

**Ontario Species at Risk Evaluation Report for
Monarch (*Danaus plexippus*)**

Eastern Subpopulation

Committee on the Status of Species at Risk in Ontario
(COSSARO)

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Assessed by COSSARO as Special Concern

September 2020

Monarque (*Danaus plexippus*)

Le monarque est facilement reconnaissable partout en Amérique du Nord grâce aux motifs noir, orange et blanc uniques des ailes des papillons adultes. Sa biologie et ses déplacements migratoires sont bien connus. Les monarques se reproduisent et vivent partout au Canada, leur aire de répartition correspondant largement à celle des plantes hôtes de leurs larves, les asclépiadacées (*Asclepias* spp.). Comme tous les papillons, le cycle de vie du monarque compte quatre parties (œuf-chenille-chrysalide-adulte). Les femelles adultes pondent jusqu'à 400 œufs sur diverses espèces d'asclépiades, où la chenille se nourrit et se développe avant de devenir chrysalide et de se transformer en adulte, à la fin de l'été et au début de l'automne, avant la migration vers le sud. La chenille emprisonne les substances chimiques que produisent les asclépiades, ce qui la protège, au stade de chenille et à celui d'adulte, contre les prédateurs vertébrés.

Au Canada, la population de monarques se divise habituellement en deux sous-groupes : l'un qui se reproduit à l'ouest des montagnes Rocheuses et hiverné en Californie, et l'autre qui se reproduit à l'est des Rocheuses et hiverné au Mexique. Les monarques adultes de l'est hivernent en grandes congrégations dans les forêts de sapin oyamel (*Abies religiosa*) des hautes terres du centre du Mexique. Au début de février et en mars, les adultes entreprennent leur migration vers le nord jusqu'aux États-Unis et au Canada, et arrivent en Ontario à la fin de mai ou au début de juin. La plupart des individus qui arrivent en Ontario sont la deuxième ou la troisième génération d'individus ayant quitté le Mexique.

L'aire de l'habitat d'hivernage occupée par les monarques au Mexique est très restreinte et affiche une tendance à la baisse depuis sa première évaluation, en 1999. Cela rend cette sous-population sensible aux perturbations et aux menaces comme les températures extrêmes, les feux, la maladie, les parasites, la prédation et l'exploitation forestière illégale. Le monarque de l'est est aussi menacé à l'intérieur de son aire de reproduction par une plus faible disponibilité d'asclépiades, ses plantes hôtes, en raison d'un usage accru d'herbicides et de l'intensification de l'exploitation agricole. L'évaluation du CDSEPO a classé le monarque dans la catégorie des espèces préoccupantes en raison des tendances positives observées actuellement dans l'aire d'habitat d'hivernage occupée au Mexique, un rétablissement récent par rapport aux tendances négatives enregistrées précédemment dans cet habitat. Des préoccupations perdurent aussi à propos de l'aire et de la qualité des habitats de reproduction, ainsi que différentes menaces qui pèsent sur le monarque et pourraient occasionner une diminution de cette sous-population dans un avenir prochain.

Ce statut diffère de celui conféré par le COSEPAC (2016), parce qu'il s'inspire de données sur les tendances publiées depuis l'évaluation nationale.

Cette publication hautement spécialisée «COSSARO Candidate Species at Risk Evaluation for Monarch» n'est disponible qu'en anglais conformément au Règlement 671/92, selon lequel il n'est pas obligatoire de la traduire en vertu de la Loi sur les services en français. Pour obtenir des renseignements en français, veuillez communiquer avec le ministère l'Environnement, de la Protection de la nature et des

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Executive summary

The Monarch is a charismatic butterfly that is recognized throughout North America, based on the unique black, orange and white markings on the wings of the adults. Its biology and migration patterns are well known. Monarchs breed and occur throughout Canada, with a distribution that largely reflects the distribution of its larval host plants, milkweed species (*Asclepias* spp.). Like all butterflies, the Monarch has a four-part life cycle (egg-caterpillar-pupa-adult). Adult females will individually lay up to 400 eggs on various milkweed species, where the caterpillar will feed and develop, before pupating and transforming into an adult in the late summer and early fall and then migrating south. Chemicals produced by the milkweed plants are sequestered by the caterpillar, which protect both the caterpillar and adult stage from vertebrate predators.

The Monarch population in Canada is generally divided into two subgroups: one that breeds west of the Rocky Mountains and overwinters in California, and one that breeds east of the Rocky Mountains and overwinters in Mexico. Adults of eastern Monarchs overwinter in large congregations in highland Oyamel Fir (*Abies religiosa*) forests in central Mexico. In early February to March, adults begin to migrate north into the United States and Canada, and arrive in Ontario in late May or early June. Most individuals that arrive in Ontario are from the second or third generation of the individuals that left Mexico.

The area of overwintering habitat occupied by Monarchs in Mexico is very small and has been on a downward trend since it was first evaluated in 1999. This makes the subpopulation susceptible to disturbances and threats such as extreme weather, fire, disease, parasites, predation, and illegal logging. The eastern Monarch is also threatened within its breeding range by reduced availability of milkweed host plants due to increasing herbicide use and agricultural intensification.

The Monarch has been assessed as Special Concern by COSSARO based on the current positive trends in the area of occupied overwintering habitat in Mexico, only recently recovering from previous negative trends in this habitat to have. There also remains ongoing concern about the area and quality of breeding habitats along with various threats that the Monarch faces which may cause this subpopulation to start to decline in the near future.

This status differs from COSEWIC (2016) based on data published since this assessment.

1. Eligibility for Ontario status assessment

1.1. Eligibility conditions

1.1.1. Taxonomic distinctness

The Monarch is morphologically distinct.

1.1.2. Designatable units

There is only one designatable unit of Monarch in Ontario, the eastern population of the Monarch. A second designatable unit occurs in western North America and has a different migration pattern, but does not occur in Ontario or Canada.

1.1.3. Native status

Monarch has long been recognized as a native species to Ontario.

1.1.4. Occurrence

Monarch is widely distributed across southern and central Ontario, with large numbers observed throughout this area every year.

1.2. Eligibility results

Monarch (*Danaus plexippus*) is eligible for status assessment in Ontario.

2. Background information

2.1. Current designations

- GRANK: G4 (NatureServe 2020)
- IUCN: NA
- NRANK Canada: N5B (NatureServe 2017)
- COSEWIC: Endangered (November 2016)
- SARA: Special Concern (Schedule 1)
- ESA 2007: Special Concern (2008)
- SRANK: S2N, S4B (ranked in 2009)

2.2. Distribution in Ontario

Monarch is widely distributed in Ontario in the summer months, occurring throughout the Deciduous and Great Lakes-St-Lawrence Forest and into the southern parts of the Boreal Forest. It is not possible to estimate the extent of occurrence (EOO) or index area of occupancy (IAO) for Monarchs in Ontario. Monarch breeding sites have not

been tracked and the provincial data does not reflect the species' entire distribution within Ontario. However, the distribution closely reflects the known range of the different milkweed species (*Asclepias* spp.) that are the Monarch caterpillars' host plants (White 1996).

Monarchs have been recorded from a number of sites much further north than the natural range of milkweeds (as far north as Fort Albany); these observations likely represent non-breeding vagrants or occurrences in human-planted milkweed stands (COSEWIC, 2016). COSEWIC (2016) does not list the number of locations for the Monarch in Canada, noting that the location concept does not apply to due to the natural history of the species and the complex nature of the threats it faces.

2.3. Distribution, broader biologically relevant geographic range and status outside Ontario

The Monarch occurs from Canada south into Colombia and Brazil, and includes six recognized subspecies. Only one subspecies, *Danaus plexippus plexippus*, occurs in North America. Two subpopulations of *D. plexippus plexippus* occur; a western subpopulation that extends along the Pacific coast and western side of the Rockies, and an eastern subpopulation that occurs east of the Rocky Mountains. Monarchs have also colonized parts of Europe, Africa and Australia in the last 200 years, along with a number of Pacific Islands, but these subpopulations are non-migratory.

The eastern Monarch subpopulation, which includes Ontario, is showing evidence of decline across its range (Monarch Watch 2020, COSEWIC 2016) from historical values. Potential non-exclusive causes of the decline of the eastern subpopulation include: the loss of milkweed plants in the breeding area of their range, particularly in agricultural regions of the Midwestern United States (Flockhart *et al.* 2015; Oberhauser *et al.* 2016; Pleasants *et al.* 2017; Zaya *et al.* 2017); increased mortality during fall migration in the southern part of their range (Ries *et al.* 2015; Inamine *et al.* 2016); and, loss of habitat in their overwintering range in Mexico (Brower *et al.* 2012; Vidal and Rendón-Salinas 2014; Monarch Watch 2020).

The area occupied by Monarchs overwintering in Mexico has shown a significant decline since it was first tracked in the winter of 1994-95, although there are recent small increases in the overwintering area that may suggest some level of recovery. However, trends across the breeding and migratory range of the eastern subpopulation are not as clear. Data on larval abundances would provide the best evidence on trends in the breeding population of Monarchs; in the absence of these data, research groups have mainly used data from summer butterfly counts and spring and fall migration counts as indices of the population size. Different research groups using these population indices have come to different conclusions about the status of Monarch populations in the breeding range, with some finding no evidence of decline (Badgett and Davis 2015; Howard and Davis 2015; Ries *et al.* 2015; Inamine *et al.* 2016) while others have shown significant declines (Crewe and McCracken 2015; Stenoien *et al.* 2015).

These interpretations are complicated by the large area occupied by Monarchs, the

heterogeneity of habitat quality across this area, and potential shifts in habitat use as the availability of milkweeds in non-agricultural areas has been reduced (Stenoien et al. 2015; Pleasants et al. 2016). Models of Monarch population size based on demographic parameters and estimates of milkweed abundance have predicted significant declines for the eastern subpopulation as a whole (Pleasants and Oberhauser 2013; Flockhart et al. 2015; Inamine et al. 2016; Oberhauser et al. 2016; Zaya et al. 2017), albeit driven by factors in different parts of the Monarch's range (i.e. migratory vs. breeding). It should be noted that despite disagreement on which is the most sensitive part of the Monarch's life cycle, all of these authors agree that the eastern Monarch subpopulation is in decline.

Additional declines have also been observed in the western Monarch subpopulation (Pelton et al. 2019). While a separate designatable unit, some individuals of this subpopulation have been shown to migrate into Mexico, presumably becoming part of the eastern subpopulation. While the impact these migrating individuals may have on the eastern subpopulation are likely extremely minimal, the declines in numbers of the western subpopulation will further reduce any rescue effect, however minor, on the eastern subpopulation.

2.4. Ontario conservation responsibility

Based on the current distributional data, Ontario has minimal conservation responsibility for the Monarch. Although Ontario represents ~19% of the Canadian range of the Monarch, it includes less than 5% of the North American range.

2.5. Direct threats

The overall threat impact for the Monarch was assessed as very high, according to the IUCN threats calculator used by COSEWIC (2016). There are specific threats to the overwintering habitats in Mexico, outside of Ontario's jurisdiction. The concentration of all wintering eastern North American Monarchs in a very small area makes them very vulnerable to catastrophic events. Logging and wood harvesting in the forests of Mexico threaten overwintering Monarchs that occur outside of, as well as within designated protected areas (Monarch Watch 2020, COSEWIC 2016). Severe storms and climatic fluctuations can also have a significant impact on the overwintering Monarchs; for example, an unknown but large number of overwintering butterflies were killed during a storm in March 2016 (Monarch Watch 2020).

Currently, the threats considered to have the greatest impact on the breeding population of migratory Monarchs are habitat degradation and pollution. Several studies suggest that the increased use of herbicide-tolerant agricultural crops as well as continuing conversion to more intensive cropping is having a deleterious effects on milkweed abundance in agricultural adjacent areas, especially in Midwestern states (Brower *et al.* 2012, Butler 2014, Flockhart *et al.* 2015; Jepsen *et al.* 2015; Pleasants et al. 2017). While data on milkweed abundance in Ontario is not available, similar trends in herbicide-tolerant crops and land-conversion have occurred here (COSEWIC 2016). In addition, the reduction of milkweed in the Midwestern states would affect the number of Monarchs moving into Ontario to breed at end of their northward migration. While the

Monarch has the ability to rapidly increase its abundance in successive generations during the northward migration and summer breeding periods, this ability may now be compromised by the sustained decline in the area of occupied overwintering habitat, increasing climate variability, and ongoing reduction and degradation of breeding habitat (Crewe and McCracken 2015).

Additional low-impact threats include the effects of ongoing residential and commercial development on milkweed populations, as well as mortality along roadways caused by herbicides, pesticides, and vehicular collisions. Threats with unknown impacts include invasive species, airborne pollutants, and the introduction of possibly deleterious genes or pathogens from reared individuals.

2.6. Specialized life history or habitat use characteristics

The natural history of the Monarch is well documented. The annual Monarch migration is a well-known phenomenon, with adults migrating south in the fall to overwinter in Mexico, and with successive generations migrating north in the spring. The Monarch caterpillar is a specialist feeder on milkweed species, where it sequesters chemicals from the plant to use as chemical protection from vertebrate predators (largely birds). COSEWIC (2010) notes that *Asclepias* species can vary in levels of cardenolides, the chemical utilized for protection in Monarchs, and that a shift in hosts may have an impact on the palatability of Monarchs to vertebrates. Pocius *et al.* (2018) found some preference in egg laying behaviour of Monarch between milkweed species, and several authors have found that Monarch egg densities are highest in small, low-density patches of milkweed in agricultural environments and gardens vs. natural areas and roadsides (Cutting and Tallamy 2015; Stenoien *et al.* 2015; Pitman *et al.* 2018). In Ontario, there are ongoing efforts by various agencies to enhance and increase potential Monarch habitat through planting of various *Asclepias* species, including in hydro corridors and conservation lands, to enhance and increase potential breeding habitat for the Monarch.

3. Ontario status assessment

3.1. Application of endangered/threatened status in Ontario

Refer to COSSARO criteria, definitions within COSEWIC Assessment Process, Categories, and Guidelines, the most current COSEWIC Operations and Procedures Manual, or the most recent [IUCN Red List guidelines](#) if more information is needed. Key applicable information of supporting text is found in technical summaries of COSEWIC status reports. These should be reviewed to determine if the information is directly applicable to Ontario, or if new information should be considered (e.g., for species that occur in several provinces including Ontario).

3.1.1. Criterion A – Decline in total number of mature individuals

Does not apply.

There is no data available on the size of the breeding population of Monarchs in Ontario, but several lines of evidence have been used to consider the subpopulation as a whole, most notably the data from overwintering sites in Mexico and fall migration data at several sites in southern Ontario.

The eastern subpopulation of Monarchs is in decline compared with historical values and NatureServe (2020) estimates both short-term and long-term declines of 30-70% for *D. plexippus* and of 70-90% for *D. plexippus plexippus*, based on data from the overwintering sites in Mexico, with a notable downward trend starting in 2013, but a reanalysis of the most recent data now suggests that the overwintering sites are now trending upwards. In 2018, when COSSARO initially discussed reassessing the Monarch, an analysis of the total area of occupied habitat at the overwintering site in Mexico showed a decline of 59.7% over a ten year period (2009 to 2018). This rate of decline was based on the predicted values from a regression for the entire available time series of data on Monarch overwintering habitat, from 1995 to 2018, as recommended by the IUCN Red List guidelines (Figure 2) (IUCN 2017). The slope for the entire time series was -0.083, and the p-value for the regression was <0.0001 (analysis conducted for this report, using data from Monarch Watch 2020). Although this data is from the overwintering grounds in Mexico, it could be inferred that the breeding population of Monarchs was declining at a similar rate. A subsequent re-examination of this data, including the last two years, found a continued decline, with a slope of -0.066, suggesting that this species continues to be in decline from historic populations, but recent population upswings are helping in recovery. Despite the historical decline, a linear regression of the last 10 years (2011 to 2020; Figure 3) found a positive increase, with a slope of 0.068 but having a weak p-value (0.13).

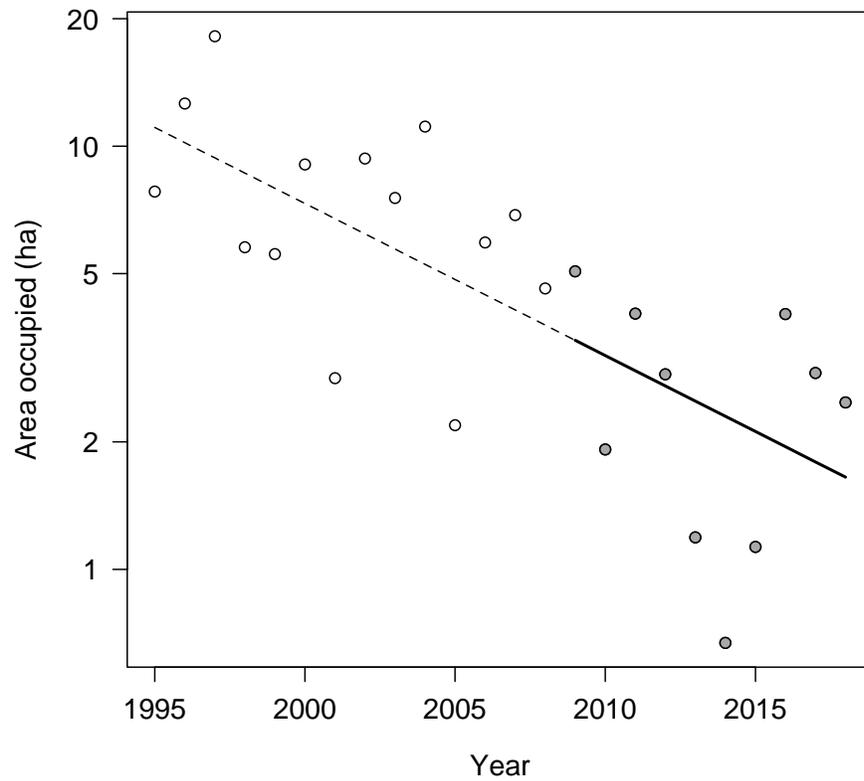


Figure 2. Area (in ha) of overwintering habitat in Mexico occupied by Monarchs between 1995 and 2018; the line indicates the predicted values of a log-linear regression for the full time series, with the values for the last ten years (2009 to 2018) highlighted. Note that the y-axis is presented on a log scale. Figure based on analysis completed for this report, using data from Monarch Watch (Monarch Watch 2020; <https://www.fws.gov/midwest/monarch/overwinteringmonarchs.html>)

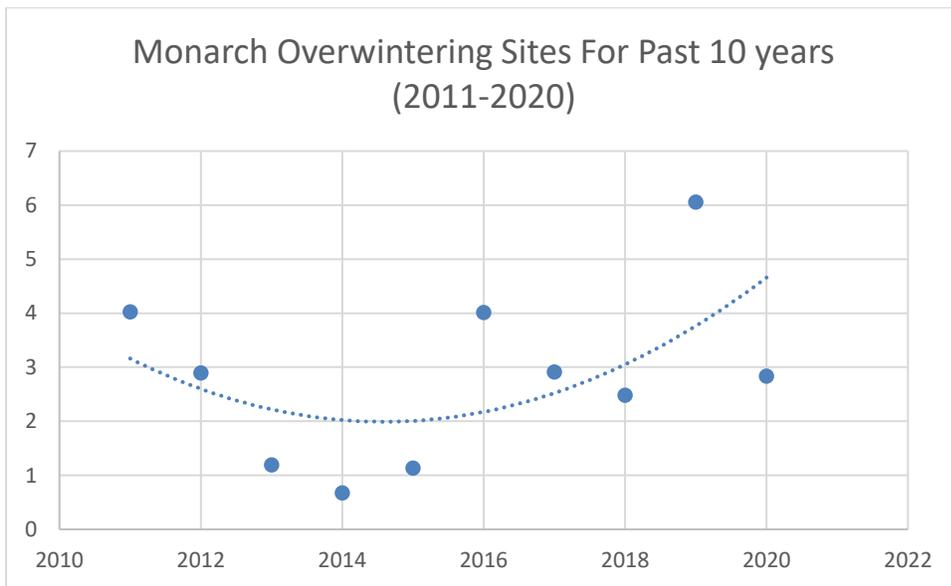
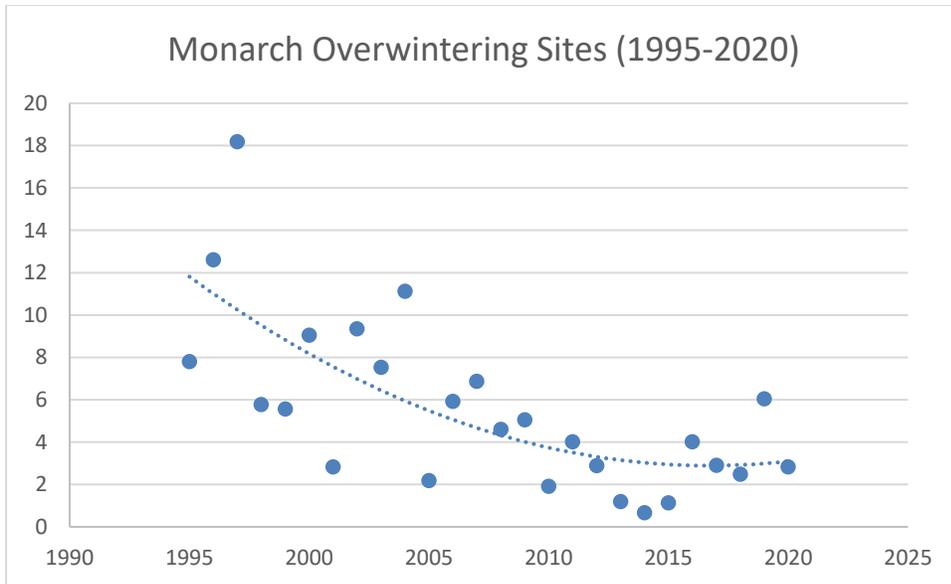


Figure 3. Monarch overwintering sites from all historical data (top) and over the past 10 years (bottom) provided by MonarchWatch (2020) with polynomic trend-lines displayed.

In regards to changes in Ontario’s population, there is some disagreement on the extent and severity of decline using fall migration data. An analysis of the number of southbound Monarchs counted during the fall migration period at two sites Long Point Bird Observatory between 1995 and 2014 (Crewe and McCracken 2015), and a more recent analysis between 1995 and 2017 shows a notable decline (Crewe 2018). These data show an overall rate of decline of 15.4% per year between 2007 and 2017, for a total decline over this period of 81.2% (Crewe 2018). Rates of annual decline over the ten year period differed between the two sites (20.4% per year at the Tip site and 9.6% per year at the Breakwater site); however, the credible intervals for these estimates overlap and the author suggests that there is a lack of strong evidence for site

differences in the trend (Crewe 2018). More recently, Ethier (2020) examined additional data from two additional sites in southern Ontario along with the Long Point data; all sites showed a decline, with an average of 3.05% decline of Monarchs per year along the Lake Erie shoreline (=26.7% decline over 10 years)

Data from Ontario butterfly counts are specific to the province and can be related to field effort, making them comparable between years. Data from all butterfly counts in the province conducted following the protocols of the North American Butterfly Association since 1999 were collated, and the number of Monarchs observed per hour of field effort was calculated (James Kamstra, personal communication). The number of counts per year ranged from 20 to 31 with an average of 24.5. These data show no significant trend in Monarchs observed per hour of effort between 1999 and 2017, although they do show significant year-to-year fluctuations (Figure 4).

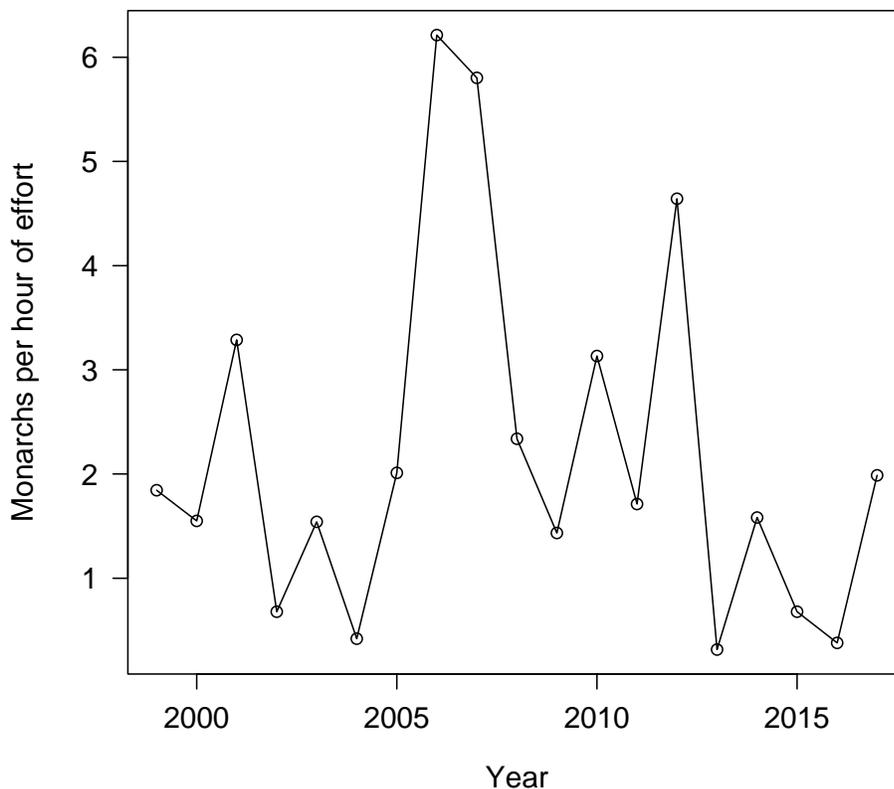


Figure 4. Number of Monarchs observed per hour of field effort on Ontario butterfly counts between 1999 and 2017. Data provided by James Kamstra; derived from North American Butterfly Association (2000 to 2009) and Kamstra (2009 to 2017).

Butterfly count data may not be well suited to assess trends in Monarch populations, for reasons including the timing and location of the counts. Most butterfly counts occur between late June and late July, while Monarchs reach their population peak in late summer (August and early September). In addition, Pleasants et al. (2017) demonstrate that an increasing proportion of Monarch populations have been found in non-agricultural areas over the past 20 years, versus the agricultural areas where they used

to be more common; given that most butterfly counts take place in non-agricultural areas, this shift in habitat use by Monarchs may account for the lack of a negative trend in population numbers seen using butterfly count data over this same time period.

In summary, the eastern subpopulation of Monarchs has declined substantially from historical values, but recent data suggest that the subpopulation is now actually slowly increasing. Data from summer Ontario butterfly counts show no clear trends; however, these data are not considered suitable for assessing Monarch populations for the reasons discussed above. While no direct observations of Monarch populations in Ontario are available, the data from the overwintering grounds in Mexico and the migration counts at Long Point represent indices of abundance appropriate to the taxon. While data from previous analyses met the requirements of subcriterion (b), (c), and (e), the recent data and new analyses suggests that Monarch is now stable, or possibly on a positive increase, based on the data from MonarchWatch (2020), and re-analysis of fall migration numbers in Ontario monitoring sites (Ethier 2020).

3.1.2. Criterion B – Small distribution range and decline or fluctuation

Does not apply. The Monarch is widely distributed in Ontario but there is insufficient data to provide EO and IAO, as this species is only partially tracked, via fall migratory staging areas in southwestern Ontario. There would likely be thousands of EOs in the province. At less than 2 ha in size, the EOO and IAO of the overwintering area in Mexico is small enough to meet the criterion; however, only one of the subcriteria is met (subcriterion b – continuing decline) since there are >10 subpopulations in the overwintering habitat, and no evidence of severe fragmentation or extreme fluctuations in population size or area occupied.

3.1.3. Criterion C – Small and declining number of mature individuals

Does not apply. Total number of mature numbers is unknown, but is certainly well over the threshold for Threatened (>10,000 individuals).

3.1.4. Criterion D – Very small or restricted total population

Does not apply. The Ontario population is not geographically restricted and the number of mature individuals during the summer months, while not specifically known, is large enough to exclude Criterion D to be applicable.

3.1.5. Criterion E – Quantitative analysis

There is no quantitative analysis specific to Ontario, but Semmens *et al.* (2016) estimated a probability of extinction of between 11-57% over the next 20 years for the eastern subpopulation of Monarchs. Assuming that this analysis applies equally to Ontario Monarchs, this estimate range encompasses the criteria for both Endangered and Threatened. Flockhart *et al.* (2015) used a spatially structured, stochastic and density-dependent periodic projection matrix model to estimate a extinction probability of >5% over 100 years for the eastern subpopulation of Monarchs. This estimate assumed that a population of <1000 individuals would qualify as extinction for eastern

Monarchs; Semmens et al. (2016) criticized this threshold as being too low, arguing that 1000 or fewer Monarchs would not be enough to ensure the persistence of the subpopulation at any point in the life cycle.

3.2. Application of Special Concern in Ontario

Applicable. The general decline of Monarch from historical values and ongoing threats to overwintering and breeding areas continue to be a concern and may cause declines in the near future, supporting the treatment of this species as Special Concern. Additionally, as two years data more was sufficient to cause substantial reassessment of the subpopulation, caution must be made in any long-term projections. Future assessments may consider utilizing 10 year rolling trends, as is done with some bird assessments. The long-term analysis of the overwintering sites suggests that this species is not yet secure, the small area of over-wintering sites make it susceptible to catastrophic events (e.g., logging, extreme regional weather event), and there is continued concern about the use of pesticides throughout its migrational route along with impacts of other threats.

3.2.1. Ontario's conservation responsibility

Ontario's conservation responsibility is not considered significant (less than 5%).

3.2.2. Status modification based on rescue effect

Rescue effect is not applicable to the Monarch because the species is migratory and dependent on annual colonization by individuals from the south of Ontario.

3.3. Other status categories

3.3.1. Data deficient

Does not apply.

3.3.2. Extinct or extirpated

Does not apply.

3.3.3. Not at risk

Does not apply.

4. Summary of Ontario status

Monarch (*Danaus plexippus*) is classified as Special Concern in Ontario.

This status of this species is consistent with the definition of Special Concern under the Endangered Species Act, 2007.

There is no change in status of this species from the 2009.

5. Information sources

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¹ A change in the classification of a species during reassessment by COSSARO may be for genuine or non-genuine reasons. Genuine reasons may include a reduction in threats to a species such that status of the species has improved, or the continuation of threats to the species such that the status of the species has further deteriorated. Non-genuine reasons may include new information on population size or threats that was not available during a previous assessment, the use of previous COSSARO criteria that

may have yielded a different result or, taxonomic revisions that result in changes in range, population sizes or designatable units.

Appendix 1: Technical summary for Ontario

Species: Monarch (*Danaus plexippus*)

Demographic information

Demographic attribute	Value
Generation time. Based on average age of breeding adult: age at first breeding = X year; average life span = Y years.	Individuals can develop over 3–4 months but the annual life cycle is 1 year
Is there an observed, inferred, or projected continuing decline in number of mature individuals?	No.
Estimated percent of continuing decline in total number of mature individuals within 5 years or 2 generations.	Unknown
Observed, estimated, inferred, or suspected percent reduction or increase in total number of mature individuals over the last 10 years or 3 generations.	Observed increase of >30% in overwintering sites in Mexico in the last 10 years
Projected or suspected percent reduction or increase in total number of mature individuals over the next 10 years or 3 generations.	Unknown
Observed, estimated, inferred, or suspected percent reduction or increase in total number of mature individuals over any 10 years, or 3 generations, over a time period including both the past and the future.	Unknown
Are the causes of the decline (a) clearly reversible, and (b) understood, and (c) ceased?	a. No b. Yes c. No
Are there extreme fluctuations in number of mature individuals?	No

Extent and occupancy information in Ontario

Extent and occupancy attributes	Value
Estimated extent of occurrence (EEO). <i>If value in COSEWIC status report is not applicable, then use geocat.kew.org. State source of estimate.</i>	Unknown, but certainly exceeding the threshold for Threatened
Index of area of occupancy (IAO). <i>If value in COSEWIC status report is not applicable, then use geocat.kew.org. State source of estimate.</i>	Unknown, but certainly exceeding the threshold for Threatened
Is the total population severely fragmented? i.e., is >50% of its total area of occupancy in habitat patches that are: (a) smaller than would be required to support a viable population, and	a. No b. No

Extent and occupancy attributes	Value
(b) separated from other habitat patches by a distance larger than the species can be expected to disperse?	
Number of locations. <i>See Definitions and Abbreviations on COSEWIC and IUCN websites for more information on the term "location". Use plausible range to reflect uncertainty if appropriate.</i>	Unknown.
Number of NHIC Element Occurrences <i>Request data from MNRF.</i>	Not currently tracked provincially
Is there an observed, inferred, or projected continuing decline in extent of occurrence?	No
Is there an observed, inferred, or projected continuing decline in index of area of occupancy?	No
Is there an observed, inferred, or projected continuing decline in number of sub-populations or EOs?	No
Is there an observed, inferred, or projected continuing decline in number of locations?	Unknown
Is there an observed, inferred, or projected continuing decline in [area, extent and/or quality] of habitat?	Yes. A general decrease in the abundance of milkweed plants in Canada is expected, based on those observed in the United States. The quality and area of overwintering sites in Mexico is also in decline
Are there extreme fluctuations in number of populations?	No
Are there extreme fluctuations in number of locations?	Unknown but not expected
Are there extreme fluctuations in extent of occurrence?	No
Are there extreme fluctuations in index of area of occupancy?	No

Number of mature individuals in each sub-population or total population (if known)

There are no estimates regarding the Monarch population in Ontario. Crewe and McCracken (2015) discuss the numbers migrating through Long Point, but there are no estimates to suggest what proportion of the Ontario population this represents

Quantitative analysis (population viability analysis conducted)

No population viability analysis has been conducted.

Threats

An International Union for the Conservation of Nature – Conservation Measures Partnership Threats Calculator was prepared by COSEWIC (2016) and the calculated impact of all of these threats is considered Very High. Pollution (from Agricultural and Forestry Effluents) was considered the highest threat. Agriculture and Aquaculture (based on Annual and Perennial Non-Timber Crops), Biological Resource Use, and Logging and Wood Harvesting (at overwintering sites in Mexico) were considered Medium Threats. Transportation and Service Corridors, and Roads and Railroads, and Climate Change & Severe Weather (due to the effects of Habitat Shifting and Alteration, Droughts, Temperature Extremes, and Storms and Flooding at the overwintering sites) were considered Low Threats.

Rescue effect and broader biologically relevant geographic range

Rescue effect attribute	Value
Does the broader biologically relevant geographic range for this species extend beyond Ontario?	Yes
Status of outside population(s) most likely to provide immigrants to Ontario	Recent trends suggest that populations are increasing
Is immigration of individuals and/or propagules between Ontario and outside populations known or possible?	Yes, migration into Ontario is known, possible and is part of an annual migration behaviour
Would immigrants be adapted to survive in Ontario?	Yes
Is there sufficient suitable habitat for immigrants in Ontario?	Yes
Are conditions deteriorating in Ontario?	Probably, if the observed decrease of milkweed abundance in the United States is also occurring in Ontario
Is the species of conservation concern in bordering jurisdictions?	Yes
Is the Ontario population considered to be a sink?	No
Is rescue from outside populations likely?	No; rescue does not apply to the eastern population of Monarch because it is a highly mobile migratory population that is dependent on colonization from south of Ontario each year

Sensitive species

Monarch is not considered as a data sensitive species.

Appendix 2: Broader biologically relevant geographic range

Information regarding rank and decline for Monarch (*Danaus plexippus*)

Adjacent Jurisdictions	Biologically Relevant to Ontario (n/a, yes, no)	Status & Trends	Condition	Notes & Sources
Quebec	Yes	S5B	Unknown. Presumed to be increasing	NatureServe 2020
Manitoba	Yes	S3S4B	Unknown. Presumed to be increasing	NatureServe 2020
Michigan	Yes	S5	Unknown. Presumed to be increasing	NatureServe 2020
Minnesota	Yes	S5B	Unknown. Presumed to be increasing	NatureServe 2020
Nunavut		n/a		
New York	Yes	S5	Unknown. Presumed to be increasing	NatureServe 2020
Ohio	Yes	S5	Unknown. Presumed to be increasing	NatureServe 2020
Pennsylvania	Yes	S2S4B	Unknown. Presumed to be increasing	NatureServe 2020
Wisconsin	Yes	SU	Unknown. Presumed to be increasing	NatureServe 2020

Broader Biologically Relevant Geographic Range in Other Jurisdictions

This is a migratory species that ranges from northern Mexico, U.S.A. and southern Canada, with all of the eastern populations originating from overwintering populations in northern Mexico. Of the 41 states of the U.S.A. with the eastern population of Monarch (all or in part), 22 have Monarch ranked as S5 or S5B, 6 as SNA or SU, 9 as S4 or S4B, and only two (West Virginia and Nebraska) have is ranked lower than S3, with the remaining two having a status range (Indiana and Pennsylvania).

Global Status and Trends

NatureServe (2020) lists the Monarch as G4, with estimates for both short-term and long-term declines of 30-70% for *D. plexippus* and of 70-90% for *D. plexippus plexippus*, based on data from the overwintering sites in Mexico. In 2013, there was a notable decline starting in 2013, but an analysis of the overwintering sites for the most recent 10 year period suggests that the overwintering sites are now trending upwards.

Acronyms

COSEWIC: Committee on the Status of Endangered Wildlife in Canada
COSSARO: Committee on the Status of Species at Risk in Ontario
ESA: Endangered Species Act
EO: Element occurrence (as defined by NHIC)
EOO: extent of occurrence
GRANK: global conservation status assessments
IAO: index of area of occupancy
IUCN: International Union for Conservation of Nature and Natural Resources
MNRF: Ministry of Natural Resources and Forestry
NHIC: Natural Heritage Information Centre
NNR: Unranked
NRANK: National conservation status assessment
SARA: Species at Risk Act
SNR: unranked
SRANK: subnational conservation status assessment
S1: Critically Imperiled
S2: Imperiled
S3: Vulnerable
S4: Apparently Secure
S5: Secure
IUCN: International Union for Conservation of Nature and Natural Resources
CDSEPO: Le Comité de détermination du statut des espèces en péril en Ontario