
2 Time scale: Immediate: action should be completed in 1 year; Short: action completed in 3 years; Medium: completed in 5 years; Long: completed in 10 years; Ongoing: currently being implemented and should continue, Permanent: need to be repeated, e.g. monitoring.
<table>
<thead>
<tr>
<th>Connected to Objective number</th>
<th>No.</th>
<th>Action</th>
<th>MS</th>
<th>Priority¹</th>
<th>Time scale²</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. Practical Conservation Studies</td>
<td></td>
<td>past but not confirmed recently and in areas where larval host plants are abundant</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>4.1</td>
<td>Fill knowledge gaps (see Chapter 2.4)</td>
<td>all MS</td>
<td>Essential</td>
<td>Immediate to long</td>
</tr>
<tr>
<td>2</td>
<td>4.2</td>
<td>Conduct research on the existing strong populations in Belarus to compare habitat quality with other sites</td>
<td>Medium</td>
<td>Short</td>
<td></td>
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<tr>
<td>2</td>
<td>4.3</td>
<td>Provide research of the current distribution of the species in non-EU states</td>
<td>Medium</td>
<td>Short</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>4.4</td>
<td>Collect and summarize all information on historical and present land-use of localities</td>
<td>PL, RO, SK</td>
<td>High</td>
<td>Short</td>
</tr>
</tbody>
</table>

5. Improvement / strengthening legal framework

| 5                              | 5.1 | Prepare national action plans giving details of site and landscape actions | AT, CZ, DE, HU, PL, RO, SK, SL | Essential | Short       |
| 5                              | 5.2 | Legally protect all remaining localities under national and/or international (e.g. Natura 2000) legislation | PL, SK, RO                  | High      | Short       |
| 5                              | 5.3 | Prepare management plans for all *C. myrmidone* sites or include conservation measures in existing plans | CZ, PL, SK, RO              | High      | Short       |
| 1, 3, 5                        | 5.4 | Maintain pastures within forests and on their margins at all remaining localities and potential habitats by elimination of legislative obstacles and support by financial tools | all MS                     | Essential | Short to long |
| 5                              | 5.5 | Prevent changes in land use of existing and potential localities by legislative and/or financial measures (e.g. intensification of any kind, abandonment, afforestation, conversion to arable land) | all MS                     | Essential | Permanent   |
| 5                              | 5.6 | Develop governmental funding to support High Nature Value farming and forestry, and fine-grained management | EU and all MS              | Essential | Permanent   |

6. Public awareness, education and information

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3.4 Monitoring and review

This plan should be reviewed in 2018-2020.

3.5 Other species that may benefit from the SAP

*C. myrmidone* inhabits a mosaic of diverse, thermophilous and traditionally maintained habitats, which are extremely important in terms of European biodiversity. Slightly different species assemblages occur on *C. myrmidone* sites in different parts of its range, however those sites always represent valuable and species rich habitats. Localities are particularly significant due to occurrence of many endangered plant species (e.g. orchids) and invertebrates. Many other Habitats Directive Annex species occur on *C. myrmidone* sites. They include plants such as Lady's Slipper orchid *Cypripedium calceolus*; butterflies and moths such as Jersey Tiger Moth *Callimorpha quadripunctaria* – priority species, *Eriogaster catrix*, False Eros Blue *Polyommatus eroides*, Large Copper *Lycaena dispar*, Fenton's Wood White *Leptidea morsei*, Marsh and Scarce Fritillaries *Euphydryas aurinia* and *E. maturna*; beetles such as Stag beetle *Lucanus cervus*, Great Capricorn Beetle *Cerambyx cerdo*, Hermit beetle *Osmorderma eremita* – priority species, beetle *Cucujus cinnaberinus*; orthopterans such as *Isophya costata*, *Isophya stysi*, *Paracaloptenus caloptenoides*, *Pholidoptera transylvanica* and many others. Among vertebrates the bat species communities are very rich in those areas.

References:


Jež M. 1983: Osnovne karakteristike favne dnevnih metuljev (Lepidoptera, Diurna) Slovenskega Podravja.


Pflkó D. 2005: Data to the knowledge of the Hungarian Chamaecytisus species II. *Flora Pannonica* 3: 163-175. (in Hungarian)


Sáfián Sz. 2009: Mőrt tűnik el a narancslepke (Colias myrmidone) az Őrség és Vendvidék területéről? (egy tájtörténeti és kezelési megközelítés) (kézirat) MSc diplomamunka, Nyugat-magyarországi Egyetem [Why is the Danube Closed Yellow – Colias myrmidone disappearing from the Őrség és Vendvidék (a landscape history and management approach) (manuscript) MSc thesis, University of West Hungary] (in Hungarian)


Warnecke G. 1929. Über die Verbreitung von Colias myrmidone Esp. in Mitteleuropa nördlich der Alpen und ihr Auftreten in Ostpreußen. *Internationale Entomologische Zeitschrift* 45: 413-422.


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**EU Species Action Plan – Colias myrmidone – final draft**

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**THE N2K GROUP**

European Economic Interest Group
ANNEXES

Annex 1 – Distribution of *Colias myrmidone* in the EU countries.

Legend:
Black dots – historical occurrence (until 2005)
Red dots – recent occurrence (after 2005)

Map combines different data sources:

- Austria – Reichl 1992
- Bulgaria – Abadijev 2001
- Czech Republic – Beneš et al. 2002
- Hungary – Sáfián 2009
- Latvia – Menhofer 1938
- Lithuania – Menhofer 1938
- Romania – Szekely Levente pers. comm.
- Slovakia – Kalivoda pers. comm.

Details on the distribution are given in the respective country chapters.
Legend:
- **black dot**: historical occurrence - before 2005
- **red dot**: recent occurrence - after 2005
- **doubtful data**: blue dot
- **migrating individuals**: purple dot
- **Colias myrmidon EU range countries**: background color

0 100 200 300 400 500 Kilometers
Annex 2 – List and map of SCIs where *Colias myrmidone* is a target species.

<table>
<thead>
<tr>
<th>Country</th>
<th>Site code</th>
<th>Site name</th>
<th>Site area (ha)</th>
<th>Population</th>
<th>Conservation</th>
<th>Isolation</th>
<th>Global Importance</th>
<th>Resident</th>
<th>Map code</th>
</tr>
</thead>
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<td>BG0000165</td>
<td>Lozenska planina</td>
<td>1 294</td>
<td>A</td>
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<td></td>
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<td>Cherni rid</td>
<td>857</td>
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<td>P</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td>ROSCI0013</td>
<td>Bucegi</td>
<td>38 759</td>
<td>B</td>
<td>B</td>
<td>C</td>
<td>B</td>
<td>C</td>
<td>29</td>
</tr>
</tbody>
</table>
## Legend (taken from EU Standard Data Form)

**Population:** Size and density of the population of the species present on the site in relation to the populations present within national territory.

A: \(100\% \geq p > 15\%\),  
B: \(15\% \geq p > 2\%\),  
C: \(2\% \geq p > 0\%\).

**Conservation:** Degree of conservation of the features of the habitat which are important for the species concerned and possibilities for restoration.

A. conservation excellent:  
   - elements in an excellent condition, independent of the grading of the possibility of restoration,  
B: good conservation  
   - elements well conserved independent of the grading of the possibility of restoration,
- elements in average or partially degraded condition and easy to restore,
  C: average or reduced conservation
- all other combinations.

**Isolation**: Degree of isolation of the population present on the site in relation to the natural range of the species.

  A: population (almost) isolated,
  B: population not-isolated, but on margins of area of distribution,
  C: population not-isolated within extended distribution range.

**Global Importance**: Global assessment of the value of the site for conservation of the species concerned.

  A: excellent value,
  B: good value,
  C: significant value.

**Resident**:

V: very rare
R: Rare
C: Common
P: Present