

How to rescue Ontario's *Endangered Species Act*: a biologist's perspective

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Background

Powerful and well-implemented legislation is an important step towards the protection and recovery of species at risk of extinction (Ray and Ginsberg 1999; Schwartz 2008). For example, the U.S. *Endangered Species Act*, despite its flaws, has resulted in several species being saved from extinction (Evans et al. 2016). Although Canada has national legislation to protect species at risk and provide for their recovery (*Species at Risk Act* (2002), S.C. 2002, c. 29), this legislation generally only applies to lands that are under federal government jurisdiction, with the exception of emergency orders, which are rarely implemented. Since most land in Canada is under provincial jurisdiction, species protection often effectively falls under provincial species-at-risk legislation (Olive and McCune 2017).

Of the seven provincial and territorial species-at-risk laws in Canada, Ontario's *Endangered Species Act* (henceforth referred to as the ESA) was considered the best (Nixon et al. 2012; Olive and Penton 2018). Ontario was the first province in Canada to pass legislation to protect endangered species in 1971, with no other province doing so until Quebec in 1989 (Olive 2014). Ontario's legislation was subsequently modernized in 2007 with the passing of the ESA (Environmental Commissioner of Ontario 2013). The process of listing species for protection under Ontario's ESA began with the assessment of a species by an independent scientific committee and Indigenous knowledge holders, known as the Committee on the Status of Species at Risk in Ontario (COSSARO (2019)). If a species was classified as threatened or endangered, then that species and its habitat would receive automatic legal protection. It was largely because of this automatic habitat protection, which many other provinces lacked, that Ontario's ESA was considered the best of its kind in Canada (Nixon et al. 2012; Olive and Penton 2018).

The *More Homes, More Choice Act*, passed by the provincial government in June 2019, includes changes to Ontario's ESA (Ministry of the Environment, Conservation and Parks 2019), with avowed aims of enhancing oversight and transparency in listing species, improving public consultation, and streamlining processes of listing and permitting for developers. These changes affect the entire process from listing to management of species at risk. Notably, they include the following: (i) opening COSSARO membership to members with "community knowledge"; (ii) considering a species' status across its entire geographic range, rather than focusing on its status within Ontario; (iii) increasing timelines for species listing and delaying automatic protections; (iv) authorizing harmful activity on a "landscape scale"; and (v) allowing a party to pay into a fund in lieu of implementing conservation actions to protect species at risk.

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Fig. 1. A species likely to be negatively impacted by the changes to Ontario's *Endangered Species Act* is the Blanding's turtle (*Emydoidea blandingii*) population of North Shore, Ontario, as this population is located on land slated for development into a quarry. Under the new legislation, developers can pay into a Species-at-Risk Conservation Fund. The fund is designed to allow developers to pay money instead of refraining from activities that may harm an at-risk species. It is up to the provincial government to decide if the quarry project may proceed (Semeniuk 2019). Photo by Dale Cooper.

In this editorial, we outline why these five fundamental changes are likely to put Ontario's species at greater risk of extinction (see example in Fig. 1). The following concerns are listed in the order in which they affect the species protection process, from species-at-risk listing to management. Although we acknowledge that endangered species legislation is often viewed as cumbersome and difficult to implement (Schwartz 2008; Bird and Hodges 2017), we argue, as do others (e.g., Waples et al. 2013; Evans et al. 2016; Westwood et al. 2019), that adequate species protection can only be achieved when strong legislation is in place. For each of our concerns, we provide alternative recommendations for ways Ontario could better protect species at risk and their habitats.

Concern #1: Potential dilution of COSSARO membership

The ESA now opens COSSARO membership beyond scientific experts and Indigenous knowledge holders to those with community knowledge. Our concern with this addition is that community knowledge is not clearly defined. We argue that valuable community knowledge holders should possess specific knowledge of species-at-risk conservation in Ontario. For example, experienced anglers, hunters, and naturalist groups may strengthen the knowledge base of species' life history characteristics, changes in distribution and abundance, etc. However, if community knowledge holders have an industrially or politically driven agenda that could be hindered by a new species being listed, the integrity of COSSARO may be compromised (Environmental Defence 2019). COSSARO should uphold the Act's fundamental purpose "to protect species that are at risk and their habitats, and to promote the recovery of species that are at risk" (*Endangered Species Act* 2007, S.O. 2007, c. 6, s. 1). Therefore, we recommend that Ontario's ESA define what constitutes valuable community knowledge to prevent the dilution of COSSARO by members with ulterior motives.

Concern #2: Lower threat category based on geographic range

Previously, COSSARO classified a species solely based on its status across Ontario (*Endangered Species Act* 2007, S.O. 2007, c. 6, s. 5 (1)). COSSARO must now consider the extinction risk to a

species not only based on its conditions in Ontario but also based on its broader geographic range. Regardless of the status of a species in Ontario, if its threat category is lower over its entire geographic range (i.e., range extends outside of Ontario and (or) Canada), then it would be classified at the lower category in Ontario as well. This means that if a species is not at risk outside of the province, it may not be listed at all (*Endangered Species Act 2007*, S.O. 2007, c. 6, s. 5 (5)).

This change raises several concerns. First, it passes responsibility to other jurisdictions. The revised legislation assumes that other jurisdictions over which Ontario has no control, both within Canada and internationally, will take responsibility to maintain populations within their borders (Epstein 2006). However, Ontario cannot control impacts to species outside of its borders and should not count on other jurisdictions to maintain species. Second, the revised legislation does not consider the possibility of Ontario having unique subpopulations of the species. Many species listed as threatened or endangered in Canada are at the northern edge of their range and have more extensive populations farther south, making them potentially globally secure species (for now) but regionally threatened (e.g., branched bartonia (*Bartonia paniculata* subsp. *paniculata* (Michx.) Muhl.), (Ciotir et al. 2013); green dragon (*Arisaema dracontium* (L.) Schott), (Donley et al. 2013)). Such marginal populations may be genetically distinct. Their extirpation may therefore lead to the loss of unique traits that are potentially important for range expansion and adaptation to future conditions (Raymond et al. 2018). As climate change begins to imperil the currently secure southern populations, Ontario's populations at the northern edge of their range may gain newfound conservation importance (Gibson et al. 2009).

We recommend that COSSARO classify species based on their status solely in Ontario, as was formerly done. Furthermore, COSSARO should continue to consider circumstances outside Ontario that may influence extirpation risk in Ontario (e.g., Ciotir et al. 2013), but not apply a lower threat category to a species based on its status in other jurisdictions.

Concern #3: Increased delays in protection

The changes to the ESA introduce delays to the listing of new species at risk and suspend protections after a new species is listed (Fig. 2). These delays pose perhaps the greatest threat among the changes in the Act to newly listed species in need of urgent protection. Previously, there was a three-month deadline to file an amendment to the regulation after receiving a report from COSSARO to classify or reclassify a species. That deadline has been extended to 12 months, and if the Minister were to request a second report from COSSARO because their original classification “may not be appropriate,” the 12-month window would begin anew. This will greatly delay implementation of any measures to protect the species, resulting in increased imperilment of the species.

Additionally, the revised legislation has added two more delays in protection that occur after a species is officially listed. Previously, species had automatic protection after listing. There will now be a “delay of prohibitions upon initial listing,” which allows permit holders or those who hold landscape agreements to continue prohibited activities for one year after listing. Further, the addition of “temporary suspensions of protection upon initial listing” gives the Minister the ability to suspend protection for up to three years after listing. The “delay of prohibitions” for one year would then begin after the conclusion of the “temporary suspension of protection” of up to three years. This means that if the Minister were to request a second COSSARO report, it could take up to five years from the submission of the COSSARO report before protective actions for an at-risk species begin (Fig. 2).

We argue that the section of the previous ESA that produced automatic listing (i.e., automatic protections) must be restored, and experts agree this is important (Westwood et al. 2019). Species at risk often cannot afford to wait (Martin et al. 2017). For example, delays in protection are responsible

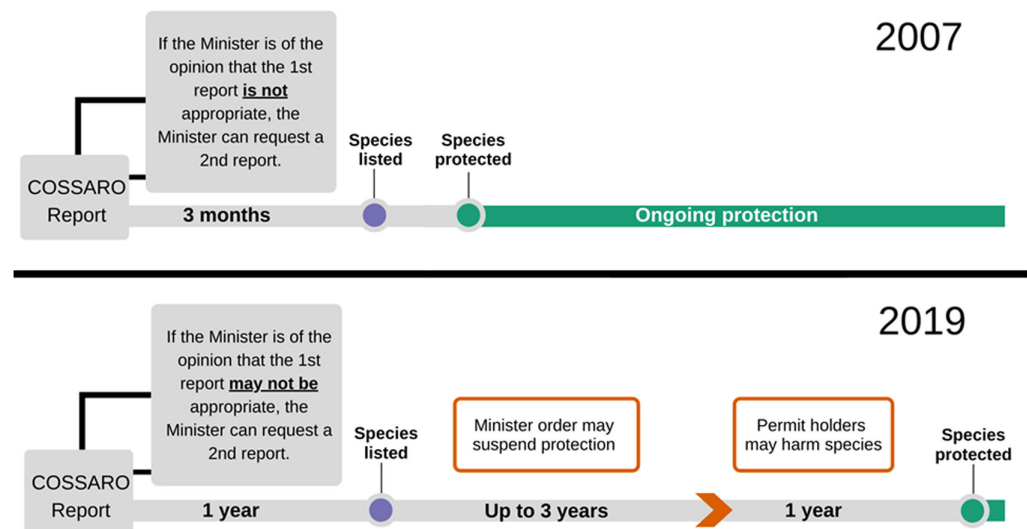


Fig. 2. The amendments to Ontario's Endangered Species Act in 2019 create significant delays before fully protecting a species and its habitat. Now, the Minister can reject the status of a species recommended by COSSARO and delay official listing for one year. Previously, once a species was listed it was automatically protected by law, but now it is no longer automatically protected, and protections may be suspended by the Minister for up to three years after listing. After the termination of the Minister's temporary suspension of protections, a delay in prohibitions begins, effectively giving permit holders an additional year to continue to harm a listed species and its habitat before protections take full effect. This process previously took three months; now, it can take up to five years before a species and its habitat is fully protected. COSSARO, Committee on the Status of Species at Risk in Ontario.

for the extinction of the Christmas Island Pipistrelle (*Pipistrellus murrayi* (Andrews)) in Australia (Martin et al. 2012), and similar inaction ultimately resulted in more expensive recovery efforts for the common hamster (*Cricetus cricetus* (L.)) in Germany (Drechsler et al. 2011). Given that the apparent rationale for the new post-listing delays is scientific uncertainty as to the status of a species, the government should turn to the Precautionary Principle, outlined in the Act (*Endangered Species Act* 2007, S.O. 2007, c. 6, s. 11 (3)): "Where there is a threat of significant reduction or loss of biological diversity, lack of full scientific certainty should not be used as a reason for postponing measures to avoid or minimize such a threat."

Concern #4: Landscape agreements allow broadscale harm to species at risk

The landscape agreement, a new addition to Ontario's ESA, authorizes a party to carry out activities that would harm and (or) destroy species at risk and their habitat over a broad geographic scale (*More Homes, More Choice Act* 2019, S.O. 2019, c. 9, s. 16.1 (1)). Previously, a permit would be issued to a single entity to engage in an activity specified in the permit, but now a landscape agreement can authorize multiple activities throughout a larger geographic area. There are now no specific limitations on the size of a project, nor the number of detrimental activities that could take place in a given location. This is problematic as larger scale, environmentally destructive activities may incur greater negative effects, especially for species with broadscale habitat requirements (Boyd et al. 2008). At a minimum, clearer definitions of the scale and scope of landscape agreements must be included in Ontario's ESA.

In addition, a landscape agreement only holds a party accountable for actions that impact one species. This means only one of the listed species negatively impacted by an authorized activity is required to

receive protection or beneficial actions (thus referred to as the benefiting species), even when multiple species at risk may be affected. We recommend that every listed species affected by a landscape agreement should be afforded equal protection, rather than only one impacted species receiving some degree of beneficial action.

Concern #5: The Species-at-Risk Conservation Trust and Fund

We strongly oppose the new rule that allows a party to conduct activities harmful to a listed species if they make a payment to a fund, called the Species-at-Risk Conservation Fund (hereafter referred to as the Fund), in lieu of performing on-the-ground conservation actions. In theory, the Fund could support conservation activities for affected species; however, the species that may be the most harmed by authorized activities may not be the one chosen as the benefiting species, i.e., the species benefiting from the conservation activities (Wilson et al. 2011). In reality, this increases the possibility that species-at-risk habitat will be damaged or entirely destroyed (e.g., Blanding's turtle, see Fig. 1) and never reconstituted (Huxel and Hastings 1999).

Offsetting policies—policies that attempt to compensate for losses of biodiversity or reconstitute habitat at an impacted site by generating ecologically equivalent habitat elsewhere (Maron et al. 2012)—may be deemed politically necessary. In such cases, we suggest that the party that destroys habitat must be required to create new habitat to replace what has been lost to all affected species, rather than paying a charge to the Fund. Although offsetting policies are not always effective (Camaclang et al. 2015; Chan et al. 2017), there have been successful cases, especially for species with small home ranges. For example, Etzezarreta and Arizaga (2014) described the nesting habitat requirements of the sand martin (*Riparia riparia* (L.)) and how to successfully replicate them in an artificially created environment. We recognize that with increasing development and urban sprawl, some level of habitat destruction is inevitable. Although preserving intact habitat is more likely to aid an at-risk species, if offsetting policies are to be included in Ontario's ESA, we propose a zero net habitat loss approach. Any destroyed habitat should be replaced by restoring or creating habitat elsewhere. Habitat should be replaced with habitat, not with dollars.

Finally, while we appreciate that the Species-at-Risk Conservation Trust must provide an annual report to the Minister of the effectiveness of the Fund in achieving its purpose (*More Homes, More Choice Act 2019*, S.O. 2019, c. 9, s. 20.16), the current evaluating entity is the Trust itself, not an independent third party. Furthermore, the report is to be made available only to the Minister and not to the public. For transparent, reproducible scientific research to effectively and efficiently protect Ontario's species at risk (see Ellison 2010), we strongly suggest the review be completed by a third-party, nongovernment scientific entity and, upon completion, be shared with the public.

Conclusion

In combination, the changes to Ontario's ESA substantially reduce protections designed to preserve Ontario's biodiversity. Ontario's situation is not unique; in Australia, species-at-risk legislation is also under review (Craik 2018), and the current U.S. administration has announced analogous politically driven changes to their ESA (Lambert 2019). The concerns outlined in this editorial are heightened by this alarming trend, whereby our biodiversity is held hostage to the current political climate, despite the fact that the majority of people unwaveringly support protecting species at risk (Bruskotter et al. 2018). All levels of government play an important role in protecting and maintaining the health of our natural environment, which is why the integrity of our provincial legislation must be restored (Ray and Ginsberg 1999).

While we recognize that the previous iteration of Ontario's ESA suffered from lack of effective implementation in some cases, the Act itself was strong relative to other provincial legislations in Canada (Nixon et al. 2012; Olive and Penton 2018). However, we also recognize that an immediate return to the previous version is unlikely. Our recommendations are thus meant to guide future changes to the ESA, with an emphasis on restoring its fundamental purpose of preserving our biodiversity.

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Author contributions

JNB, ADB, REM, CAP, TTN, ESU, MAV, JGV, LF, and JRB conceived and designed the study. JNB, ADB, REM, CAP, TTN, ESU, MAV, JGV, LF, and JRB performed the experiments/collected the data. JNB, ADB, REM, CAP, TTN, ESU, MAV, JGV, LF, and JRB analyzed and interpreted the data. JNB, ADB, REM, CAP, TTN, ESU, MAV, JGV, LF, and JRB contributed resources. JNB, ADB, REM, CAP, TTN, ESU, MAV, JGV, LF, and JRB drafted or revised the manuscript.

Competing interests

The authors have declared that no competing interests exist.

Data availability statement

All relevant data are within the paper.

References

- Bird SC, and Hodges KE. 2017. Critical habitat designation for Canadian listed species: slow, biased, and incomplete. *Environmental Science & Policy*, 71: 1–8. DOI: [10.1016/j.envsci.2017.01.007](https://doi.org/10.1016/j.envsci.2017.01.007)
- Boyd C, Brooks TM, Butchart SHM, Edgar GJ, Da Fonseca GAB, Hawkins F, et al. 2008. Spatial scale and the conservation of threatened species: spatial scale and the conservation of threatened species. *Conservation Letters*, 1(1): 37–43. DOI: [10.1111/j.1755-263X.2008.00002.x](https://doi.org/10.1111/j.1755-263X.2008.00002.x)
- Bruskotter JT, Vucetich JA, Slagle KM, Berardo R, Singh AS, and Wilson RS. 2018. Support for the U.S. Endangered Species Act over time and space: controversial species do not weaken public support for protective legislation. *Conservation Letters*, 11(6): e12595. DOI: [10.1111/conl.12595](https://doi.org/10.1111/conl.12595)
- Camaclang AE, Maron M, Martin TG, and Possingham HP. 2015. Current practices in the identification of critical habitat for threatened species: identifying critical habitat. *Conservation Biology*, 29(2): 482–492. PMID: [25472827](https://pubmed.ncbi.nlm.nih.gov/25472827/) DOI: [10.1111/cobi.12428](https://doi.org/10.1111/cobi.12428)
- Chan KMA, Anderson E, Chapman M, Jespersen K, and Olmsted P. 2017. Payments for ecosystem services: rife with problems and potential—for transformation towards sustainability. *Ecological Economics*, 140: 110–122. DOI: [10.1016/j.ecolecon.2017.04.029](https://doi.org/10.1016/j.ecolecon.2017.04.029)
- Ciotir C, Yesson C, and Freeland J. 2013. The evolutionary history and conservation value of disjunct *Bartonia paniculata* subsp. *paniculata* (Branched Bartonia) populations in Canada. *Botany*, 91(9): 605–613. DOI: [10.1139/cjb-2013-0063](https://doi.org/10.1139/cjb-2013-0063)

- COSSARO. 2019. Committee on the Status of Species at Risk in Ontario [online]: Available from cossaroagency.ca.
- Craik WAM. 2018. Independent review of interactions between the EPBC Act and the agriculture sector. Commonwealth Department of the Environment and Energy, Canberra, ACT: Australian [online]: Available from environment.gov.au/epbc/publications/review-interactions-epbc-act-agriculture-final-report.
- Donley R, Jalava JV, and van Overbeeke J. 2013. Management plan for the Green Dragon (*Arisaema dracontium*) in Ontario. Ontario Management Plan Series. Prepared for the Ontario Ministry of Natural Resources, Peterborough, Ontario. vi + 43 p. [online]: Available from ontario.ca/page/green-dragon-management-plan#section-6.
- Drechsler M, Eppink FV, and Wätzold F. 2011. Does proactive biodiversity conservation save costs? Biodiversity Conservation, 20(5): 1045–1055. DOI: [10.1007/s10531-011-0013-4](https://doi.org/10.1007/s10531-011-0013-4)
- Ellison AM. 2010. Repeatability and transparency in ecological research. Ecology, 91(9): 2536–2539. PMID: [20957944](https://pubmed.ncbi.nlm.nih.gov/20957944/) DOI: [10.1890/09-0032.1](https://doi.org/10.1890/09-0032.1)
- Endangered Species Act. 2007. c. 9 [online]: Available from ontario.ca/laws/statute/07e06.
- Environmental Commissioner of Ontario. 2013. Laying siege to the last line of defence: a review of Ontario's weakened protections for species at risk [online]: Available from docs.assets.eco.on.ca/reports/special-reports/2013/2013-Laying-Siege-to-ESA.pdf.
- Environmental Defence. 2019. Analysis shows that Ontario's Bill 108 gives the development industry most of what it asked for [online]: Available from environmentaldefence.ca/2019/05/31/analysis-shows-that-ontarios-bill-108-gives-the-development-industry-most-of-what-it-asked-for.
- Epstein C. 2006. The making of global environmental norms: endangered species protection. Global Environmental Politics, 6(2): 32–54. DOI: [10.1162/glep.2006.6.2.32](https://doi.org/10.1162/glep.2006.6.2.32)
- Etchezarreta J, and Arizaga J. 2014. Characteristics of Sand Martin *Riparia riparia* colonies in artificial river walls. Ardeola, 61(1): 127–134. DOI: [10.13157/arla.61.1.2014.127](https://doi.org/10.13157/arla.61.1.2014.127)
- Evans DM, Che-Castaldo JP, Crouse C, Davis FW, Epanchin-Niell R, Flather CH, et al. 2016. Species recovery in the United States: increasing the effectiveness of the Endangered Species Act. Issues in Ecology. Report No. 20. Ecological Society of America, Washington, D.C. 27 p. [online]: Available from fs.fed.us/rm/pubs_journals/2016/rmrs_2016_evans_d001.pdf.
- Gibson SY, Marel RCVD, and Starzomski BM. 2009. Climate change and conservation of leading-edge peripheral populations. Conservation Biology, 23(6): 1369–1373. PMID: [20078636](https://pubmed.ncbi.nlm.nih.gov/20078636/) DOI: [10.1111/j.1523-1739.2009.01375.x](https://doi.org/10.1111/j.1523-1739.2009.01375.x)
- Huxel GR, and Hastings A. 1999. Habitat loss, fragmentation, and restoration. Restoration Ecology, 7(3): 309–315. DOI: [10.1046/j.1526-100X.1999.72024.x](https://doi.org/10.1046/j.1526-100X.1999.72024.x)
- Lambert J. 2019. Trump administration weakens Endangered Species Act. Nature. DOI: [10.1038/d41586-019-02439-1](https://doi.org/10.1038/d41586-019-02439-1)
- Maron M, Hobbs RJ, Moilanen A, Matthews JW, Christie K, Gardner TA, et al. 2012. Faustian bargains? Restoration realities in the context of biodiversity offset policies. Biological Conservation, 155: 141–148. DOI: [10.1016/j.biocon.2012.06.003](https://doi.org/10.1016/j.biocon.2012.06.003)

Martin TG, Nally S, Burbidge AA, Arnall S, Garnett ST, Hayward MW, et al. 2012. Acting fast helps avoid extinction. *Conservation Letters*, 5(4): 274–280. DOI: [10.1111/j.1755-263X.2012.00239.x](https://doi.org/10.1111/j.1755-263X.2012.00239.x)

Martin TG, Camaclang AE, Possingham HP, Maguire LA, and Chadès I. 2017. Timing of protection of critical habitat matters: timely critical habitat protection. *Conservation Letters*, 10(3): 308–316. DOI: [10.1111/conl.12266](https://doi.org/10.1111/conl.12266)

Ministry of the Environment, Conservation and Parks. 2019. 10th year review of Ontario's Endangered Species Act: discussion paper. Environmental Registry of Ontario [online]: Available from ero.ontario.ca/notice/013-4143.

More Homes, More Choice Act. 2019. c. 9 [online]: Available from ola.org/en/legislative-business/bills/parliament-42/session-1/bill-108.

Nixon S, Page D, Pinkus S, Podolsky L, and Russell S. 2012. Failure to protect: grading Canada's species at risk laws. Ecojustice Canada, Vancouver, BC, Canada [online]: Available from ecojustice.ca/wp-content/uploads/2014/08/Failure-to-protect_Grading-Canadas-Species-at-Risk-Laws.pdf.

Olive A. 2014. Land, stewardship, and legitimacy: endangered species policy in Canada and the United States. University of Toronto Press, Toronto, ON, Canada [online]: Available from jstor.org/stable/10.3138/j.ctt6wrg5n.

Olive A, and McCune JL. 2017. Wonder, ignorance, and resistance: landowners and the stewardship of endangered species. *Journal of Rural Studies*, 49: 13–22. DOI: [10.1016/j.jrurstud.2016.11.014](https://doi.org/10.1016/j.jrurstud.2016.11.014)

Olive A, and Penton G. 2018. Species at risk in Ontario: an examination of environmental non-governmental organizations. *The Canadian Geographer/Le Géographe canadien*, 62(4): 562–574. DOI: [10.1111/cag.12483](https://doi.org/10.1111/cag.12483)

Ray JC, and Ginsberg JR. 1999. Endangered species legislation beyond the borders of the United States. *Conservation Biology*, 13(5): 956–958. DOI: [10.1046/j.1523-1739.1999.09911.x](https://doi.org/10.1046/j.1523-1739.1999.09911.x)

Raymond CV, Wen L, Cooke SJ, and Bennett JR. 2018. National attention to endangered wildlife is not affected by global endangerment: a case study of Canada's species at risk program. *Environmental Science & Policy*, 84: 74–79. DOI: [10.1016/j.envsci.2018.03.001](https://doi.org/10.1016/j.envsci.2018.03.001)

Schwartz MW. 2008. The performance of the Endangered Species Act. *Annual Review of Ecology, Evolution, and Systematics*, 39(1): 279–299. DOI: [10.1146/annurev.ecolsys.39.110707.173538](https://doi.org/10.1146/annurev.ecolsys.39.110707.173538)

Semeniuk I. 2019. Northern Ontario's turtle tussle pits scientists against quarry builders, with a threatened species caught in the middle. *The Globe and Mail* [online]: Available from theglobeandmail.com/business/technology/science/article-northern-ontarios-turtle-tussle-pits-scientists-against-quarry/.

Species at Risk Act. 2002. c. 29 [online]: Available from laws-lois.justice.gc.ca/eng/acts/S-15.3/index.html.

Waples RS, Nammack M, Cochrane JF, and Hutchings JA. 2013. A tale of two acts: endangered species listing practices in Canada and the United States. *BioScience*, 63(9): 723–734. DOI: [10.1525/bio.2013.63.9.8](https://doi.org/10.1525/bio.2013.63.9.8)

Westwood AR, Otto SP, Mooers A, Darimont C, Hodges KE, Johnson C, et al. 2019. Protecting biodiversity in British Columbia: recommendations for developing species at risk legislation. *FACETS*, 4: 136–160. DOI: [10.1139/facets-2018-0042](https://doi.org/10.1139/facets-2018-0042)

Wilson HB, Joseph LN, Moore AL, and Possingham HP. 2011. When should we save the most endangered species? *Ecology Letters*, 14(9): 886–890. PMID: [21749599](https://pubmed.ncbi.nlm.nih.gov/21749599/) DOI: [10.1111/j.1461-0248.2011.01652.x](https://doi.org/10.1111/j.1461-0248.2011.01652.x)