Argynnis nokomis (Nokomis Fritillary)

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Taxonomy

- **Class**: INSECTA
- **Order**: LEPIDOPTERA
- **Family**: NYMPHALIDAE
- **Genus**: Argynnis
- **Scientific Name**: *Argynnis nokomis* Edwards, 1862
- **Common Name**: Nokomis Fritillary
- **Synonyms**: Speyeria nokomis (Edwards, 1862) (Edwards, 1862)
- **Taxonomic Name Source**:Pelham, J. P. 2008. A catalogue of the butterflies of the United States and Canada with a complete bibliography of the descriptive and systematic literature. The Journal of Research on the Lepidoptera. Volume 40. 658 pp. Revised 14 February, 2012.

Agency Status

- **NMDGF**:
- **Federal Status**:
- **BLM Sensitive**:
- **USFS**:
- **IUCN Red List**: Not Evaluated
- **Nature Serve Global**: G3
- **NHNM State**: S1
- **NM Endemic**:NO

Description

The sexual dimorphism of this large butterfly, Nokomis, is amazing. Males resemble other Argynnis (Speyeria) species in size and maculation, although the dorsal ground color may be redder and the ventral ground color yellower. Females, in contrast, are blue-black dorsally, with whitish in the wide postmedian area. Below, females have a brown discal region and a pale greenish submargin. Eyes are brown. Range and Habitat. Also called Great Basin Silverspot, this butterfly occurs discontinuously in the Great Basin and surrounding uplands, south into northern Mexico. It inhabits wet meadows with the larval host. This habitat is scarce in the semi-arid west and southwest; colonies often are small, disjunct and vulnerable to degradation by human activities. Beaver activity once kept riverside habitats in good shape for Nokomis, but they have been eliminated from most of their former habitats. In New Mexico, the few remaining colonies of Argynnis nokomis are in the marshiest valleys in our wettest mountains (counties: Ca,Ci,Gr,Mo,Ot,SJ,SM,Ta), from 7000 to 9500? elevation. Life History. The only known host is kidney-leaf violet (Viola nephrophylla; Violaceae), which thrives in emergent aquatic (up to ankle-deep) marsh habitats. Larvae hatch in

autumn, overwinter, and begin feeding in spring. Flight. Argynnis nokomis has one late summer brood; New Mexico adults fly from July 13 to September 29, principally August. They go to nectar but rarely stray far from their wet-meadow homes. Comments. This beautiful, hard-to-find insect has long been prized by collectors, some of whom keep colony locations secret. Sapello Canyon (SM) was the type locality of Argynnis nokomis nigrocaerulea W. Cockerell and T. Cockerell 1900 and aberration “rufescens” (Cockerell 1909). These were later synonymized with the nominate subspecies, to which northern New Mexico colonies are assigned based on recent DNA analyses. Western New Mexico colonies (Ca,Ci,Gr) belong to Mogollon Rim subspecies Argynnis nokomis nitocris (W. H. Edwards 1874). Validity and identity of Nokomis colonies in the Sacramento Mountains (Ot), now probably extirpated, has long been a topic of heated debate among the personal, private, passionate, even the published world of Nokomis lovers. Arizona collector Kilian Roever may have made the only collections of actual specimens from there, ever. Unfortunately, all that seems to remain of those specimens is a single photograph, which suggests it may belong with the Mexican subspecies, Argynnis nokomis coerulescens (W. Holland 1900). Richard Holland found specimens in the Carnegie Museum that were labeled from the Sacramentos (Holland 2010) and he named it ssp. tularosa, but DNA analysis showed the type was from the Sangre de Cristos, as predicted by Scott & Fisher (2014). One cannot do DNA analysis on a photo, so unless Nokomis is rediscovered in the Sacramentos, that may be the final word on what, if anything, once was there.

Description courtesy of Steven J. Cary, Butterflies of New Mexico, 2024

Habitat and Ecology

This species lives in moist meadows, seeps, and in streamside meadows where its sole host plant, Northern Bog Violet (*Viola nephrophylla*), can be found (Scott 1986, Opler and Wright 1999, Glassberg 2001, Lotts and Naberhaus 2021, Cary and Toliver 2024). The presence of Northern Bog Violet seems to be one of the major limiting factors for this species, as it has not been found in habitats without this Violet (NatureServe 2024). In captivity the species has been able to complete its life cycle when fed *Viola papilionacea* and *Viola peiceana,* but there is no evidence of this occurring in the wild (Matoon *et al.* 1971, NatureServe 2024). Additionally, toxicity and deficiency symptoms were observed in the lab when individuals where fed other violet species (Hammond 1974, NatureServe 2024). Northern Bog Violet requires a shady microclimate, often growing under shrubs, especially willows. It also requires soggy soil or standing water, sometimes even thriving in ankle deep water (Baird 1942, Cary and Toliver 2024). This ties *A. nokomis* to a very specialized hydrology and microclimate, one that is often associated with Willows (*Salix spp.*) and Sedges (*Carex spp.*). This species also requires readily available nectar sources and it has been observed nectaring on thistles, both native and introduced (*Cirsium, Carduus*, and *Onopordon* species), Horsemint (*Agastache*), and Joe Pye Weed (*Eupatorium maculatum*) (Scott 1986, Opler and Wright 1999, NatureServe 2024). Most sources report thistles as being the primary nectar source for this butterfly, and an important component of this specialized habitat (Scott 1986, Opler and Wright 1999, Lotts and Naberhaus 2021, NatureServe 2024).

This highly specialized habitat is a rarity in the arid southwestern U.S. Where found, they are typically small and isolated from other similar habitats by large stretches of desert (Cary and Toliver 2024, NatureServe 2024). This increasing isolation has resulted in inbreeding depression and spelled doom for many metapopulations, leading to declines across the species range (Ehrlich and Murphy 1987, Saccheri *et al.* 1998, Nonaka *et al*. 2018, NatureServe 2024). It is also thought that beavers once maintained these riverside habitats for *A. nokomis*; however, beavers have been largely eliminated from the southwestern United States, and many of the habitats they maintained have now disappeared (Cary and Toliver 2024).

This species is univoltine, with one flight generally occurring from mid-July to early September, depending on locality. Males typically emerge a week or two before females (Ferris and Fisher 1971, Mattoon *et al.* 1971, Scott and Mattoon 1981, Scott 1986, Opler and Wright 1999, Lotts and Naberhaus 2021, NatureServe 2024). During flight, adults go to nectar but otherwise rarely stray far from their wet meadow habitats (Cary and Toliver 2024). Males patrol all day starting as early as 8:30am, around wet meadows and seeps looking for receptive females (Ferris 1969, Scott 1986,

Lotts and Naberhaus 2021, NatureServe 2024). After mating females will walk on the ground and lay eggs singly on substrates near Northern Bog Violet. Females seem to preferential lay eggs on hard substrates such as willow stems, tree trunks, or logs (Scott 1986, Lotts and Naberhaus 2021, NatureServe 2024). Adult females may be able to use olfactory cues to find stands of Northern Bog Violet, to lay their eggs in or near (Hammond 1974, NatureServe 2024). Soon after eggs hatch and unfed first instar larvae seek shelter and then hibernate (Scott 1986, Lotts and Naberhaus 2021, Cary and Toliver 2024). In the spring larvae emerge from diapause and begin to feed on the leaves of their host plants without forming nests (Scott 1986, Lotts and Naberhaus 2021, Cary and Toliver 2024).

Larvae of this species go through six larval instars before reaching maturity. In the lab, a 60% average growth rate between instars has been observed (Scott and Mattoon 1981). In the wild, the larvae of this species are rarely observed as they feed nocturnally and leave their host plants during the day (Holland 1898, Hammond 1974, NatureServe 2024). Before pupation mature larvae stop feeding and wander around rapidly looking for a place to pupate. The pupae of this species are suspended by silk (NatureServe 2024).

Some previous studies have reported that this species has vastly skewed sex ratios, and males are observed much more commonly than females. This is especially true in *A. n. nokomis,* where a 9:1 male to female ratio has been observed (Ferris and Fisher 1971, NatureServe 2024). However, females are more cryptic and harder to detect. Additionally, more in depth investigations of a colony of *A. n. nokomis* at Unaweep Seep, in Colorado, found a nearly 1:1 sex ratio (Arnold, 1979, 1989; NatureServe 2024).

Geographic Range:

This species is found from the southwestern United States to central Mexico (GBIF.org 2024). Within this vast distribution, the Nokomis Fritillary occurs in small, disjunct occurrences; populations exist discontinuously across the Great Basin, with colonies being found in far eastern California, Nevada, and Utah, and in Colorado, New Mexico, Arizona, and northern Mexico (Opler and Wright 1999, Glassberg 2001, Brock and Kaufman 2003, Cary and Toliver 2024, GBIF.org 2024).

There are currently eight subspecies recognize: *Argynnis nokomis coerulescens, A. n. nitocris, A. n. nokomis, A. n. tularosa, A. n. apacheana, A. n. carsonensis, A. n. wenona*, and *A. n. melaena* (Pelham 2024). *A. n. coerulescens* is one of the three Mexican subspecies; Although there were formerly several occurrences in southeastern Arizona, they have now been extirpated (Wielgus 1972, Hammond and McCorkle 1986, Scott 1986, Tilden and Smith 1986, Glassberg 2001, Bailowitz and Brock 2022). Another subspecies in Mexico, *A.n. wenona* was found in Neuvo Leon. However, this subspecies may be extinct as it has not been documented since the 1970s, despite several expeditions to its habitat to search for it (Hammond and McCorkle 1983, Selby 2007). Lastly *A.n. melaena* has been described from central Mexico around Aguascalientes (Pelham 2024). There is active debate debate over the validity of some of the subspecies found in the United States. The current knowledge suggests there are three very well defined subspecies in the United States, *A. n. apacheana, A. n. nokomis*, and *A. n. nictoris* (Cong *et al.* 2019, USFWS 2023). *A. n. nokomis* is currently is found in a few sites in eastern Utah, western Colorado, and northwestern New Mexico (Callaghan and Tidwell 1972, Ehrlich 1983, Toone 1991, Cary and Holland 1992, Stanford and Opler 1993, Holland 2008, Cong *et al.* 2019, USFWS 2023). *A. n. nokomis* seems to regularly interbreed and hybridize with *A. n. nictoris,* in the Chuska Mountains, of the Navaho Nation, and with *A.n. apacheana,* in Utah and Nevada. Hybrid individuals more closely resemble *A.n. apacheana,* the closer one gets to California (Cong *et al*. 2019, USFWS 2023). These southern Utah and Nevada populations have previously been called *A. n. carsonensis,* as they are somewhat genetically distinct from both *A. n. apacheana* in California and *A. n. nokomis* in western Colorado and Utah. However, more recently individuals occurring in Nevada, southern Utah, and eastern California are treated as *A.n. apacheana,* which was originally described from Inyo County, in California. The subspecies now appears to be extirpated from that area (Stanford and Opler 1993, Cong *et al.* 2019, USFWS 2023). This potentially means that all â€œpureâ€• *A. n. apacheana* are now extinct as the populations in Nevada and Utah occasionally mate with *A. n. nokomis* (Stanford and Opler 1993, Cong *et al*. 2019). *A. n. nictoris* lives from the White Mountains in Arizona, along the Mogollon Rim into

New Mexico (Cong *et al.* 2019, Cary and Toliver 2024, GBIF.org 2024). *A. n. tularosa* is also still considered to be valid; however, the type locality associated with the specimens is incorrect. It has not been determined where the type series actually came from or whether it remains extant. It is however, clearly genetically distinct (Cong *et al.* 2019).

Conservation Considerations:

There are no conservation measures in place for this species at the species level. Efforts to protect various subspecies are ongoing, with varying degrees of success. Subspecies taxonomy issues have long plagued *A. nokomis.*In 1994 three subspecies were candidates for federal endangered species protection in the United States. However, uncertainty over which populations would be protected if listed, prevented the listing (Grey 1989, NatureServe 2024). Recently more robust genetic evidence has solidified the validity of *A. n. nokomis,* and it was ruled federally threatened in 2023 (USFWS 2023). Many of the other subspecies may also be suitable candidates for federal listing, especially *A.n. apacheana* and *A.n. nitocris,* which have small ranges and have experienced widespread declines.
Considering the documented declines across the range of the species, remaining habitats should be protected from continued habitat loss (Lotts and Naberhaus 2021). The United States Fish and Wildlife Service estimated that a minimum of 12 acres of habitat is needed to host a resilient population (USFWS 2023). In some cases, 12 acres of suitable habitat may not be available to extant colonies; therefore, habitat restoration may be required. Due to the specific hydrological and microclimatic variables required by this species habitat restoration may be challenging (Arnold 1989, NatureServe 2024). More research on the factors that promote Northern Bog Violet survival would likely be needed for these efforts to be effective. Targeting existing colonies to increases resiliency and population numbers will likely be the most effective strategy. Dispersal data for *A. nokomis* has shown this species traveling 1.2 km (.75 miles) between disjunct habitats (Arnold 1989). Therefore, restoration efforts should likely be targeted with this range in mind. Ellis (1989) suggests protecting a metapopulation of several small colonies in proximity, may be the most effective strategy. Individuals could move between colonies, and in the event of catastrophic loss, recolonization would still be a possibility (Ellis 1989). Sites would also need to have nectar resources, in order to support adults. While the species could be reintroduced or introduced into habitats with Northern Bog Violets, it would be unclear whether habitats have the correct hydrology and microclimatic variables required to support a population (Arnold 1989, NatureServe 2024). Additionally, care to make sure subspecies integrity is being maintained would be a necessary prerequisite for any reintroduction (Pyle 1976, NatureServe 2024).

Management for this species' host plant, Northern Bog Violet, will also likely be required in order to ensure the species long term survival. Monitoring of trends and population sizes may be required to determine the health of metapopulations and properly implement conservation actions. Status of Northern Bog Violet and habitat conditions should also be monitored where possible, especially in relation to grazing activities. Additionally, more research is needed to better understand the population size and trends of the Nokomis Fritillary. Trying to identify any additional colonies, and further analyzing the threats to this species is also needed.

Threats:

This species is a habitat specialist, relying on isolated wet habitats in an otherwise arid region. As a result, colonies of this butterfly are small, isolated, and vulnerable to degradation by humans (Cary and Toliver 2024). This isolation has caused a variety of problems for this species, including inbreeding depression, which can quickly drive small, isolated colonies to extirpation (Lynch *et al.* 1995, Saccheri *et al.* 1998, Nieminen *et al.* 2001, Nonaka *et al.* 2018). Historically, this species likely exhibited a metapopulation dynamic where populations frequently extricated, but were readily recolonized by nearby larger populations. However, due to habitat loss and increasing isolation, extirpated colonies can no longer be recolonized.
As the western United States and northern Mexico continue to get hotter and drier over the next century, these declines are expected to continue (Cook *et al.* 2009, Cook *et al.* 2015, Forister *et al.* 2021, Williams *et al.* 2022, USFWS 2023). Several climate change vulnerability assessments suggest the species is highly vulnerable to climate change (CNHP 2015, USFWS 2023).

Historically, the main threat to this species was habitat loss due to water development projects, which included draining of habitat and capping of springs (Pyle 1976, Hammond and McCorkle 1983, Stanford and Opler 1993, Lotts and Naberhaus 2021). Some habitats have also been lost due to natural hydrological disturbance (Pyle 1976, NatureServe 2024). In some cases, water development has forced some populations of *A. n. nokomis* further up canyons, reducing the amount of available habitat and decreasing their population numbers (Stanford and Opler 1993). Additionally, it has been theorized that historically beaver activity maintained many of the marshy floodplain habitats utilized by the species (Cary and Toliver 2024).

Additional threats to this species include overgrazing of cattle, which may impact the species' habitat (Hammond and McCorkle 1983, Arnold 1989, NatureServe 2024). One study found that livestock grazing was the primary threat causing widespread extirpations of *A. n. carsonensis* in Nevada and Utah (Sanford 2011). While flooding and fire, may have once been beneficial to this species' host violets in small amounts, now the short term mortality caused by even moderate events may be enough to extirpate colonies (NatureServe 2024). This species has also previously been over collected in some areas, further stressing already small and isolated populations (Pyle 1976, New 1991, NatureServe 2024). Other threats to this species include invasive weeds, which can choke out and kill Northern Bog Violets, elimination of nectar resources, and insecticides (NatureServe 2024).

Several aspects of the species' life history may also make it more vulnerable to threats (Forister *et al.* 2023). For example, in other *Argynnis* species, temperature and humidity have been shown to have a large effect on the timing of individuals development and on mortality of individuals (Mattoon *et al*. 1971, NatureServe 2024). As this species has a single brood and a single host plant, the observed effect of heat on development timing may put the species at risk for phenological mismatch (Singer and Parmesan 2010, Patterson *et al.* 2019). Additionally, species that are univoltine are thought to have decreased dispersal abilities, which limits the area they can utilize, in turn making them less resilient to stressors (Eskildsen *et al.* 2015). This species also has just a single known host plant and host specificity is a key indicator of extinction risk, as threats affecting the host plant will result in direct population declines (Kotiaho *et al.* 2005, Palash *et al.* 2022, Forister *et al.* 2023). Extreme temperatures and dry conditions can also cause mortality in all life stages of this species as well as disease, predators, and parasitic organisms (Mattoon *et al.* 1971, NatureServe 2024).

Population:

The population size for this species is unknown, though declines due to human disturbances have been observed (Hammond and McCorkle 1983). Declines have been especially drastic along major river floodplains, such as the Animas River near Durango, Colorado and along the Uncompaghre River near Ouray, Colorado, where human impacts are quite severe (NatureServe 2024). Additionally, subspecies *A. n. coerulescens* is likely now extinct in the United States due to human disturbance (Hammond and McCorkle 1983). *A. n apacheana* has undergone severe declines in California and Utah, and *A. n. nokomis* has declined to the point where only ten populations remain; the subspecies was federally listed as threatened by the United States Fish and Wildlife Service (USFWS) (USFWS 2023). Climate models suggest that without conservation action, four of the ten populations are likely to become extricated by 2050, with the other six being in moderate condition, at best (USFWS 2023). *A. n. nokomis* is also still considered to be declining (USFWS 2023). Furthermore, *A. n. wenona* is now considered to be possibly extinct, with several searches since the 1970s coming up empty (Hammond and McCorkle 1983, Selby 2007). Other populations of this species have also undoubtedly undergone declines, or been extirpated due to water development and agriculture. Stanford and Opler (1993) suggests that water development has driven this species further up canyons, reducing the habitat available for them and decreasing numbers (Stanford and Opler 1993, NatureServe 2024).

This species exists in a metapopulation dynamic, which makes it much more prone to extinction (Ehrlich and Murphy 1987, Saccheri *et al.* 1998, Nonaka *et al.* 2018). Additionally, many of these metapopulations are now isolated from each other due to habitat decline and land use changes (USFWS 2023). As a result, the usual cycle of extinction and recolonization has been broken, with extinct colonies unable to be recolonized by other individuals. In addition to

external threats, these small isolated colonies are also at risk to extirpation due to genetic inbreeding, which can lead to rapid declines (Hedrick 1994, Lynch *et al.* 1995, Saccheri *et al.* 1998, Nieminen *et al.* 2001, Nonaka *et al.* 2018). Due to these factors, the species is considered severely fragmented; more than half of the remaining colonies may not be viable, due to the small numbers of individuals, and are isolated from neighboring colonies, such that recolonization is not possible in the event of extirpation.

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More Information