Michigan Journal of International Law

Volume 36 | Issue 3

2015

Uncertainty, Precaution, and Adaptive Management in Wildlife Trade

Annecoos Wiersema
University of Denver Sturm College of Law

ARTICLES

UNCERTAINTY, PRECAUTION, AND ADAPTIVE MANAGEMENT IN WILDLIFE TRADE

*Annecoos Wiersema**

* Professor of Law, University of Denver Sturm College of Law. I am grateful to Fred Cheever, Alan Chen, Lorna McGregor, Viva Moffat, Justin Pidot, Rock Pring, Nantiya Ruan, Joyce Sterling, Eli Wald, Andrew Wetzler, and Chris Wold for their helpful comments. I owe sincere thanks to Alexandra Chinenova, Alexandra Jennings, Jamie Crawford, Katie McAuley, and Jaime Menegus for their excellent research assistance.

Introduction

Wildlife trade is big business. Legal international trade in just some of the wild animals and plants traded worldwide is estimated at $350 to $530 million per year.[1] The United States is the primary importer of virtually every major taxon of these species, including mammals, reptiles, fish, and plants.[2] When it comes to illegal trade, estimates of its value range from $7 to $23 billion annually, covering wild animals, fish, and timber.[3] This illegal trade fuels organized crime and militia and terrorist groups.[4] In the face of all this pressure, some wild species appear to be traded in sustainable amounts. Others are headed for extinction.

In this high-stakes world, both uncertainty and value conflicts abound. With scientific and socioeconomic uncertainty, data, inferences, and predictions can all be contested. The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) manages international trade in wild at-risk species and their parts through a combination of international decision-making and national and sub-national implementation, banning and regulating trade in species with the goal of avoiding extinction due to international trade.[5] Every decision taken by CITES parties—whether on the floor of the regular meetings or by Scientific Authorities designated by the state—has to deal with uncertainty due to data gaps, the effect of human activity, and complexity, among other things.[6]

This Article addresses how the parties to CITES have dealt with uncertainty by analyzing their approach to precaution and adaptive management. The Article concludes that the parties have shied away from adopting the precautionary principle or approach and have instead incorporated any precautionary elements into monitoring and adaptive management. This way of implementing precaution emphasizes uncertainty

1. U.N. Env't Programme World Conserv. Monitoring Ctr., *CITES Trade: Recent Trends in International Trade in Appendix II-Listed Species*, at 4, SC62 Inf. 7 (July 23-27, 2012) [hereinafter *CITES Trade*]. This estimate covers only trade in species listed on Appendix II of CITES because trade in their parts needs to be monitored to ensure survival and does not even cover trade in species that are not considered at risk. *Id.*

2. *Id.* at 12, 17, 20, 22, 24, and 29.

3. U.N. Env't Programme and GRID-Arendal, *The Environmental Crime Crisis – Threats to Sustainable Development from Illegal Exploitation and Trade in Wildlife and Forest Resources*, at 23, (June 24, 2014) [hereinafter *The Environmental Crime Crisis*], *available at* http://www.unep.org/unea/docs/rracrimecrisis.pdf.

4. *The Environmental Crime Crisis*, *supra* note 3, at 8, 78–79. Concern about illegal wildlife trade reaches the highest levels of government around the world, and has been addressed by the United Nations Security Council. *See London Conference on the Illegal Wildlife Trade 2014*, Gov.uk, https://www.gov.uk/government/topical-events/illegal-wildlife-trade-2014; S.C. Res. 2134, U.N. Doc. S/RES/2134 (Jan. 28, 2014); S.C. Res. 2136, U.N. Doc. S/RES/2136 (Jan. 30, 2014).

5. Convention on Int'l Trade in Endangered Species of Wild Fauna and Flora, Mar. 3, 1973, 27 U.S.T. 1087 [hereinafter CITES].

6. *See* Matthew J. Smith et al., *Assessing the Impacts of International Trade on CITES-Listed Species: Current Practices and Opportunities for Scientific Research*, 144 Biological Conserv. 82, 84 (2011) (observing that, for many CITES-listed species, decisions on whether to grant an export permit will not be straightforward).

arising from data gaps. However, uncertainty also arises from complexity and indeterminacy, and cannot always be resolved by more data. Thus, uncertainty is not always temporary. For the parties to ensure that international trade does not result in species extinction, they need to be informed by science and aware of its limitations.[7] Incorporating precaution within adaptive management is therefore necessary for decision-making on wildlife trade, but it is not sufficient. The Article argues that fully acknowledging the range of sources of uncertainty requires both a first role for precaution within adaptive management approaches—as the parties are doing, albeit less explicitly—and a second role for precaution at the point of final decision-making.

Part I describes various sources of uncertainty in conservation, with a particular focus on uncertainty in the context of wildlife trade. Part II discusses the precautionary principle and precautionary approach developed in legal circles to address uncertainty. It introduces the criticisms of the precautionary principle or approach and discusses responses to those criticisms. Part II also introduces adaptive management and monitoring as one approach that is increasingly significant in conservation circles as a way to incorporate precaution but cabin it within scientific processes.

Part III of the Article analyzes how the parties to CITES have addressed uncertainty, precaution, and adaptive management in the context of key aspects of the treaty: listing criteria and non-detriment-findings. Part III also analyzes debates surrounding some significant species discussed at recent Conferences of the Parties (CoPs): sharks, polar bears, and elephants. The CITES parties' preference for monitoring and information-gathering over explicit references to precaution is evident in each of these contexts.

In Part IV, the Article develops a two-part role for precaution in decision-making about wildlife trade. First, precaution should play an explicit role in adaptive management and scientific decision-making—a procedural role. This is consistent with the approach many commentators have developed and the emphasis the parties have placed on adaptive management. Second, precaution can and should play a supplementary role when the science has reached its limits—a substantive role. Although some commentators and parties to CITES seem to consider this risky in that it could allow non-scientific values to override science, their concerns do not take account of the fact that science cannot resolve every question the parties will face regarding wildlife trade. The Article sets out a strategy that is both linked to science and can supplement it, without undermining or overriding that science.

Because this Article views monitoring and precaution as complementary tools for conservation, listing on the CITES appendices is presented as a positive step for most species. Listing allows for both monitoring and precaution. This is discussed further in Part IV of the Article. Some parties

7. *See* Jacqueline Peel, The Precautionary Principle in Practice: Environmental Decision-Making and Scientific Uncertainty 10 (2005) (arguing for decision-making processes that "neither [abandon] science entirely, nor [embrace] it uncritically").

and commentators will always resist more listing on CITES appendices and many of the value disputes between CITES parties revolve around whether listing on the appendices is good or bad. This is a false dichotomy. A proper understanding of the role of listing as a mechanism to assist science-based and precautionary decision-making allows for listing to play an important role in CITES.

The complex mix of uncertainty and value debates evident in wildlife trade decision-making is not unique. It is replicated across conservation and natural resource management decisions at every level of governance and in every region of the world. Understanding how decision makers can navigate this complexity and uncertainty within the field of wildlife trade also sheds light on principles for decision-making for conservationists and natural resource managers everywhere.

I. Uncertainty

A. *Sources of Uncertainty*

Ecological systems are complex, and uncertainty abounds.[8] Much of this stems from the nonlinear and dynamic nature of ecological systems.[9] Since the 1970s, ecologists and conservation biologists have urged recognition that, contrary to the standard narratives that appeared to inform conservation science, policy, and law, the notion of balanced nature and a goal of maintaining nature's own static equilibrium were misplaced.[10] Instead, commentators urged the conservation community to recognize that nature is far more complex and unpredictable. The natural world is made up of processes and connections in constant flux with no predetermined fixed outcome.[11] As Holling put it, we are dealing with "complex, nonlinear systems where discontinuous behavior and structural change are the norm."[12] Among the lessons Holling, Walters, and others sought to convey were aspects of the complexity of natural systems that should have, they argued,

8. Karline Soetaert & Peter M.J. Herman, A Practical Guide to Ecological Modeling: Using R as a Simulation Platform 1 (2009); M. Henry H. Stevens, A Primer of Ecology with R 3–4 (2009); Peel, *supra* note 7, at 43.

9. *See generally* C.S. Holling, *What Barriers? What Bridges?*, *in* Barriers and Bridges to the Renewal of Ecosystems and Institutions 3 (Lance H. Gunderson, C.S. Holling & Stephen S. Light eds., 1995) (discussing the dynamic nature of ecological systems).

10. *See* Holling, *supra* note 9, at 14–16; Daniel Botkin, Discordant Harmonies: A New Ecology for the Twenty-First Century 3 (1990); Carl Walters, Adaptive Management of Renewable Resources 1 (1986); Richard O. Brooks, Ross Jones, & Ross A. Virginia, Law and Ecology: The Rise of the Ecosystem Regime 127 (2002); J.B. Ruhl, *Thinking of Environmental Law as a Complex Adaptive System: How to Clean Up the Environment by Making a Mess of Environmental Law*, 34 Hous. L. Rev. 933 (1997) (discussing the equilibrium theory from different perspectives); A. Dan Tarlock, *Slouching Toward Eden: The Eco-Pragmatic Challenges of Ecosystem Revival*, 87 Minn. L. Rev. 1173, 1174–1175 (2003); Annecoos Wiersema, *A Train Without Tracks: Rethinking the Place of Law and Goals in Environmental and Natural Resources Law*, 38 Envtl. L. 1239, 1246 (2008) [hereinafter Wiersema, *Train Without Tracks*].

11. *See* Holling, *supra* note 9, at 3, 19.

12. *Id.*

significant effects on the way natural resource managers approached the work of conservation.[13]

In addition, a key aspect of work by these ecologists is recognition that humans and nature are not distinct. Humans are part of the ecosystem.[14] They are "ecosystem components."[15] As a result, conservationists cannot afford to approach their work without recognizing the potential impact of social and economic forces, and without recognizing the myriad ways in which human activity affects nature indirectly as well as directly. Otherwise, they run the risk that policies could fail due to unanticipated human activity.[16]

Recognizing these aspects of natural systems can lead us to recognize different sources of uncertainty. The source of uncertainty in turn, can inform how decision makers should deal with that uncertainty. While policymakers for conservation and natural resources management generally understand that their decisions are made under conditions of uncertainty,[17] their assumption about the nature of the source of uncertainty is often barely articulated, even though it is often key to how these decision makers will respond to it. Thus, this Section discusses the sources of uncertainty of most relevance to decision-making for biological conservation generally and wildlife trade particularly.

The discussion below is informed by more general and complete discussions and typologies of uncertainty in environmental and health regulation. In particular, Peel's focus on three categories of uncertainty within science is highly informative: epistemological uncertainty, methodological

13. *See* Bradley Karkkainen, *Collaborative Ecosystem Governance: Scale, Complexity, and Dynamism*, 21 VA. ENVTL. L.J. 189 (2002) (discussing the natural systems' effects on how natural resources managers approach conservation); Wiersema, *Train Without Tracks*, *supra* note 10, at 1248–1253.

14. Norman L. Christensen, Jr. & Jerry F. Franklin, *Ecosystem Function and Ecosystem Management*, *in* ECOSYSTEM FUNCTION AND HUMAN ACTIVITIES: RECONCILING ECONOMICS AND ECOLOGY 1, 17 (R. David Sampson & Norman L. Christensen, Jr. eds.,1997); Stephen S. Light, Lance H. Gunderson & C.S. Holling, *The Everglades: Evolution of Management in a Turbuluent Ecosystem*, *in* BARRIERS AND BRIDGES TO THE RENEWAL OF ECOSYSTEMS AND INSTITUTIONS *supra* note 9, at 103, 151–154; R. Edward Grumbine, *Reflections on "What is Ecosystem Management?,"* 11 CONSERV. BIOLOGY 41, 45 (1997); R. Edward Grumbine, *What is Ecosystem Management*?, 8 CONSERV. BIOLOGY 27, 31 (1994).

15. Christensen and Franklin, *supra* note 14, at 17.

16. WALTERS, *supra* note 10, at 49–50.

17. *See* Holly Doremus, *Adaptation and Resiliency in Legal Systems: Adaptive Management as an Information Problem*, 89 N.C. L. REV. 1455, 1462 (2011) [hereinafter Doremus, *Information Problem*] (describing the view that natural resource management decisions "must typically be made in the face of incomplete knowledge about the systems being managed" as common ground); Holly Doremus, Symposium, *Of Salmon, the Sound, and the Shifting Sands of Environmental Law—A National Perspective: Essay: Precaution, Science, and Learning While Doing in Natural Resource Management*, 82 WASH. L. REV. 547, 548 (2007) [hereinafter Doremus, *Precaution, Science and Learning*] (describing uncertainty as the "unifying hallmark" of environmental and natural resource regulation); Michael C. Runge, *An Introduction to Adaptive Management for Threatened and Endangered Species*, 2 J. OF FISH AND WILDLIFE MGMT. 220, 223–24 (2011).

uncertainty, and sociological uncertainty.[18] The first of these, 'epistemological uncertainty,' describes the uncertainty that arises from incomplete scientific knowledge of natural processes and phenomena.[19] 'Methodological uncertainty' refers to the uncertainty that stems from methods used to collect and analyze data, including due to lack of adequate techniques within science.[20] Peel uses the term 'sociological uncertainty' to refer to the scientific community's practices that determine what science is considered to be recognizable as "certified 'scientific knowledge'."[21] Peel's forms of scientific uncertainty play a role in the uncertainties I describe below, although I do not elaborate on them explicitly here.

Typologies can break down uncertainty based on whether it arises from information gaps, similar to Peel's epistemological uncertainty,[22] the absence of baseline data,[23] lack of knowledge about future events, including the impact of regulatory interventions,[24] and the interaction of the variables at play in these complex ecological systems.[25] These forms—or more accurately, sources—of uncertainty can be elaborated in the context of wildlife trade and wildlife conservation and grouped into the following four types of uncertainty that will be relevant for discussion throughout this Article.

1. Current Data Gaps

Uncertainty in the context of wildlife trade frequently arises from data gaps. This is information that scientists have not been able to gather either because existing technologies do not allow it or because resources or capacity have been limited.[26] This problem pervades wildlife biology generally, and not just the context of wildlife trade. Data on population size and range, habitat requirements, and other basic biological information is frequently lacking.[27] Indeed, these data gaps can exist for whole populations of even the most prominent species.[28] Even if taxonomic and distribution data is available, other critical information for the purposes of determining

18. PEEL, *supra* note 7, at 42–47.

19. *Id.* at 43–44.

20. *Id.* at 44–46.

21. *Id.* at 46.

22. *Id.*, at 43-44 (epistemological uncertainty); Doremus, *Information Problem*, *supra* note 17, at 1471.

23. PEEL, *supra* note 7at 42–43; Doremus, *Information Problem*, *supra* note 17, at 1475.

24. Doremus, *Information Problem*, *supra* note 17, at 1471-72.

25. *Id.* at 1474–75.

26. *See* PEEL, *supra* note 7, at 44–46 (As Peel indicates, this source of uncertainty straddles her epistemological and methodological uncertainties).

27. Doremus, *Information Problem*, *supra* note 17, at 1468.

28. The IUCN Red List of Threatened Species does not have full assessments of all species. *See* Int'l Union for Conservation of Nature, *Overview of the IUCN Red List*, THE IUCN RED LIST OF THREATENED SPECIES, http://www.iucnredlist.org/about/overview#expanding_coverage (last visited Feb. 20, 2015).

the effect of trade on species that are subject to either legal or illegal trade is missing, such as population demography and responses to harvesting and use.[29] In addition, data about the volume of international trade in wild animals and plants is incomplete.[30]

This source of uncertainty, arising from data gaps, is characterized by the sense that the uncertainty is temporary. In many cases, it is.[31] Given sufficient effort, resources, and time, the implicit assumption may be that the data gaps will increasingly be filled. Policy-makers should, in turn, respond by advocating more scientific research. They might also put in place temporary protective measures to avoid irreversible consequences while they seek more data.

2. Historical Data Gaps

Uncertainty also arises because of information gaps that we know exist, but that cannot be fully corrected. This is often a product of time, either past or future. With regard to the past, scientists lack historical baseline data for many species.[32] Scientists and historians can make attempts to reconstruct information from various sources, including fossil research and historical accounts, but they will never be fully certain of the baseline information. Of course, baseline data cannot itself resolve all uncertainty, because without a natural state of equilibrium in nature, the choice of what to treat as the baseline is also significant.[33] Nevertheless, in some cases, data that has remained relatively constant over extensive periods of time can be used as a baseline without difficult value decisions.

Historical data gaps can have a significant effect on interpretation of current data. For example, in the case of the polar bear, the lack of historical data has led to competing narratives of whether polar bear numbers have gone up in recent decades and how adaptable polar bears are in the face of ecological change.[34]

---

29. Smith et al., *supra* note 6, at 82, 85 (noting that there appears to be very little peer-reviewed literature on population demography, responses to harvesting, or sustainable use of CITES-listed species).

30. *See CITES Trade*, *supra* note 1.

31. The IUCN Red List of Threatened Species has increased dramatically the number of species it has fully assessed. *See* Int'l Union for Conservation of Nature, *Summary Statistics*, The IUCN Red List of Threatened Species, http://www.iucnredlist.org/about/summary-statistics#Expanding_Red_List (last visited Feb. 20, 2015). *See also* Natalie Angier, *Our Understanding of Giraffes Does Not Measure Up*, N.Y. Times, Oct. 5, 2014, at D1 (describing the lack of scientific research and therefore lack of knowledge about giraffes).

32. Doremus, *Information Problem*, *supra* note 17, at 1475–76.

33. *See* Daniel B. Botkin, *Adjusting Law to Nature's Discordant Harmonies*, 7 Duke Envtl. L. & Pol'y F. 25, 29–31 (1996) (describing the effect of humans on what we think of as natural).

34. *See infra* notes 40, 60–61 and accompanying text.

3. Variables and Complexity

Ecological systems are complex systems. Complexity breeds uncertainty because complex systems are connected in so many ways and affected by so many variables that those studying the system can never gain a full understanding of how any single variable will respond.[35] Further, because humans are part of ecological systems, the variables that contribute to complexity are not limited to apparently natural phenomena. They include socioeconomic variables.

In part, this is a current data gap and can be, to a limited extent, remedied by more information and better modeling. However, complexity makes developing a full picture of the system ultimately impossible. It also exacerbates uncertainty arising from data gaps. Scientists' ability to learn in an area with known information gaps may be hampered by their lack of understanding of how that area is connected to another area. It can, therefore, affect how scientists structure experiments, demonstrated by Peel's discussion of methodological uncertainty.[36]

4. Indeterminacy

Ecologists understand ecological systems to be in a constant state of flux.[37] They are stochastic systems, subject to randomness. There is also no state of equilibrium to which they will return if 'left alone' by humans.

Uncertainty arising from indeterminacy is closely related to the problems of complexity and variability.[38] In some ways, it is the most intractable because it arises not from a lack of information, but from a lack of any determinate end-point. This adds to complexity, because if systems are operating along non-linear paths they may interact with each other and behave internally in ways that would not have been predicted by extrapolating from data in a linear fashion. Models, discussed further below, can build in probabilities and identify the level of confidence in their predictions but, again, cannot provide absolute certainty.

Indeterminacy adds to uncertainty in another very concrete way for decision makers. Because ecological systems do not have their own state of equilibrium, decision makers will sometimes have to choose the environmental condition they want to maintain. Science cannot provide the answer, beyond advocating maintenance of 'ecological integrity'.[39] As a result, decision makers must make value judgments, both in the sense of

35. STEVENS, *supra* note 8, at 4 (describing the myriad potential interactions within ecosystems). *See also* PEEL, *supra* note 7, at 37 (describing the problem of generalizing between data sets because of variability).

36. PEEL, *supra* note 7, at 45.

37. *See* Holling, *supra* note 9, at 19.

38. In a complex system with an equilibrium state, resolving the uncertainty arising from complexity would require grappling with all the variables but could still lead to a determinable endpoint. In systems that lack an endpoint, the uncertainty becomes more intractable.

39. For difficulties defining this term and more discussion on this, *see* Wiersema, *Train Without Tracks*, *supra* note 10.

which goal they are seeking to achieve and in the sense of which values they wish to accommodate in meeting that goal.

B. *Uncertainty in Wildlife Trade*

Uncertainty abounds in wildlife trade. This uncertainty ranges from data gaps to problems of complexity and indeterminacy, and results in contested information that can be heavily informed by value preferences. For example, the parties to CITES have spent time debating trade in polar bears, sharks, and ivory. All four types of uncertainty appear in these debates.

In the case of the polar bear, in spite of some knowledge and some scientific consensus, uncertainty remains. Sources of uncertainty include current and historic data gaps. Polar bear research did not begin until the 1960s, so there are no reliable population numbers before that time. This in turn has led to persistent, albeit unreliable, claims that populations of polar bears have increased in recent decades.[40] Even after some decades of scientific study, data is currently missing for almost half of the subpopulations of polar bears. This current data gap also informs views of population dynamics. For example, reports from Inuit hunters that they were seeing more bears in the mid-2000s led to a belief by some communities that polar bear numbers were increasing. However, some scientists argued that the increase in polar bear sightings was more likely related to sea ice changes due to climate warming, with polar bears increasing their time near human settlements because the ice they would traditionally be spending time on has diminished due to melting.[41]

Information gaps exist for many other species, including species regulated by CITES.[42] Indeed, more is known about polar bears than about many other species. Absence of data is significant in the study of oceanic sharks, many of which have been the subject of discussion at CITES's

40. Peter Dykstra, *Magic Number: A Sketchy "Fact" About Polar Bears Keeps Going . . . and Going . . . and Going*, Soc'y of Envtl. Journalists J. (2008), *available at* http://www.sejarchive.org/pub/SEJournal_Excerpts_Su08.htm.

41. *See* Eric V. Regehr et al., *Effects of Earlier Sea Ice Breakup on Survival and Population Size of Polar Bears in Western Hudson Bay*, 71 J. of Wildlife Mgmt. 2673, 2680–81 (2007); Ian Stirling & Claire L. Parkinson, *Possible Effects of Climate Warming on Selected Populations of Polar Bears (Ursus Maritimus) in the Canadian Arctic*, 59 Arctic 262, 262–63, 271–72 (2006); Martina Tyrrell, *More Bears, Less Bears: Inuit and Scientific Perceptions of Polar Bear Populations on the West Coast of Hudson Bay*, 30 Études/Inuit/Stud. 191, 198–99 (2006); Martina Tyrrell and Douglas A. Clark, *What Happened to Climate Change? CITES and the Reconfiguration of Polar Bear Conservation Discourse*, 24 Global Envtl. Change 363, 364 (2014).

42. Smith et al., *supra* note 6 at 85–86.

CoPs.[43] Very little is known, for example, about porbeagle shark spatial ecology, movement, and habitat preference.[44]

With regard to the ivory trade, even with robust efforts and international support for data collection, lack of data still hampers full certainty on elephant populations. The most comprehensive assessment of African elephants, prepared at the direction of the parties to CITES by the IUCN/SSN African Elephant Specialist Group covers only thirty to forty percent of the elephant population, with the status and reliability of information varying by region.[45] Monitoring the Illegal Killing of Elephants, MIKE, has contributed greatly to information on poaching, but the system is also rife with information gaps.[46]

Resolving these data gaps is in part a question of putting more resources into research, although historical data gaps cannot be fully remedied. Counting polar bears, although easier than counting many other species, involves certain logistical difficulties, making it unlikely that all data gaps can be remedied this way.[47] For sharks, some uncertainty can be remedied by directing resources to studying the species, and by using new technology like satellite tracking technology.[48] This will take time, and is unlikely to result in complete information, but would be helpful to conservation efforts. Nevertheless, significant barriers exist to the collection of additional information on sharks, including the difficulty of gaining information from illegal fishing, and problems of capacity.[49] Where countries rely on catch landing information, the data could be wrong for many reasons.[50] Data collection is complicated by problems in identification of fins and the lack of species-specific reporting.[51]

---

43. Shelley C. Clarke et al., *Population Trends in Pacific Oceanic Sharks and the Utility of Regulations on Shark Finning*, 27 CONSERV. BIOLOGY 197 (2012); U.N. Food and Agric. Org. [FAO], Technical Workshop on the Status, Limitations and Opportunities for Improving Monitoring of Shark Fisheries and Trade: Advance Copy, Nov. 3-6, 2008, at 7–10, Fisheries and Aquaculture Rep. No. 897 (2009) [hereinafter FAO, Technical Workshop on Shark Fisheries and Trade] (presented at CITES's Animal Commitee's 24th Meeting), *available at* http://cites.org/sites/default/files/common/com/ac/24/EFS24i-06.pdf.

44. Nicolas G. Pade et al., *First Results from Satellite-Linked Archival Tagging of Porbeagle Shark, Lamna Nasus: Area Fidelity, Wider-Scale Movements and Plasticity in Diel Depth Changes*, 370 J. OF EXPERIMENTAL MARINE BIOLOGY & ECOLOGY 64, 65 (2009); Ryan A. Saunders, François Royer, & Maurice W. Clark, *Winter Migration and Diving Behavior of Porbeagle Shark, Lamna Nasus, in the Northeast Atlantic*, 68 ICES J. OF MARINE SCI. 166 (2011).

45. *See* CITES, 65th Meeting of the Standing Comm., *Elephant Conservation, Illegal Killing and Ivory Trade*, Geneva, Switz., July 7–11, 2014, SC65 Doc. 42.1, at 14, *available at* http://cites.org/sites/default/files/eng/com/sc/65/E-SC65-42-01_2.pdf.

46. *See id.* (describing information gaps with regard to elephant populations).

47. *See generally* PETER LOURIE, THE POLAR BEAR SCIENTISTS (2012) (describing the work of the polar bear scientists and the challenges they face counting polar bears).

48. *See* Pade et al., *supra* note 44 at 72–72.

49. FAO, Technical Workshop on Shark Fisheries and Trade, *supra* note 43, at 7.

50. *Id.* at 7, 11–12.

51. *Id.* at 10.

Even if these information gaps could be addressed, questions about these species are still affected by uncertainty arising from the interplay of a number of variables. For example, for polar bears, the interaction of climate change with polar bear population viability may also be complicated by the impact of climate change on other species, such as the ringed seal, and the cumulative effects of behavioral changes by polar bears that could increase human-polar bear interactions. The scientists who study polar bears are in broad agreement that polar bear numbers are currently not in decline, but that sea ice loss—projected by climate scientists—will likely have an impact on populations.[52] Yet the overall vulnerability of the polar bear to climate change will depend on a number of variables regarding climate change, other species, and polar bear adaptability.[53] Thus, even though scientists agree that the polar bear is vulnerable to habitat change and that climate change is causing and will continue to cause that habitat change, uncertainty remains.[54] Similarly sharks, as climate change affects ocean temperatures, may be affected both directly and indirectly.

Information gaps about levels of trade[55] in shark and elephant parts—indeed, all wildlife trade—are also exacerbated by socio-economic variables and the uncertainty arising from the indeterminacy of demand, migration of people, and market dynamics. Elephant populations and levels of poaching are affected by physical habitat changes and by factors such as war and trade routes. Indeed, demand for illegal wildlife appears to be fueled currently by wealth, rather than traditional medicines, adding a new set of variables to predictions about levels of trade.[56] Variables concerning proposals to legalize trade in ivory and rhino horn and the effects of that trade on poaching levels include many questions. For example, it is unknown whether demand will increase in response to legalization, how illegal traders will respond, and whether buyers will see parts of captive-bred or raised animals as substitutable for wild-caught specimens.[57] In addition,

52. *See, e.g.*, Tanya Shadbolt, Geoff York, & Ernest W.T. Cooper, Icon on Ice: International Trade and Management of Polar Bears 5 (2012) (noting that all polar bear range states agree that the greatest threat to the polar bear is climate change and its impact on their habitat); Andrew E. Derocher, Nicholas J. Lunn, and Ian Stirling, *Polar Bears in a Warming Climate*, 44 Conserv. Biology 163, 166 (2004); Christine M. Hunter et al., *Climate Change Threatens Polar Bear Populations: A Stochastic Demographic Analysis*, 91 Ecology 2883 (2010); Tyrrell & Clark, *supra* note 41, at 364 (describing the consensus about the nature of threats to polar bears, even though the status and trends of polar bear populations is contested).

53. *See* Derocher, Lunn, & Stirling, *supra* note 52 (outlining some of the variables that could affect polar bear populations).

54. *See* Tyrrell & Clark, *supra* note 41, at 364 (noting that the status and trends of polar bear populations is contested).

55. Shadbolt, York, & Cooper, *supra* note 52, at 4.

56. *See* Press Release, CITES, CITES Meets as 'Wealth' is Replacing 'Health' as a Driver of Wildlife Consumption, July 4, 2014, *available at* http://www.cites.org/eng/CITES_SC65_wealth_replacing_health_as_driver_of_wildlife_consumption.

57. *See* Annecoos Wiersema, *Uncertainty and Markets for Endangered Species Under CITES*, 22 Rev. of Eur., Comp. & Int'l. Envtl. L. 239, 242 (2013) [hereinafter Wiersema, *Uncertainty and Markets*].

biological questions remain unanswered, such as questions about how rhinos would respond to having their horns harvested.

To account for these variables, scientists have developed complex models that allow them to translate the data into predictions.[58] These models cannot provide certainty, as discussed further below, but could provide enough of a basis for regulatory response. However, local communities often do not agree with all of the scientists' predictions.[59] Not only do communities dispute scientific estimates of the number of polar bears, but they also dispute how adaptable polar bears will be and whether they are likely to be able to survive the effects of climate change.[60] Scientists are still unclear on exactly when polar bears separated from their brown bear ancestors, leading to disputes about whether they may have survived previous warm periods.[61]

These variables give rise to a deeper layer of uncertainty because they affect not only predictive capacity, but also affect how new data is interpreted. In the case of poaching of elephants, despite the fact that there is full agreement that poaching has gone up since the last legally sanctioned sale of ivory, experts do not agree on whether that increase in poaching is connected to the sale.[62]

It should go without saying that one way to address lack of knowledge is to conduct additional research. As Smith and his coauthors note, channeling more funds toward research that is targeted to answer particular questions can increase the amount of relevant knowledge available to scientists and policy makers.[63] However, simply seeking additional information will not address much of the uncertainty discussed above.

First, policy responses may be needed before the research is available. This can be significant for conservation, where the risk of extinction is at play. Second, much of the uncertainty discussed above cannot be fully addressed even with more information. More information is certainly important, for example when trying to reconstruct historical baselines or account for variables, but the complexity of the system is such that it would be

58. *See, e.g.*, Regehr et al., *supra* note 41 at 2674; Lourie, *supra* note 47, at 48–49.

59. *See* Martina Tyrrell, *West Hudson Bay Polar Bears: The Inuit Perspective*, *in* INUIT, POLAR BEARS AND SUSTAINABLE USE: LOCAL, NATIONAL AND INTERNATIONAL PERSPECTIVES 95, 98–101 (M.M.R. Freeman and Lee Foote eds., 2009) [hereinafter Tyrell, *West Hudson Bay Polar Bears*] (describing the view of Arviarmiut that polar bear numbers are increasing).

60. Government of Nunavut, *Response to the U.S. Fish and Wildlife Service's Proposed Rule to List the Polar Bear as Threatened Throughout its Range*, *in* INUIT, POLAR BEARS AND SUSTAINABLE USE: LOCAL, NATIONAL AND INTERNATIONAL PERSPECTIVES, *supra* note 59, at 153, 155–161 (questioning the methodology and conclusions of scientific studies that have projected that polar bears will be endangered or extinct within three generations due to climate-induced reduction in sea ice). *See also id.* at 156 (arguing that polar bears can survive and flourish in areas that have an ice-free season); *id.* at 157–158 (discussing alternative explanations for polar bear population numbers).

61. LOURIE, *supra* note 47, at 74.

62. *See* sources cited *infra* note 229.

63. Smith et al., *supra* note 6, at 83.

impossible to know everything with absolute certainty. The uncertainty that remains is a predictive uncertainty. We will never have quite enough information to predict fully what will happen next.

Ecological modeling, a form of applied mathematics, can facilitate some understanding in the face of complexity because it allows abstractions "to highlight the relevant aspects of complex phenomena."[64] The very act of abstraction and simplification necessary for developing models allows for a spotlight on the key features of ecological systems, which in turn allows for prediction, explanation, and generalization.[65] Ecological modelers use the example of a map, which is a simplified model of an area. The map allows a viewer to focus on the feature they are most interested in—depending on the map, it could be a road or a border.[66] Without that simplification and spotlight, scientists would be overwhelmed by complexity.[67] Indeed, modelers generally begin with the simplest model they can design before adding additional elements.[68] As Soetaert and Herman say "[t]he largest intellectual challenge of [modeling] consists in the creative simplification of a scientific problem, in such a way that no great injustice is done to realism."[69] Modelers stress that the most complex model is not always the best model.[70]

While modeling can provide a mechanism for grappling with complexity and learning about aspects of the system, it is still modeling. At best, modelers will recognize that modeling should generally be iterative, and be capable of recognizing when a model needs refinement.[71] Modelers must also be explicit and transparent about their assumptions.[72] Yet even with these precautions, modelers are limited by available techniques, heuristics, and available knowledge, as Peel describes.[73] Models may allow for prediction, explanation, and generalization, but they do not provide certainty. Thus, in the face of complexity, some uncertainty will always remain.

Modeling also cannot address uncertainty arising from indeterminacy, which requires value choices. In the case of wildlife trade, core differences

64. Soetaert & Herman, *supra* note 8, at 1.

65. Stevens, *supra* note 8, at 3–4.

66. *Id.*, at 4 (describing the advantage of a road map for a traveler); Soetaert & Herman, *supra* note 8, at 2 (describing the benefit of a map with only the position and name of countries, without details such as the position of houses and agricultural information).

67. Stevens, *supra* note 8, at 4; Soetart & Herman, *supra* note 8, at 1.

68. *See* Soetaert & Herman, *supra* note 8, at 15–16 ("[A] model should be as simple as possible, but not simpler."). *See also* Stevens, *supra* note 8, at 4 (using this approach in his teaching methodology).

69. Soetaert & Herman, *supra* note 8, at 15.

70. *Id.* at 16.

71. *Id.* at 7, 11.

72. *Id.* at 6–7.

73. Elements of all three of Peel's uncertainties are implicated here, epistemological uncertainty, methodological uncertainty, and sociological uncertainty. *See* Peel, *supra* note 7, at 43-47.

arise between groups opposed to captive breeding of wild animals or any killing of wild animals, and groups focused on the maintenance of a market in wild animal products. While these disagreements can be informed by knowledge and predictions about population dynamics, the sustainability of trade, and the likely behavior of markets, that knowledge cannot resolve core decisions. For example, in the question of whether to legalize a market in rhino horn, there is a possibility that such a market could result in the extinction of current semi-wild populations of rhinoceros and the species surviving only in ranched environments. It is a value decision whether this is a risk the parties to CITES are willing to bear, even if all parties wish to maintain populations of rhinoceros.

II. Managing Uncertainty: Precaution and Adaptive Management

A. *The Precautionary Principle and Precautionary Approach*

In international law, policy makers adopted the precautionary principle or precautionary approach as a tool to allow regulatory action in the face of uncertainty. Although the principle takes different forms in different contexts, its most generalized form is embodied by Principle 15 of the 1992 Rio Declaration on Environment and Development, which provides that "[w]here there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation."[74]

This generalized form of precaution from Principle 15 demonstrates several important aspects of the precautionary principle. First, Principle 15 limits the application of the principle to situations of "serious or irreversible damage," implicitly creating a threshold of the type of harm implicated before it will be triggered. This is a common approach when the precautionary principle is applied.[75] Second, the principle seems to assume that policy makers can isolate a single identifiable threat and that regulatory action will be beneficial in stemming that threat, without concern for other consequences of regulatory action. Third, the principle calls for "cost-effective measures" for prevention of "environmental degradation," making environmental protection an explicit goal to be achieved within certain parameters, although it does not define "environmental."[76] Fourth, the

74. United Nations Conference on Environment and Development, Rio de Janeiro, Braz., June 3–14, 1992, *Rio Declaration on Environment and Development*, U.N. Doc. A/CONF.151/26/Rev.1 (Vol. 1), Annex I (Aug. 12, 1992) [hereinafter *Rio Declaration*].

75. *See, e.g.*, MOX Plant Case (Ireland v. U.K.), Case No. 10, Order of Dec. 3, 2001, *available at* http://www.itlos.org/fileadmin/itlos/documents/cases/case_no_10/Order.03.12.01.E.pdf; Southern Bluefin Tuna Cases (N.Z. v. Japan; Austl. v. Japan), Cases Nos. 3, 4, Order of Aug. 27, 1999, *available at*, http://www.itlos.org/fileadmin/itlos/documents/cases/case_no_3_4/Order.27.08.99.E.pdf; Peel, *supra* note 7, at 65 (discussing the problem of reliance on a threshold before precaution is triggered); Jacqueline Peel, *Precaution – A Matter of Principle, Approach, or Process?*, 5 Melb. J. Int'l L. 483 (2004) [hereinafter Peel, *Precaution*].

76. *Rio Declaration*, *supra* note 74, at 877–79.

principle could be read as reversing the burden of proof traditionally required for action, requiring proof of safety rather than proof of harm.[77]

All of these aspects of the Rio Principle are the subject of extensive debate and different definitions of the principle have been adopted in different fora over the years.[78] Many commentators have sought to highlight that the principle is highly context-dependent. This flexible context-dependent application has, in turn, consequences for where the burden of proof will fall, what the threshold will be before application of precaution, and what the response should be to this threshold risk. The precautionary principle has therefore been described as having strong and weak versions and a range in between. Increasingly, commentators and decision makers are endorsing a 'precautionary approach' rather than a 'precautionary principle,' arguing that an approach allows more flexibility than a principle.[79] In weaker versions, the principle can play a role only as a 'preventative' principle, justifying action that will prevent harm, but not adding any additional layer of precaution to address uncertainty.[80]

Even with this context-dependent application, and perhaps in part because of it, commentators have argued that the principle or approach is too vague to be useful for decision makers. Precaution stands in the uneasy position of being accepted as a foundational part of international environmental law, while having an unfixed and unclear meaning. Perhaps because of this status, it has been viewed as incapable of being applied in any principled manner to environmental decision-making, making it seem anti-scientific, indeterminate, and paralyzing, irrational, or all of the above.[81]

One particular criticism is that the principle seems applicable only to a scenario where new technologies have the potential for more harm than good and can be banned. As many commentators have pointed out, this does not fit most regulatory decisions, where risks must be balanced and where potentially harmful technologies may also offset other harms and bring significant benefits, for example with genetically modified organisms. Sunstein argues, for example, that a strong precautionary principle applied to risks is indeterminate and potentially paralyzing because it is

77. *See id.*

78. *See generally* Arie Trouwborst, Evolution and Status of the Precautionary Principle in International Law (2002) (discussing the precautionary principle in international law); The Precautionary Principle and International Law: The Challenge of Implementation (David Freestone and Ellen Hey eds., 1995) (discussing the precautionary principle in international law).

79. *See, e.g.*, Peel, *Precaution*, *supra* note 75.

80. *See* Arie Trouwborst, *Prevention, Precaution, Logic, and Law*, 2 Erasmus L. Rev. 105, 118 (2009).

81. *See, e.g.*, Cass R. Sunstein, Laws of Fear: Beyond the Precautionary Principle (2005) (describing the weak version of the principle as commonsense and the strong version of the principle as "paralyzing") [hereinafter Sunstein, Laws of Fear]; Cass R. Sunstein, *The Paralyzing Principle*, 25 Reg. 32 (2002).

not clear that regulatory action will always result in a better outcome than waiting.[82]

Some commentators apply this criticism with particular force to the context of conservation and wildlife trade.[83] In the context of wildlife trade, a presumption behind banning trade assumes that trade is inherently harmful to a species' survival. Therefore, if a species is threatened, there should be less trade. A strict precautionary approach would suggest that even if there is uncertainty, states should not wait to ban trade, but should ban it even without full information. However, some commentators argue that some trade can actually save a species on the brink of extinction. If this is true, banning trade before there is full information could be more harmful than not banning trade. If decision makers recognize that both action and inaction could cause harm, they may not know what to do and they risk being paralyzed.[84]

The effect of this indeterminacy is, some argue, to leave decision makers with no guidance for what precaution actually requires them to do. That in turn leaves the door open for value-based decision making that may be unconnected from scientific considerations. It appears to some that precaution could be used to override prevailing scientific consensus, with a perception of risk triggering action even if that perception of risk is based on value preferences and heuristic biases not based on scientific analysis.[85]

For some, the response is to ignore any need for precaution and rely solely on the available scientific evidence. This is evident in some parties' approaches to listing decisions in CITES, as we shall see. Yet many commentators and states recognize some forms of uncertainty. The question becomes how to navigate this uncertainty without appearing to undermine scientific processes and conclusions.

One apparent way to do this that is increasingly taking hold is to acknowledge a role for a precautionary approach but to cabin it within decision-making processes that are perceived as more objective or more tied to scientific methodology. In short, the move is toward a proceduralization of the precautionary approach. This takes several forms.

---

82. *See* SUNSTEIN, LAWS OF FEAR, *supra* note 81, at 26–33.

83. *See* BIODIVERSITY AND THE PRECAUTIONARY PRINCIPLE: RISK, UNCERTAINTY AND PRACTICE IN CONSERVATION AND SUSTAINABLE USE (Rosie Cooney & Barney Dickson eds., 2005) [hereinafter BIODIVERSITY AND THE PRECAUTIONARY PRINCIPLE].

84. *See, e.g.*, SUNSTEIN, LAWS OF FEAR, *supra* note 81. *Cf.* Robert V. Percival, *Who's Afraid of the Precautionary Principle?*, 23 PACE ENVTL. L. REV. 21 (2006) (defending a role for the precautionary principle and arguing that critics of the precautionary principle are attacking a straw man).

85. *See* SUNSTEIN, LAWS OF FEAR, *supra* note 81, at 35–49 (describing the heuristics necessary for the precautionary principle to be operational).

B. *Precaution as Procedure: Risk Assessment, Cost-Benefit Analysis, and Environmental Impact Assessment*

One approach that spans the range of environmental problems is to limit precaution to a procedural requirement, rather than allowing it a substantive role to play. This means that standard decision-making processes must acknowledge uncertainty and account for it. They can do this, for example, by accompanying conclusions with an assessment of confidence in their accuracy. This approach does not, however, require policy decision makers to apply precaution to their final substantive decisions.

For example, precaution can be viewed as part of risk assessment and risk management or as part of cost-benefit analysis.[86] McAllister, discussing a series of decisions in Brazil on genetically modified organisms, argues the precautionary principle should be understood as a procedural requirement, a mechanism to allow decision makers to "identify and consider risks with caution when faced with scientific uncertainty about potentially serious environmental harms."[87] On this interpretation, the precautionary principle is not a substitute for risk assessment or cost-benefit analysis, but an inherent part of them.[88] As McAllister notes, one Protocol to the Convention on Biological Diversity (CBD)—the Biosafety Protocol—"relies extensively on the precautionary principle but also specifies the use of risk assessment techniques"[89] and the Rio Declaration's original statement of the precautionary principle "explicitly refers to the use of cost-benefit analysis when it speaks of "cost-effective" measures."[90] Sunstein, in his rejection of the precautionary principle as a useful decision-making tool, argues in favor of a modified form of cost-benefit analysis that, he believes, would be able to account for uncertainty and address many of the concerns that inform the desire for a precautionary approach without abandoning science.[91]

Similarly, precaution is increasingly seen as being most aptly operationalized through environmental impact assessment (EIA), which requires an assessment of the likely environmental impacts of certain activities. EIA has become a prominent tool in international environmental law. Although it has not always fully addressed uncertainty, it has the potential to incorporate risk assessment and worst-case scenario analysis as one way to capture uncertainty.[92]

---

86. *See* SUNSTEIN, LAWS OF FEAR, *supra* note 81, at 175–203.

87. Lesley K. McAllister, *Judging GMOs: Judicial Application of the Precautionary Principle in Brazil*, 32 ECOLOGY L.Q. 149, 155–157 (2005).

88. *See id.* at 156.

89. *Id.*; Cartagena Protocol on Biosafety to the Convention on Biological Diversity arts. 10(1), 15, Jan. 29, 2000, 2226 U.N.T.S. 208.

90. McAllister, *supra* note 87, at 157.

91. SUNSTEIN, LAWS OF FEAR, *supra* note 81, at 175–203.

92. Graham Tucker & Jo Treweek, *The Precautionary Principle in Impact Assessment: An International Review*, *in* BIODIVERSITY AND THE PRECAUTIONARY PRINCIPLE, *supra* note 83, at 73.

As complements to moves that limit precaution to a procedural role, commentators and decision makers often treat precaution as a tool to deal with temporary information gaps and only apply it where the science has already demonstrated a threshold of risk.[93] This makes decision makers feel as though they can acknowledge some uncertainty without completely overriding scientific data. Yet this approach depends on a view both that uncertainty can be resolved in time and that the threshold analysis of risk can be relied on.[94] It is a view that treats uncertainty as arising primarily from current data gaps and complexity that can be minimized. Gillespie goes further to suggest that the precautionary principle involves a second active step for anyone applying it, namely the requirement that attempts be made to resolve the scientific uncertainty.[95] Thus, he argues, "any measures adopted under the auspice of the precautionary principle are of a transitory nature."[96]

The World Trade Organization's (WTO) Panel in the EU Biotech decision interpreted the principle within the context of the SPS Agreement's process for risk analysis, which contains the embedded assumption that more scientific knowledge could ultimately make the principle unnecessary for a particular issue.[97] The International Tribunal for the Law of the Sea (ITLOS) has discussed precaution as part of environmental impact assessment, both in a decision that applied the principle, the Southern Bluefin Tuna case, and in a decision that decided against the party that invoked the principle, the MOX Plant case.[98] Courts in Brazil have taken a similar approach, with the lower district court holding that the precautionary principle required an Environmental Impact Assessment,[99] while the appellate court held that other environmental risk assessment techniques could also satisfy the principle.[100] Despite differences in outcome, both Brazilian courts relied on procedure to determine whether the agency concerned had complied with the principle.[101] Similarly, within the European Union, where the precautionary principle has been endorsed

93. *See* PEEL, *supra* note 7 (extensively documenting the way in which judges rely on a threshold before being willing to allow the precautionary principle or precautionary approach to be invoked).

94. *See* ALEXANDER GILLESPIE, CONSERVATION, BIODIVERSITY, AND INTERNATIONAL LAW 466 (2011). *See also* PEEL, *supra* note 7, at 63–64.

95. GILLESPIE, *supra* note 94 at 466.

96. *Id.*

97. *See* Report of the Panel, *European Communities – Measures Affecting the Approval and Marketing of Biotech Products*, at 241, 336, U.N. Doc. WT/DS291/R, WT/DS292/R, WT/DS293/R, (Sept. 29, 2006).

98. Southern Bluefin Tuna Cases, *supra* note 75; MOX Plant Case, *supra* note 75.

99. McAllister, *supra* note 87, at 165 (discussing the district court's holding that preparation of an EIA represented compliance with the principle).

100. *Id.* at 168 (discussing the appellate court's conclusion that not only an EIA, but also other environmental risk techniques could satisfy the precautionary principle).

101. *Id.* at 165–68 (discussing the two decisions); *Cf. id.* at 171 (describing the district court as having substituted its judgment for that of the political decision maker with regard to whether the Brazilian government should have banned GMO soybeans, a suggestion that the

and developed, it has become an important component of risk assessment and environmental impact assessment.

C. *Precaution within Adaptive Management*

Within conservation circles, a role has been urged for application of precaution that is distinct from cost-benefit analysis and risk assessment techniques. Increasingly, in conservation circles, precaution is seen as having its most important role to play within the practices of adaptive management. As discussed in Part III of the Article, this is the approach the parties to CITES appear to have taken in dealing with the uncertainties surrounding wildlife trade.

Adaptive management is a conservation approach adopted in response to ecologists' recognition of complexity and uncertainty discussed above. In response to the lessons of ecology, some commentators began to argue in the 1970s that policymakers should develop management responses that would allow for adaptive management, moving away from one-time decision making. Protection and management should provide for monitoring, evaluation of results against operational goals or benchmarks, and reevaluation of both benchmarks and approaches to achieving those benchmarks.[102] Policymakers should also build in some ability to cope with surprise.[103]

In order to learn, some commentators discuss the need for experimentation, though commentators differ on how active that experimentation should be.[104] Even without resolving this debate, it is clear that monitoring of whatever experimentation or management is put in place is key. In addition, learning from that monitoring is key. Management cannot be adaptive if no one is paying attention to what is happening on the ground. As Doremus argues, "[a]daptive management is, in important ways, an information problem."[105]

Incorporating precaution within adaptive management brings together adaptive management's focus on monitoring and science-based decision making with the recognition of complexity and uncertainty. Precaution can provide a means of ensuring that scientists are questioning their work and that decision makers do not assume that science can provide every answer.

---

district court made its decision on the basis of substantive concerns rather than procedural concerns, a point I'll return to later).

102. *See* Wiersema, *Train Without Tracks*, *supra* note 10, at 1252, fig. 1.

103. *Id.* For further discussion of efforts to introduce adaptive management into U.S. environmental policy, *see* also Robin Kundis Craig & J.B. Ruhl, *Designing Administrative Law for Adaptive Management*, 67 VAND. L. REV. 1 (2014); J.B. Ruhl & Robert L. Fischman, *Adaptive Management in the Courts*, 95 MINN. L. REV. 424 (2010); J.B. Ruhl, *Regulation by Adaptive Management—Is It Possible?*, 7 MINN. J.L. SCI. & TECH. 21 (2005); Robin Kundis Craig, *"Stationary is Dead"—Long Live Transformation: Five Principles for Climate Change Adaptation Law*, 34 HARV. ENVTL. L. REV. 9 (2010).

104. Doremus, *Information Problem*, *supra* note 17 (describing the different approaches to experimentation.

105. *Id.*

When seen in this light, precaution is no longer seen as counter to science but instead as complementary.[106]

The move is interesting, however, because it shifts precaution away from playing a substantive function in decision-making and moves it into a more process-oriented role. It allows for meta-analysis of the scientific decision-making process without actually bringing any non-scientific concerns into play.

D. *Analysis and Conclusion*

The move to limit precaution's role to procedures and the move to incorporate precaution within adaptive management are based on a shared assumption. They have in common the view that precaution should not function at the regulatory decision-making stage as an additional element in the decision-making process. Instead, precaution should either be incorporated within assessment procedures, as with environmental impact assessment and risk assessment, or be used as a means of evaluating the quality of the scientific data informing the ultimate policy decision. Under this approach, the decision maker is not required to apply precaution as an additional substantive factor and the burden of proof required for activities to go ahead is not reversed. Instead, the decision maker is required to incorporate precaution into the procedures they use to evaluate the data.

These moves are indeed critical and an important role for precaution to play. As Peel points out, a precautionary approach is necessary for decision makers when they evaluate scientific data because of the uncertainties inherent within scientific processes.[107] Thus, Peel would go further than many commentators in suggesting that precaution does not require a threshold showing of harm.[108] Its most significant role is in ensuring that uncertainty is accounted for.[109]

It is easy to see the appeal of this approach for situations where data is contested, uncertainty is prevalent, and conservation constituencies are informed by value concerns beyond science. Basing decision-making on apparently objective criteria, with an element of precaution added to address acknowledged weaknesses of those criteria, appears to be a way to limit non-conservation objectives and limit disagreement among decision-making. In the search for the right decision, it seems that science should prevail and precaution should only play a supporting role to that science, informing the procedures for scientific work and decision makers' evaluation of that work.

Yet even if this procedural role for precaution is necessary, the question remains whether this procedural role alone is sufficient. Can it diminish value disputes and ensure that decision makers act in the best interests of environmental protection? Can it ensure that decision makers have

106. *Id.*

107. PEEL, *supra* note 7, at 54–55.

108. *Id.,* at 221–222.

109. *Id.,* at 222.

fully accounted for all of the sources of uncertainty that are inherent in managing conservation? Part III discusses the role of precaution and adaptive management within CITES in order to shed light on these questions.

III. Managing Uncertainty within CITES

Under international law, international trade of wild fauna and flora is regulated through the Convention on International Trade in Endangered Species (CITES).[110] It has significant participation by states and has been referred to as the most important conservation treaty in force.[111]

The CITES text contains no explicit reference to the precautionary principle in its treaty text, which is not surprising given that the treaty was negotiated before the principle became prominent in international environmental law. Precaution is explicitly mentioned in the listing criteria developed through subsequent resolutions at Conferences of the Parties.[112] Parties occasionally refer to precaution in listing proposals, and experts working on CITES have also invoked precaution. However, evidence of strong reliance on precaution in CITES decision-making is hard to find. On the other hand, over the years, the parties to CITES have emphasized the need for science-based decision-making and have developed new mechanisms for monitoring and information gathering to strengthen this science-based foundation.

This Section discusses the role of both precaution and monitoring in key aspects of CITES decision making in order to shed light on the way in which the parties view uncertainty. This Section focuses on the CITES listing criteria and on non-detriment findings, as well as discussing several particular species that the parties to CITES have addressed in recent years and will likely be addressing again at CoP 17 in 2016.

A. *Structure of CITES*

By its terms, CITES applies only to species threatened by international trade.[113] Its treaty text establishes a structure based on three appen-

110. CITES, *supra* note 5.

111. *See* Michael Bowman, *A Tale of Two CITES: Divergent Perspectives upon the Effectiveness of the Wildlife Trade Convention*, 22 Rev. Eur. Comp. & Int'l Envtl. L. 228, 228 (2013).

112. CITES, 25th Meeting of the Animal Comm., Geneva, Switz., July 18-22, 2011, *Criteria for Inclusion of Species of Appendices I and II*, AC25 Doc. 10 [hereinafter *Criteria for Inclusion*]. For discussion of the role of CoP resolutions in the evolution of the treaty, *see* Annecoos Wiersema, *The New International Law-Makers? Conferences of the Parties to Multilateral Environmental Agreements,* 31 Mich. J. Int'l L. 231, 241–245 (2009) (discussing the significance of examples of CITES CoP activity). *See generally id.* (discussing the legal status of CoP activity and its relation to the state parties' underlying treaty obligations).

113. *See* CITES, *supra* note 5, at preamble (recognizing both "that peoples and States are and should be the best protectors of their own wild fauna and flora," and that international cooperation is required for protection of certain species "against over-exploitation through international trade"); *id.*, art. 2 (limiting the scope of the treaty to species "which are or may be affected by trade" and species that may become threatened with extinction "unless trade in specimens of such species is subject to strict regulation").

dices. Species are to be listed, through votes of the parties, based on their current level of threat if international trade would contribute to further threat to their survival. Once species are listed on any of the Appendices, international trade must only be in accordance with the treaty's provisions.[114] For a species to be listed on either Appendix, the parties must agree to that listing by a two-thirds majority of the parties present and voting.[115]

Appendix I is reserved for "all species threatened with extinction which are or may be affected by trade."[116] For these species, both export and import permits are required.[117] For the export permit, the Scientific Authority in the exporting state must advise that the trade "will not be detrimental to the survival of that species."[118] The importing state's Scientific Authority must advise that the import "will be for purposes which are not detrimental to the survival of the species involved."[119] These are non-detriment findings, common to both Appendices I and II and discussed further below.

In addition to requiring that any trade not be detrimental to the survival of the species, the Management Authority of the importing state must be satisfied that the Appendix I-listed specimen "is not to be used for primarily commercial purposes."[120] Trade for "primarily commercial purposes" is thereby prohibited for Appendix I species and listing a species on Appendix I results in what amounts to a ban on virtually all international trade in that species and its parts, although the word 'ban' is not used in the Convention.[121]

Appendix II listing is for "all species which although not necessarily now threatened with extinction may become so unless trade in specimens of such species is subject to strict regulation in order to avoid utilization

---

114. *Id.* art. 2(4).

115. *Id.* art. 15(1).

116. *Id.* art. 2(1).

117. *Id.* arts. 3(2) & (3).

118. *Id.* art. 3(2)(a).

119. *Id.*

120. *See id.* arts 3(2)(d) &3(3)(c); *see also* WILLEM WIJNSTEKERS, THE EVOLUTION OF CITES 128 (9th ed. 2011).

121. The extent to which Appendix I listing amounts to an international trade ban is affected by how the parties interpret the treaty phrase 'primarily commercial purposes.' *See* CITES, 5th Meeting of the Conf. of the Parties, Buenos Aires, Arg., Apr. 22–May 3, 1985, *Definition of 'Primarily Commercial Purposes*, ¶¶ 3, 4, Res. Conf. 5.10 (Rev. CoP15), *available at* http://www.cites.org/eng/res/05/05-10R15.php (stating that countries of import should define the phrase as broadly as possible, and clarifying that the question of commercial purposes relates to use after import and not to the particular transaction at the time of import). *See generally* WIJNSTEKERS, *supra* note 120, at 128–132 (discussing the CoP Resolution in detail and outlining examples of trade that would or would not be considered to be for primarily commercial purposes). A few exceptions to the ban are permitted in the treaty. CITES, *supra* note 5, art. 7. These exceptions do not affect the prohibition on commercial trade of wild-bred species and specimens being exported from their country of origin. *Id.* arts. 7(3)(a) & 7(4).

incompatible with their survival."[122] In addition, the treaty provides for listing on Appendix II for non-threatened species whose listing is necessary to ensure that trade in specimens of threatened species listed on Appendix II "may be brought under effective control."[123] This allows, therefore, for listing of lookalike species.

The effect of Appendix II listing is not to ban international trade, but essentially to provide for its regulation so that the species will not reach a point of needing to be listed on Appendix I. Import permits are not required for Appendix II species and import for "primarily commercial purposes" is not prohibited. Instead, listing on Appendix II is supposed to ensure that a species does not become threatened with extinction in two main ways. First, the treaty again provides that the Scientific Authority of the exporting state must advise that export "will not be detrimental to the survival of that species."[124] This is the same wording as that for the export permits for Appendix I.[125] Second, the treaty provides that Scientific Authorities are supposed to monitor export permits and actual exports of Appendix II species and specimens. Whenever the Authority determines that export should be limited "in order to maintain that species throughout its range at a level consistent with its role in the ecosystems in which it occurs and well above the level at which that species might become eligible for inclusion in Appendix I," the Authority shall advise the Management Authority "of suitable measures to be taken to limit the grant of export permits."[126] Thus, under this provision, both monitoring of trade in Appendix II species and response to that monitoring is required. These rules are discussed further in Section C below.

The treaty also provides for a third appendix for species that a party is regulating within its own jurisdiction "for the purpose of preventing or restricting exploitation" and for which it needs "the co-operation of other Parties in the control of trade."[127] Export of Appendix III species whose origin is the state that has listed the species requires an export permit from that state that is based on compliance with the domestic laws of that state.[128] The treaty adds that shipment must minimize "risk of injury, damage to health or cruel treatment," as it does for trade in species listed on any of the three appendices, but the treaty does not add any additional conservation requirements to export of Appendix III species.[129] Thus, Appendix III essentially allows states to impose their own requirements on international trade if they deem it necessary for a particular species, even if the species concerned does not meet the criteria of Appendix I or II.

122. CITES, *supra* note 5, art. 2(2)(a).

123. *Id.*, art. 2(2)(b).

124. *Id.* art. 4(2)(a).

125. *See id.* art. 3(2)(a).

126. *Id.* art. 4(3).

127. *Id.* art. 2(3).

128. *Id.* art. 5(2)(a).

129. *See id.* arts. 3(2)(c), 3(4)(b), & 5(2)(b).

These requirements need not mirror the treaty's requirements for Appendix I or Appendix II species, meaning that the treaty does not require any kind of non-detriment finding or limit on trade for primarily commercial purposes. Under this provision, individual state parties can take a precautionary or preventative approach to trade in their own species if they so wish.

The listing that lies at the heart of CITES has a precautionary aspect to it, seeking to ensure that international trade does not result in the irreversible harm of extinction of a species. In addition, listing on Appendix II can result in regulation and monitoring of trade that could in turn generate information that can help that species. In this sense, Appendix II embodies a notion of precaution facilitated by monitoring and the potential for adaptive responses.

The capacity of Appendix II listing to provide this kind of information depends on a number of actions made possible by Appendix II listing, although far from guaranteed because of different technical capacity among member states. First, the requirement of an export permit for an Appendix II species to be exported allows for the tracking of movement of that species across borders.[130] Second, listing should ensure that trade is not harmful to survival of the species due to the requirement of a non-detriment finding for the issuance of an export permit.[131] Third, Appendix II-listed species are subject to a provision in the treaty that is not applied to Appendix I species for whom commercial trade is prohibited completely. As mentioned above, Article 4(3) of the treaty states that:

> A Scientific Authority in each Party shall monitor both the export permits granted by that State for specimens of species included in Appendix II and the actual exports of such specimens. Whenever a Scientific Authority determines that the export of specimens of any such species should be limited in order to maintain that species throughout its range at a level consistent with its role in the ecosystems in which it occurs and well above the level at which that species might become eligible for inclusion in Appendix I, the Scientific Authority shall advise the appropriate Management Authority of suitable measures to be taken to limit the grant of export permits for specimens of that species.[132]

Article 4(3) therefore provides a mechanism for preventing further decline of a species because it requires action to avoid the species being eligible for listing on Appendix I. This is significant because it indicates that avoidance of listing on Appendix I is intended, under the original treaty terms, to be part of the management plan for Appendix II species.

130. *See CITES Trade*, *supra* note 1.

131. CITES, *supra* note 5, art. 4(2)(a).

132. *Id.* art. 4(3).

B. *Precaution and Monitoring in the Listing Criteria*

The parties have included the precautionary approach within their listing criteria, although they rarely invoke it to support listing. As we shall see, the approach to precaution in the listing criteria is one that equates precaution with monitoring and adaptive responses to monitoring.

Listing decisions lie at the heart of CITES. It is through listing on either Appendix I or II that CITES operates, regulating international trade in those listed species. Yet listing decisions are complicated by fundamental disagreements about the role of utilization and trade in species conservation. This translates into two main debates. First, the idea that banning commercial trade in a species will always help ensure that species' survival is itself contested. Some commentators and countries suggest that, because trade can be beneficial for the survival of some species, listing itself should be a last resort. In addition, commentators note that banning commercial trade can have a detrimental effect on livelihoods and that sound conservation can accommodate sustainable utilization.[133] Second, certain species trigger another set of concerns, namely the appropriateness of killing or domestication of some or all animals. These debates often merge but reflect distinct concerns. The first concern involves predictions and information about the viability of sustainable utilization for population viability of particular species.[134] The second concern invokes values that go beyond what the data might tell decision makers.

The effect of these debates has been to create a fracture among CITES decision makers about whether parties should favor listing or disfavor listing. Contentious debates have arisen with regard to Appendix I listing for proposals to down-list a species from Appendix I to Appendix II or to up-list a species from Appendix II to Appendix I. Disputes are not limited to the context of Appendix I listing. Parties have also disagreed about whether to list a species on Appendix II, with some parties seeking lesser regulation even than Appendix II offers. This was particularly evident over the course of multiple CoPs for certain species traditionally traded at large commercial volume, such as timber and fish species.[135]

The parties have sought to avoid these debates in specific listing decisions by seeking to ground listing decisions in science. The current listing criteria provide a set of biological and trade criteria tied to science and to

133. *See* Rosie Cooney and Max Abensperg-Traun, *Raising Local Community Voices: CITES, Livelihoods, and Sustainable Use*, 22 Rev. of Eur. Comp. & Int'l Envtl. L. 301, 303 (2013). This discussion relates primarily to species listed on Appendix I, because commercial trade in species listed on Appendix II is rarely limited.

134. *See generally* Wiersema, *Uncertainty and Markets*, *supra* note 57 (discussing uncertainty in debates about sustainable utilization).

135. Soledad Aguilar, *Regulatory Tools for the Management of Fish and Timber Species Through CITES*, 22 Rev. of Eur., Comp. & Int'l. Envtl L. 281, 281 (2013); Sara F. Oldfield, *The Evolving Role of CITES in Regulating the International Timber Trade*, 22 Rev. of Eur. Comp. & Int'l Envtl. L. 291, 293 (2013).

the legal requirements of the treaty that, in theory at least, require the parties to make decisions without resort to non-scientific principles.[136]

In 1994, the precautionary principle was included in the first set of detailed listing criteria, known as the Fort Lauderdale criteria (now superseded).[137] The parties resolved that "when considering any proposal to amend Appendix I or II the Parties shall apply the precautionary principle so that scientific uncertainty should not be used as a reason for failing to act in the best interest of the conservation of the species."[138] Similarly, Annex 4 of the Fort Lauderdale criteria referred to the parties acting in the best interest of the conservation of the species when considering proposals to amend the Appendices "in the case of uncertainty, either as regards the status of a species or as regards the impact of trade on the conservation of a species."[139] While this version of the precautionary principle does not explicitly demand listing in the face of uncertainty, it also does nothing to turn the presumption away from listing.

A few years later, a multi-year process began to amend these criteria in response to concerns about whether they were sufficiently based in science. The initial proposals for revision presented to the parties at CoP12 deleted the references to the precautionary principle and the reference to uncertainty, replacing them with a reference to the parties adopting measures "proportionate to the anticipated risks to the species."[140] This is a telling proposal. Shifting the discussion to being one about risk assessment and proportionate response suggests a belief that the scientific evidence could be weighed, with risk assessed, closer to the procedural approaches to precaution described above.

In addition to deleting references to the precautionary principle, the proposed new listing criteria would have changed the trade criteria a proposing party would need to satisfy. The Fort Lauderdale criteria had called for listing if a species is "known to be in trade, probably in trade, but conclusive evidence is lacking, or there is potential international demand, or it would probably enter trade were it not subject to [A]ppendix 1 controls."[141] The new proposal would have listing only occur "[i]f [the species] was known to be in trade, and that trade has a detrimental impact on the status of the species, or it is suspected to be in trade, or there is potential

136. *See Criteria for Inclusion*, *supra* note 112, at 13.

137. *See* CITES, Resolutions of the Conference of the Parties, 9th Meeting of the Conf. of the Parties, Conf. 9.24 (Rev. CoP15) at 87 (Nov. 7–18, 1994), *available at* http://www.cites.org/sites/default/files/eng/cop/09/E9-Res.pdf. This resolution has now been amended. A very basic set of criteria had been in operation before 1994, the Berne Criteria, but they did little to elaborate.

138. *Id.*

139. *Id.*, annex 4, at 89.

140. CITES, 12th Meeting of the Conf. of the Parties, Santiago, Chile, Nov. 3-15, 2002, *Revision of Resolution Conf. 9.24*, at 14, CoP12 Doc. 58, Annex 5a [hereinafter *Revision of Resolution Conf. 9.24 Annex 5a*]., *available at* http://www.cites.org/sites/default/files/eng/cop/12/doc/E12-58-A5a.pdf

141. *Id.*, at 63.

international demand for the species that may be detrimental to its survival in the wild."[142] The possibility of listing on the basis of probability without conclusive evidence would be removed. This does not reflect even a weak version of the precautionary principle.

Several countries objected to these proposals, observing that sometimes information would be lacking and noting that the new criteria might limit listing under those circumstances.[143] Others supported the changes, expressly referring to the need for "sound science" as the basis for both the biological criteria and the trade criteria.[144]

In the end, a form of precaution was brought back into the criteria before they were adopted in their current form.[145] In the operative part of the criteria, the parties resolved that:

> when considering proposals to amend Appendix I and II, the parties shall, by virtue of the precautionary approach and in case of uncertainty either as regards the status of a species or the impact of trade on the conservation of a species, act in the best interest of the conservation of the species concerned and adopt measures that are proportionate to the anticipated risks to the species.[146]

The parties also resolved that proposals to amend Appendices I and II "should be based on the best information available."[147]

The precautionary approach is not explicitly referred to in the detailed biological or trade criteria. Specific precautionary measures are instead, elaborated in a separate section of the current criteria, Annex 4.[148] In addition, where sufficient data are available to indicate that a species warrants delisting, either from Appendix I or Appendix II, the criteria state that delisting should only occur "in accordance with the relevant precautionary measures listed in Annex 4 [setting out precautionary measures]."[149]

Yet Annex 4's precautionary measures are strikingly limited. Beyond repetition of the overall exhortation to apply the precautionary approach in its opening chapeau, Annex 4's specific precautionary measures do not

142. *Id.* at 63, 68.

143. *See, e.g.*, *id.* at 1 (comments by Australia), 3 (comments by Denmark), 4 (comments by Spain and Great Britain), 5 (comments by New Zealand), 5-6 (comments by United States). *See also id.* at 12–13, 14–15 (comments by various countries on the specific amendments proposed).

144. *Id.* at 5 (comments from Norway). *See also id.* at 15 (comments from Japan). For more discussion of the debates surrounding the revision of the listing criteria and inclusion of the precautionary approach in the criteria, *see* Annecoos Wiersema, *Adversaries or Partners? Science and the Precautionary Principle in International Wildlife Treaty Regimes*, 11 J. Int'l Wildlife L. & Pol'y 211, 223-28 (2009) [hereinafter Wiersema, *Adversaries or Partners?*].

145. *Criteria for Inclusion*, *supra* note 112, at 4.

146. *Id.* at 2.

147. *Id.*

148. *See id.* at 17.

149. *Id.* at 2.

refer to uncertainty or even an absence of data.[150] They focus on provisions to limit when species may be down-listed and de-listed, explicitly addressing the possibility that down-listing could trigger increased impact on a species from inadequately controlled or increased trade.[151] Tellingly, these precautionary measures allow down-listing from Appendix I to Appendix II even if the de-listed species is likely to be in demand for trade, provided the parties are compliant with the treaty's provisions for Appendix II species and have put in place measures for enforcement controls and compliance, or have specified an export quota or other special management measure.[152] If quotas are relied on, Annex 4 provides for review procedures.[153]

The biological and trade criteria themselves contain only limited and mostly indirect acknowledgements of uncertainty and lack of information. The criteria allow action on the basis of what is "known, or can be inferred or projected," defined in Annex 5's "Definitions, Explanation and Guidelines."[154] Annex 5 refers to some choice of methodological approach and refers to "stochastic events" in the list of extrinsic factors that can affect extinction risk.[155] Further, Annex 6, setting out the format for proposals to amend the appendices acknowledges that "for some species the amount of scientific information will be limited," meaning that proposals may not always have all the information requested for the proposal.[156]

Yet these limited acknowledgements of the need for inferences or projections and the possibility of missing information do not address how the parties should deal with these uncertainties. The criteria also do not address how the parties should evaluate data and the possibility of differing information or multiple methodologies producing different results. The criteria contain no explicit reference to "uncertainty" and there is no provision for a preventative or precautionary cushion to ensure survival of the species.

Thus, despite the fact that the criteria explicitly refer to the precautionary approach, they do little to grapple with uncertainty and the complexities of applying the principle. When the criteria specify particular measures for the application of the precautionary approach, they place heavy reliance on management mechanisms and monitoring.

The context of amendment of the criteria is important to illuminate why this might be. As we have seen, early proposals had removed the precautionary principle or approach from the criteria completely, endorsed by the Secretariat. This was seen by some states as an attempt to limit the use of listing and to promote sustainable utilization. States explic-

150. *Criteria for Inclusion*, *supra* note 112, at 5–6.

151. *Id.*

152. *Id.* at 5–6.

153. *Id.* at 6.

154. *Id.* at 4.

155. *Id.* at 7 & 10.

156. *Id.* at 11.

itly in favor of this change were among those known to favor more sustainable utilization of certain species, namely Norway and Japan. Parties favoring deletion of precaution highlighted the need to base decisions on science. Parties favoring reference to precaution highlighted the same thing, but added reference to uncertainty. One can infer that the compromise reached was a way to maintain a sense among the parties that scientific decision-making would prevail. Precaution is then seen as leaving too much room for what are perceived to be value judgments to inform listing decisions.

Thus, while a reference to precaution was maintained in the listing criteria, its particular role has been limited to one ensuring monitoring and adaptive responses. The potential for a more expansive application of precaution has not been pursued, as is evident from listing decisions for specific species discussed further below.

C. *Adaptive Management for Non-Detriment Findings*

This preference for adaptive management and monitoring over explicit endorsement of precaution is also evident in another key aspect of CITES operations: non-detriment findings.

Under the terms of the treaty, the export of Appendix I- and II-listed species must not be detrimental to the survival of the species.[157] In order to ensure this, the parties' Scientific Authorities must make non-detriment findings when they grant export permits.[158] Non-detriment findings can serve as both a trigger for countries to gather information and monitor trade, and a trigger for them to respond to new information. Beyond the requirement of non-detriment findings for export permits, monitoring of exports is also critical for parties to comply with their obligations regarding Appendix II-listed species to limit trade if necessary "in order to maintain [a] species throughout its range at a level consistent with its role in the ecosystems in which it occurs and well above the level at which that species might become eligible for inclusion in Appendix I."[159] These non-detriment findings are, therefore, an important component of the effective operation of the treaty's terms and, since commercial trade is not permitted in any case for Appendix I-listed species, these findings are particularly important for trade in Appendix II-listed species to ensure that commercial trade in those species is sustainable.[160]

---

157. CITES, *supra* note 5, arts. 3(3)(a) & 4(2)(a). This is also required for import permits for Appendix I-listed species. *Id.* art. 3(2)(a). Since commercial trade is not permitted for Appendix I-listed species, this discussion focuses on non-detriment findings for export permits for Appendix II-listed species. Non-detriment findings are also required for introduction from the sea of Appendix I- and Appendix II-listed species. *Id.* arts. 3(5)(a) & 4(6)(a).

158. CITES, Designation and Role of the Scientific Authorities, 10th Meeting of the Conf. of Parties, Conf. 10.3 (Jun. 9–20, 1997), *available at* http://www.cites.org/eng/res/10/10-03C15.php.

159. CITES, *supra* note 5, at art. 4(3).

160. *See* Aguilar, *supra* note 135, at 283 (describing robust non-detriment findings as providing "the foundation for the effectiveness of CITES in regulating and managing trade in Appendix II species").

However, compliance with these non-detriment finding requirements has been far from complete, largely due to capacity and information problems.[161] Non-detriment findings will often require significant resources and information.[162] Information about non-detriment findings has been limited through the course of CITES lifespan and no formal publication of these findings has been required.[163] As a result, Scientific Authorities have not been able to benefit from other Scientific Authorities' work.[164] On the basis of her interviews, Aguilar finds that in practice Scientific Authorities "often make decisions on an intuitive basis, based on their own knowledge and the advice of researchers and experts in the field."[165] Indeed, even compliance with the requirement that a state party designate a Scientific Authority, a pre-requisite to compliance with the specific terms of the treaty regarding non-detriment findings, has been incomplete.[166]

The obligations related to non-detriment findings have remained in the hands of the state parties, rather than defined in detail by the Conferences of the Parties, with even guidance being somewhat limited until relatively recently. Parties have expressed wariness of any binding effect of decisions on non-detriment findings.[167]

An earlier CoP Resolution 10.3, replacing an earlier Resolution, states that the non-detriment finding should be based on "scientific review of available information on the population status, distribution, population trend, harvest and other biological and ecological factors, as appropriate, and trade information relating to the species concerned."[168] Beyond this, until recently, CoP Resolutions have largely resulted in the Secretariat coordinating the development of guidelines and workshops for training for

161. *See id.*; ROSALIND REEVE, POLICING INTERNATIONAL TRADE IN ENDANGERED SPECIES: THE CITES TREATY AND COMPLIANCE, 152–154 (2002); James Murphy, *Alternative Approaches to the CITES "Non-Detriment" Finding for Appendix II Species,* 36 ENVTL. L. 531, 538 (2006). *See also* Smith et al., *supra* note 6 (discussing challenges for making non-detriment findings and ways to improve those findings).

162. Aguilar, *supra* note 135, at 283; Smith et al., *supra* note 6, at 84 (observing that for many CITES-listed species, decisions on non-detriment findings will not be straightforward).

163. Smith et al., *supra* note 6, at 88.

164. *Id.*

165. Aguilar, *supra* note 135, at 283.

166. *Designation and Role of the Scientific Authorities*, *supra* note 156, at 1 (noting that the Secretariat's reports have identified "several Parties that have not designated Scientific Authorities").

167. CITES, 15th Meeting of the Conf. of the Parties, Doha, Qatar, Mar. 13–25, 2010, *Report of the Animals and Plants Committees*, CoP15 Doc. 16.2.2 [hereinafter *Report of the Animals and Plants Committees*] (Mexico expressing concern about whether any future draft resolution would be binding and urging flexibility); *id.* at 4-5 (Animals Committee recognizing concern of Parties regarding any binding effect); *id.* at 3 (Zambia requesting respect for the need for sustainable use of natural resources in Zambia). *See also* CITES, 15th Meeting of the Conf. of the Parties, Doha, Qatar, *Summary Record of the Second Session of Committee 1*, CoP Com.I Rec.2 (Rev. 1) 16.2.2 (Mar. 15, 2010) (inserting non legally binding before "guidelines" in the draft decisions and ensuring that it says it will be a tool).

168. Designation and Role of the Scientific Authorities, *supra* note 158, ¶ h.

Scientific Authorities.[169] In some instances, the CoP itself has set export quotas, which then superseded the requirement for a state party's Scientific Authority to make a non-detriment finding.[170]

In recent years, the parties have done more to advance the capacity of state parties to comply with the treaty provisions on non-detriment findings.[171] In response to a proposal presented to the parties at CoP14 in 2007, an international expert workshop was held in Cancun in 2008, "attended by 103 participants from thirty-three countries of the six CITES regions." This, coupled with work from the Animals and Plants Committee, resulted in a decision at the most recent CoP in 2013. It was the first to address non-detriment findings specifically and to provide guiding principles for Scientific Authorities to take into account. While these guiding principles are explicitly non-binding,[172] the fact that they are contained in a CoP Resolution gives them some legitimacy, having been adopted by the parties.[173]

The final resolution agreed to at CoP16, Resolution Conf. 16.7 on Non-Detriment Findings, drew on the work of the expert workshop.[174] The Resolution contains more than the checklist of scientific concerns that was contained in the earlier Resolution 10.3. It adds recommendations, in the form of non-binding guiding principles, for what Scientific Authorities should take into account in considering whether trade would be detrimental to the survival of a species. As well as reiterating the standard set out in Article 4(3)[175] and reiterating that non-detriment findings should be "the result of a science-based assessment,"[176] the Resolution recommends that parties take into account the volume of both legal and illegal trade, including what is "known, inferred, projected, [and] estimated" relative to the vulnerability of the species based on both intrinsic and extrinsic factors.[177] In this way, the guidance builds in a recommendation that parties account for what is still unknown, but can be inferred, projected, or estimated. In

169. *See, e.g.,* CITES, Guidance for CITES Scientific Authorities: Checklist to Assist in Making Non-Detriment Findings for Appendix II Exports (A. Rosser and M. Haywood eds. 2002), Inf. 11.3 (2000), *available at* http://www.cites.org/eng/cop/11/info/03.pdf.

170. Aguilar, *supra* note 135; *Non-Detriment Findings*, CITES, http://www.cites.org/eng/prog/ndf/index.php (last visited Feb. 20, 2015). Some of these allow for amendment in response to new information. *See* generally Aguilar, *supra* note 135, and Murphy, *supra* note 161, on the relationship of NDFs to nationally established quotas.

171. This includes several CITES decisions containing guidance on particular taxonomic groups.

172. CITES, 16th Meeting of the Conf. of the Parties, Bangkok, Thai., Mar. 3–14, 2013, *Non-Detriment Findings*, ¶ a, Res. Conf. 16.7, [hereinafter Resolution Conf. 16.7].

173. Aguilar, *supra* note 135.

174. *See* Resolution Conf. 16.7, *supra* note 172.

175. Article 4(3) requires that Scientific Authorities act to limit export "in order to maintain that species throughout its range at a level consistent with its role in the ecosystems in which it occurs." CITES, *supra* note 5, at art. 4(3); *see also* Resolution Conf. 16.7, *supra* note 170, at Recommendations, ¶ a(ii).

176. Resolution Conf. 16.7, *supra* note 172, at Recommendations, ¶ a(i).

177. *Id.* ¶ a(iii).

addition, the Resolution urges that an important consideration be "the implementation of adaptive management, including monitoring."[178]

The Resolution recommends that the data requirements for a non-detriment finding "should be proportionate to the vulnerability of the species concerned."[179] Where a species is more vulnerable, more evidence seems to be warranted that export will not result in detriment to the survival of the species. Although this does not per se reverse the burden of proof so that trade is always prohibited, it does provide a highly contextualized way to address the burden of proof, consistent with what we have seen in the precautionary principle: the greater the possibility of irreversible harm, the greater the evidence needed to allow trade. In addition, the Resolution lists relevant sources of information, consistent with its urging of science-based decision-making.[180]

Although adaptive management is explicitly endorsed in the Resolution, precaution is not mentioned. Yet documents from the International Expert Workshop on Non-Detriment Findings—that heavily informed the Resolution—provide an interesting contrast. During the workshop, after some plenary sessions, the 103 attendees broke into working groups organized on taxonomic and life form lines, working with taxon-specific case studies and developing general guidelines.[181] Despite using different terminology, these working groups generally addressed precaution and the recognition that more precaution would be appropriate where there is less information or where the species was less resilient.[182] They also referred to the importance of monitoring and principles of adaptive management.[183]

Despite these references to the precautionary approach within the summary of the Experts Workshop, nowhere does the final CoP Resolution 16.7 with guidance on non-detriment findings refer to precaution, caution, or the precautionary approach.[184] The Resolution does refer to "the implementation of adaptive management, including monitoring," as "an important consideration in the making of a non-detriment finding."[185] If adaptive management and monitoring are assumed to incorporate a pre-

178. *Id.* ¶ a(viii).

179. *Id.* ¶ a(iv).

180. *Id.* ¶ a(x).

181. *Report of the Animals and Plants Committees*, *supra* note 167, at 4, ¶ 7.

182. *Id.* at 7, ¶ 10; *see also id.* at 17 (summary report of the Trees Working Group), 18 (summary report of the Perennial Plants Working Group), 19 (summary report of the Succulents and Cycads Working Group), 20 (summary report of the Geophytes and Epiphytes Working Group), 21 (summary report of the Mammals Working Group), 24 (summary report of the Fishes Working Group).

183. *Id.* at 9–10. *See also id.*, Annex 3, *specifically e.g.,* at 17 (summary report of the Trees Working Group), 18 (summary report of the Perennial Plants Working Group), 21 (summary report of the Mammals Working Group), 24 (summary report of the Fishes Working Group), 26 (summary report of the Aquatic Invertebrates Working Group).

184. Resolution Conf. 16.7, *supra* note 172.

185. *Id.* ¶ a(viii).

cautionary approach, this reference should be sufficient. However, the expert workshop working groups' reports did not subsume precaution within monitoring and adaptive management.

The shift suggests something important about the way in which policymakers address information gaps and the way scientists do. While the scientific experts recognized the need for caution and precaution as distinct from monitoring and adaptive management, the policy makers seemed unwilling to bring precaution to bear on decision-making that they wanted to regard as science-based. Thus, the emphasis on science-based decision-making without engaging with the need for a layer of precaution within and beyond the science makes it appear that the science will be able to direct an answer. Caution is enveloped within adaptive management and within the recognition of "proportionality." In this sense, it seems to be the task of the scientists to exercise precaution, rather than the task of the policy decision makers.

D. *Listing and Trade Decisions*

As is clear from the discussion of polar bears, sharks and ivory trade in Part I, uncertainty pervades wildlife trade and can lead to contestation and disagreement. This Section discusses how the parties have addressed aspects of trade in three groups of species to shed light on how the parties have dealt with uncertainty and contested science. The examples show that the parties have focused on current data gaps and have addressed these by seeking more data in the form of monitoring. Yet this monitoring cannot resolve the other uncertainties at play: current data gaps, historical data gaps, complexity and variables, and indeterminacy. In these debates, the focus is primarily on monitoring and gathering information, rather than more explicit references to adaptive management.

Although the precautionary approach is explicitly mentioned in the CITES listing criteria, evidence from discussions about listing certain high-profile species suggests that many of the parties to CITES are unwilling to rely heavily on precaution even where scientific information is acknowledged to be lacking. The examples discussed here reinforce the view that the parties do not rely on precaution as heavily persuasive in debates about whether and where to list species, even if parties are taking it into account in their votes. The parties are, however, willing to give significant attention to efforts to decrease uncertainty through increased monitoring, sharing of information, and capacity building to enhance scientific knowledge. Where precaution is mentioned, it is often seen as part of those efforts.

The examples below cover the process leading to listing of certain shark species at CoP16 in 2013, unsuccessful proposals to list the polar bear at CoP15 and CoP16, and the role of monitoring to address deep conflicts about whether ivory should be legally traded. The examples do not represent all CITES activities or stand in for all CITES species. Nor are they all meant to be interchangeable: the species vary from each other in many ways, including the source of their primary threat, the extent of

what is known about them, the source of demand for their parts, and whether their parts can be used without killing.

The examples share one thing in common that also makes them distinct from many of the species listed on CITES Appendices. These are all high-profile fauna-charismatic megafauna that inspire passionate debate, including debate about whether any killing or capture is appropriate and about concern for local livelihoods from utilization of the species. Yet the fact that these species are subject to intense debate also makes them useful examples for a study in how the CITES parties use precaution and monitoring to navigate uncertainty and deal with deep divisions.

In addition, these examples were chosen because they involve different aspects of listing decision-making at CITES. The listings of three shark species at CoP16 involved listing these shark species on Appendix II, having not been listed previously except by a few countries on Appendix III. The polar bear listing proposals involved whether to up-list the polar bear from Appendix II to Appendix I. Debates about ivory involve a species that is split-listed, with some populations listed on Appendix I and some on Appendix II, and with a unique regime governing sale of ivory even from Appendix II-listed species.

1. Appendix II Listing of Shark Species

From the beginning, questions about whether to list certain shark species on CITES have been dogged by two issues, namely whether CITES is the appropriate forum for addressing shark trade and the lack of information about biological and trade data.

On one side, several countries argued that the Food and Agriculture Organization (FAO) and Regional Fisheries Management Organizations (RFMOs) were the bodies responsible for managing fish stocks, including shark stocks. These countries seem particularly concerned that involving CITES in the management of fish, including sharks, would result in a shift away from utilization and begin the path toward a trade ban.[186]

At CoP9, the parties began efforts to gain more information about sharks and to encourage other bodies charged with managing fisheries to do the same.[187] This resulted in additional data, and began a process of

186. This debate has some interesting implications for the discussion in this Article, since positions that CITES is not the right forum are often tied to the view that CITES listing should be a last resort and limited to proven threats from trade. This means, in turn, that those who have argued against bringing sharks under the auspices of CITES often do not regard CITES listing as a precautionary measure. *See, e.g.,* CITES Mgmt. Auth. of the People's Republic of China, "Sharks" and COP12 – A Case for Caution, 12th Meeting of the Conf. of the Parties, Nov. 3-5, 2002, at 2–3, CoP12 Inf. 30 (2002), *available at* http://cites.org/sites/default/files/eng/cop/12/inf/E12i-30.PDF.

187. IUCN Species Survival Commission's Shark Specialist Group and TRAFFIC, The Role of CITES in the Conservation and Management of Sharks 1 (2002), *available at* http://cites.org/sites/default/files/common/notif/2002/ESF042A.pdf; CITES, 12th Meeting of the Conf. of the Parties, Santiago, Chile, Nov. 3-5, 2002, *Conservation and Management of Sharks*, 2, CoP12 Doc. 41.1 [hereinafter *Conservation and Management of Sharks*], *available at* http://cites.org/sites/default/files/eng/cop/12/doc/E12-41-1.pdf.

monitoring and reporting on progress in shark fisheries management by the CITES Animals Committee.[188] Nevertheless, by 2002, there was a sense that shark fishing states had made insufficient progress in developing international plans of action with the FAO and some states began to want more action. Australia and the United Kingdom each listed a species of shark on Appendix III, allowing them to monitor trade through their own export permits.[189]

At subsequent CoPs, certain shark species were proposed for listing and ultimately listed. However, these listing votes have been consistently close, often taken in Committee, with debates then opened at the plenary session of the CoP. This Section gives some detail on various shark-listing proposals to shed some light into the parties' approach to listing these sharks.

In 2002, two shark species were listed on Appendix II after close votes. Arguments were raised in debate that the proposals for listing had not met Appendix II criteria. In Committee I discussion, the listing proposals for the whale shark (Rhincodon typus) and the basking shark (Cetorinhus maximus) were first rejected by the parties, not receiving the required two-thirds majority vote. In plenary session, the votes were reopened in the form of opening debate at plenary. With additional parties voting, the two-thirds majority was reached.[190] In addition, a simple majority of the parties voted in favor of CoP Resolution 12.6, continuing the process of finding ways to gather more biological and trade information about sharks.[191]

In attempts to list certain shark species since 2002, proposals have been consistent in acknowledging the lack of data for shark species, but inconsistent in whether or not they invoke precaution. Only one more shark species was listed on Appendix II in the years between 2002 and 2013, the great white shark (Carcharodon carcharias). In its proposal for listing the great white shark, Australia invoked the need for "precautionary measures" and proposed a zero annual export quota. Indeed, Australia had originally sought range state input on the possibility of Appendix I

188. The Role of CITES in the Conservation and Management of Sharks, *supra* note 187, at 1.

189. *Conservation and Management of Sharks*, *supra* note 187, at 3.

190. Proposals to list these two shark species were initially rejected in Committee I, but accepted after debate was reopened in plenary session. CITES, 12th Meeting of the Conf. of the Parties, Plen. mtg., Santiago, Chile, Nov. 3–15, 2002, Rep. on its 9th Sess., at 2–3, CoP12 Plen. 9, Nov. 15, 2002 (reporting re-opening of the proposals to list the basking shark and whale shark on Appendix II and acceptance of those proposals at plenary session); CITES, 12th Meeting of the Conf. of the Parties, Comm. I mtg., Santiago, Chile, Nov. 3–15, 2002, Rep. on 11th Sess., at 3, CoP12 Com. 1 Rep. 11 (Rev.), Nov. 12, 2002 (reporting the rejection of a proposal to list the whale shark on Appendix II); CITES, 12th Meeting of the Conf. of the Parties, Comm. I mtg., Santiago, Chile, Nov. 5–13, 2002, Rep. on its 12th Session, at 2, CoP12 Com. I Rep. 12 (Rev.) Nov. 13, 2002 [hereinafter Comm. I Mtg., 12th Session] (reporting the rejection of a proposal to list the basking shark on Appendix II).

191. Comm I. Mtg., 12th Session, *supra* note 190, at 3 (reporting acceptance of Resolution 12.6 after a vote, with a simple majority).

listing, but had not received full support for Appendix I listing by other range states. Australia did not dwell on precaution, however, focusing instead on both the lack of full data and the evidence from existing data that populations were declining significantly to argue that an Appendix II listing "would help ensure that exploitation of this globally threatened species is regulated and monitored and that international trade is not detrimental to its survival."[192] The precaution seems to be embedded within the desire for listing.

At CoP15 in 2010, additional shark species were proposed for listing: the oceanic whitetip shark (Carcharhinus longimanus), the scalloped hammerhead shark (Sphyrna lewini), and the porbeagle shark (Lamna nasus).[193] Although a simple majority of parties voted in favor of listing, the two-thirds majority required for listing was not achieved. Many states talked about the need for management and regulation of the trade, arguing that listing on Appendix II would allow for collection of data.[194] Speaking about the hammerhead shark, Brazil noted that an Appendix-II listing "would provide an important tool for the sustainable management of sharks that were naturally vulnerable to overexploitation."[195] All those in favor also argued that the proposals met scientific evidence requirements.[196] Only the proposal to list the porbeagle shark referred to precaution, noting that countries would have to implement precautionary and conservation measures.[197] None of the proposals relied heavily on precaution as a supporting factor for listing, even though information gaps were

192. CITES, 13th Conf. of the Parties, Bangkok, Thai., Oct. 2–14, 2004, *Consideration of Proposals for Amendment of Appendices I and II*, 1, CoP13 Prop. 32 (2004) (proposal to include *Carcharodon carcharias* in Appendix II with a zero annual export quota).

193. CITES, 16th Conf. of the Parties, Bangkok, Thai., Mar. 3–14, 2013, *Proposals for Amendment of Appendix I and II*, CoP16 Props. 42-44 (2013).

194. CITES, 15th Meeting of the Conf. of the Parties, Comm. I mtg., Doha, Qatar, Mar. 13–25, 2010, Summary Rec. of 13th Sess., at 2, CoP15 Com. I Rec. 13 (Rev. 2), Mar 23, 2010 [hereinafter 13th Sess. Comm. I mtg.]; *id.* at 4 (reporting that Spain, arguing on behalf of the EU for a listing of the oceanic whitetip shark, noted that since historical data was lacking, now would be the time to start collecting data). CITES, 15th Meeting of the Conf. of the Parties, Comm. I mtg., Doha, Qatar, Mar. 13–25, 2010, Rep. on its 14th Sess., CoP15 Com. I Rec. 14 (Rev. 2), Mar. 23, 2010 [hereinafter 14th Sess., Comm. I mtg.] (reporting that Canada argued that listing the porbeagle shark would assist international conservation efforts "by providing data on management and harvesting").

195. 13th Sess., Comm. I mtg., *supra* note 194, at 2; *see also id.* (reporting that Norway noted that Appendix II listing could "improve controls along the commodity chain").

196. *Id.*

197. CITES, 15th Meeting of the Conf. of the Parties, Doha, Qatar, Mar. 13–25, 2010, *Consideration of Proposals for Amendment of Appendices I and II*, 13, CoP15 Prop. 17 (2010) (proposal for inclusion of *Lamna nasus*). *See also* CITES, 15th Meeting of the Conf. of the Parties, Doha, Qatar, Mar. 13–25, 2010, *Consideration of Proposals for Amendment of Appendices I and II*, CoP15 Prop. 15 (2010) (proposal for inclusion of *Sphyrna lewini*), and CITES, 15th Meeting of the Conf. of the Parties, Doha, Qatar, Mar. 13–25, 2010, *Consideration of Proposals for Amendment of Appendices I and II*, CoP15 Prop. 16 (2010) (proposal for inclusion of *Carcharhinus longimanus*).

acknowledged and some evidence existed of severely declining shark stocks.

Indeed, those opposing the listings in 2010 primarily stressed the lack of data about the species and concerns about the lack of capacity to implement the requirements of an Appendix II listing, particularly with regard to non-detriment findings.[198] Although others refuted the idea that non-detriment findings could not be made for sharks, and the U.S. agreed to a 24-month implementation delay and committed to supporting capacity-building activities, this was not enough to persuade several parties.[199] Rather than favoring listing on Appendix II as a means of generating data and building capacity, Japan for example, commented that conservation of the scalloped hammerhead shark "would be best addressed through improved enforcement efforts rather than by an Appendix-II listing."[200]

Enough parties were convinced of the need for listing of the porbeagle shark that it achieved a two-thirds majority at the Committee stage of discussion and voting.[201] However, the other shark listing proposals were rejected and the porbeagle shark proposal was reopened in plenary session and rejected at that point.[202] Meanwhile, the parties made revisions to

198. 13th Sess., Comm. I mtg., *supra* note 194, at 2–3 (reporting comments by Japan, China, Cuba, Saint Lucia, Guinea Bissau, and Indonesia discussing lack of sufficient scientific data to support the proposal for listing the scalloped hammerhead shark (Sphyrna lewini) on Appendix II and difficulties of implementation); *Id.* at 4-5 (reporting comments by Chile, China, Indonesia, Japan, Republic of Korea, the Bolivarian Republic of Venezuela, and Vietnam expressing concerns about lack of scientific data and implementation problems in opposing the proposal to list the oceanic whitetip shark (Carcharhinus longimanus) in Appendix II). *See also* CITES, 15th Meeting of the Conf. of the Parties, Comm. I mtg., Doha, Qatar, Mar. 13–25, 2010, Summary Rec. of the 4th Sess., at 3, CoP 15 Com. I Rec. 4 (Rev. 1), Mar. 16, 2010 (reporting that China and the Libyan Arab Jamahiriya expressed concern about adopting decisions regarding sharks based on incomplete data); *Id.* at 4 (reporting that the Libyan Arab Jamahiriya "disagreed with the logic of protecting endangered species before management tools had been developed"); 14th Sess., Comm. I mtg., *supra* note 191, at 2 (reporting that China and Cambodia worried about the difficulties of implementing an Appendix II-listing of the porbeagle shark).

199. 13th Sess., Comm. I mtg., *supra* note 194, at 2 (reporting that Australia invoked the work of the non-detriment finding workshop held in Mexico in 2008 that had found that issuing non-detriment findings for shark species would be possible). *See also* CITES, CITES Non-Detriment Findings Guidance for Shark Species, 27th Meeting of the Animals Comm., Apr. 28 – May 3, 2014, AC27 Inf.1 (2014), *available at* http://cites.org/sites/default/files/common/com/ac/27/E-AC27-Inf-01.pdf. *See* CITES, 15th Meeting of the Conf. of the Parties, Doha, Qatar, Mar. 13-25, 2010, *Conservation and Management of Sharks and Stingrays*, 13, CoP15 Doc. 53, *available at* http://cites.org/sites/default/files/eng/cop/15/doc/E15-53.pdf; 14th Sess,. Comm I mtg., *supra* note 194, at 2 (reporting that an expert at the meeting clarified that identification of the various shark species was possible). 13th Sess., Comm. I mtg., *supra* note 192, at 3, 4 (reporting the U.S. agreeing to an extension of the implementation delay in response to a request by the United Arab Emirates).

200. 13th Sess., Comm. I mtg, *supra* note 192, at 2.

201. 14th Sess., Comm. I mtg., *supra* note 194, at 2.

202. CITES, 15th Meeting of the Conf. of the Parties, Plen. Mtg., Doha, Qatar, Mar. 13-25, 2010, Summary Rec. of the 6th Sess., at 2, CoP15 Plen. 6 (Rev. 1), Mar. 25, 2010.

Resolution 12.6 to encourage the parties to increase data collection and information gathering activities.[203]

These same shark species were proposed for listing on Appendix II again at CoP16, this time resulting in listing.[204] Amendments were also made again to Resolution 12.6, ensuring continued data gathering and monitoring.[205] Again, the proposals did not refer to precaution, even though they acknowledged some lack of data. This time, the proposals for listing made clear that sufficient data existed to support listing, so that even if some information was lacking, the data presented came from the "best available scientific study."[206] In a document addressing potential frequently asked questions on the porbeagle listing proposal, one question explicitly addressed the difference between the proposal for listing at CoP16 and the proposal for listing at CoP15 in 2010 by touting the availability of new information to support listing-fisheries management information, new catch and trade data, and re-evaluation of available trend data.[207] This time, the proposals passed by the required two-thirds majority, although the votes were close. They were re-opened at plenary session, but the listing decisions remained. By 2013, it seems, the parties felt they had sufficient information to meet the threshold required for listing.

2. Polar Bear

The polar bear (Ursus maritimus) has been listed on Appendix II of CITES since 1992. In 2010 and again in 2013, the United States proposed transferring the polar bear to Appendix I.[208] Neither attempt was successful. This Article focuses on the more robust discussion at CoP16 in 2013.

The polar bear question is unusual for CITES because the bear's primary threat does not come from trade, but from the projected effects of climate change.[209] Further, those projected effects are not yet evident in polar bear populations. As discussed above, polar bear populations may

203. *See Conservation and Management of Sharks and Stingrays*, *supra* note 199, at 13.

204. CITES, 16th Meeting of the Conf. of the Parties, Plen. mtg., Bangkok, Thai., Mar. 3-14, 2013, Summary Rec. of its 7th Sess., CoP16 Plen. 7 (Rev. 1), Mar. 14, 2013, *available at* http://cites.org/sites/default/files/common/cop/16/sum/E-CoP16-Plen-07.pdf.

205. CITES, 12th Meeting of the Conf. of the Parties, Santiago, Chile, Nov. 3-15, 2002, *Conservation and Management of Sharks*, Conf. Res. 12.6 (Rev. CoP16), *available at* http://cites.org/eng/res/12/12-06R16.php.

206. CITES, Oceanic Whitetip Proposal Additional Supporting Scientific Information, 16th Meeting of the Conf. of the Parties, Mar. 3–14, 2013, CoP16 Inf. 26 (2013), *available at* http://cites.org/sites/default/files/eng/cop/16/inf/E-CoP16i-26.pdf.

207. CITES, Fact Sheet and FAQ Paper on the Porbeagle Listing Proposal, 16th Meeting of the Conf. of the Parties, Mar. 3–14, 2013, 2 at question 3, CoP16 Inf.29 (2013), *available at* http://cites.org/sites/default/files//eng/cop/16/inf/E-CoP16i-29.pdf.

208. CITES, 15th Meeting of the Conf. of the Parties, Bangkok, Thai., Mar. 13-25, 2010, *Consideration of Proposals for Amendment of Appendices I and II*, CoP15 Prop. 3 (2010); CITES, 16th Meeting of the Conf. of the Parties, Bangkok, Thai., Mar. 3–14, 2013, *Consideration of Proposals for Amendment of Appendices I and II*, CoP16 Prop. 3 (2013) [hereinafter *Polar Bear Proposal*].

209. See discussion *supra* notes 40–40 & 60–61 and accompanying text.

not currently be in decline, but climate scientists' projections of sea ice loss will, polar bear scientists predict, have an impact on populations. Thus, through modeling, scientists predict polar bear populations declining throughout the next decades, with some projecting polar bear extinction within around forty-five years. Yet, this scientific consensus is contested by some Inuit communities, who question scientific estimates of the number of polar bears, as well as disputing how adaptable polar bears will be in the face of climate change.[210]

At CoP16, the proposal to up-list the polar bear from Appendix II to Appendix I acknowledged that polar bear populations were not currently in decline and, to support up-listing, discussed inferred and projected declines in population due to sea-ice loss and the concern that commercial hunting could exacerbate problems caused by that sea-ice loss.[211] In order to satisfy the biological listing criteria, the proposal referred to the basis for listing as being a "marked decline in the population size in the wild, which has been inferred or projected on the basis of a decrease in area of habitat and a decrease in quality of habitat."[212] The proposal also stated that although some polar bear harvesting occurs for primarily subsistence purposes, a substantial number of polar bears were exported or re-exported, about half of the total number harvested.[213]

In addition to addressing the likely effect of predictions of sea-ice loss, the proposal addressed the relationship among the various activities and threats.[214] In particular, the proposal discussed the compounding effect of sea-ice loss leading to polar bears having to spend more time on land.[215] This additional time on land could make the bears more susceptible to hunting because they would be spending more time closer to human habitation-partly due to sea-ice loss and partly due to their need to supplement their diet, which they often do by scavenging around human settlements.

Arguing that the projected decrease in habitat exacerbates all other potential threats, the proposal explicitly invoked the need for a precautionary approach "to ensure that primarily commercial trade does not compound the threats posed to the species by loss of habitat."[216] The pro-

210. *See* Martina Tyrrell, *West Hudson Bay Polar Bears*, *supra* note 59, at 95, 98–101 (describing the view of Arviarmiut that polar bear numbers are increasing); Government of Nunavut, *Response to the U.S. Fish and Wildlife Service's Proposed Rule to List the Polar Bear as Threatened Throughout its Range*, *in* INUIT, POLAR BEARS AND SUSTAINABLE USE: LOCAL, NATIONAL AND INTERNATIONAL PERSPECTIVES, *supra* note 59, at 153, 155–61 (questioning the methodology and conclusions of scientific studies that have projected that polar bears will be endangered or extinct within three generations due to climate-induced reduction in sea ice).

211. *Polar Bear Proposal*, *supra* note 208, at 2.

212. *Id.* at 1.

213. *Id.* at 2.

214. *Id.* at 6.

215. *Id.* at 2.

216. *Id.*

posal also explicitly addressed the lack of information for most polar bear populations.[217]

In response, Denmark, speaking on behalf of Greenland, opposed the proposal.[218] Denmark's contribution to the discussion, as recorded in the summary of the meeting, is of particular interest: "[Denmark, on behalf of Greenland] considered that proposals should be based on unequivocal scientific evidence. It did not consider the proposal met the criteria for transfer to Appendix I and believed there would be a risk to the credibility of CITES if it were accepted."[219] The opposition to the listing argued that harvesting was not market-driven; in other words, harvesting was part of conservation efforts not driven by a desire for consumption.[220] Countries also highlighted the fact that the primary threat was due to climate change, not hunting.[221] The parties generally acknowledged this; they just didn't agree on what to do about it.

Ireland, acting on behalf of the European Union and Croatia, then made an unusual move. In an attempt to find some middle ground, Ireland proposed an amendment to the Proposal that would have maintained the polar bear on Appendix II with the addition of export quotas and reporting obligations to the Animals Committee and the CITES Secretariat. The amendment would also have placed polar bears in the Significant Trade Review process.[222] The polar bear range states were split on whether they supported this amendment.[223]

The debate suggests that the parties did not know what to do about uncertainty, or did not want to wrestle with it. While the proposal itself explicitly invoked the precautionary approach, those states opposing the proposal did not refer to precaution, but instead referred to the absence of conclusive evidence and noted that the proposal did not fit with the biological criteria of the listing criteria.[224] The IUCN flagged the uncertainty and the criteria's lack of a means to address it, but the parties did not take up the issue explicitly. The summary of IUCN's response is worth quoting in full:

> IUCN stressed that forecasts of future declines in polar bear populations were based on uncertain models of the future habitat

217. *Id.* at 5.

218. CITES, 16th Meeting of the Conf. of the Parties, Plen. mtg., Bangkok, Thai., Mar. 3–14, 2013, Summary Rec. of its 6th Sess., at 2, CoP16 Com I. Rec. 6 (Rev. 1), Mar. 13, 2013 [hereinafter 16th Sess. plen. mtg.]. Denmark was supported by Canada, Iceland, Japan and South Africa. *Id.*

219. *Id.*

220. *Id.* This view was contested by proponents of the proposal.

221. *Id.* (discussing Denmark's comments on the proposal to not add the polar bear to Appendix I); Id. at 3 (quoting the provision of Ireland's proposed amendment that noted that "polar bears are primarily threatened by climate change and the associat7d loss of Arctic sea ice"); *see also Polar Bear Proposal*, *supra* note 208.

222. *See* 16th Sess. plen. mtg., *supra* note 218 at 3.

223. *Id.*

224. *Id.* at 2, 4.

> of the species, and noted that the guidelines for assessing proposals in [the listing criteria] did not explicitly address the time period over which projected future declines should be considered in the context of the biological criteria for inclusion in Appendix I. It urged the Parties to clarify this in any future revision of the Resolution, regardless of the outcome of the present proposal.

The IUCN's point is well taken. The criteria address a five to ten year time period, while the projections being offered by the U.S. proposal, drawing on scientific projections, covered a far longer time span.

Neither proposal passed. The EU's proposal fared better than the US proposal, but probably only because the EU did not abstain on it as they did for the US proposal, accounting for several of the votes. Although a large reason for the difference in voting records was the fact that the EU voted for its own proposal, but abstained on the US proposal, the fact that it was proposed and received some support suggests something interesting. For some parties, recognition of uncertainty may not be enough to justify listing, but will be enough to justify additional study. The coda to the listing discussion supports this view. At the 27th Meeting of the Animals Committee in 2014, the UK put the polar bear into the Significant Trade Review process. Thus, more research is likely to be pursued.

Of course, the story of the polar bear listing proposal is different from the story of the sharks, because the polar bear was already listed on Appendix II, allowing for monitoring and enhanced information. Its listing on Appendix II is what allows it to be placed in the Significant Trade Review process. However, the story also tells us something interesting about how the parties appear to approach precaution. First, as with the sharks, lack of data is seen as a reason not to list or up-list, rather than a reason to list as a precautionary measure. Second, the parties are unwilling to expand their definition of precaution to encompass precautionary measures to address a species in decline from a variety of sources, where trade may not be its primary threat but could exacerbate a different threat. In this sense, the parties did not fully grapple with the explicit reference to the variables at play in the U.S. proposal for up-listing.

3. Elephants, MIKE, and Ivory Sales

In 1989, the up-listing of the African elephant (Loxodonta africana) from Appendix II to Appendix I was not universally supported by the African range states. Southern African states, opposed to the up-listing and accompanying ban on commercial ivory trade, argued that their populations were well managed and that removing the possibility of allowing sale of ivory stockpiles from, among other things, culling operations that were part of conservation activity, would deprive these countries of a needed source of income.[225] The east African states, by contrast, wanted to end the market in ivory, having watched their elephant populations

225. *See* Raymond Bonner, At the Hand of Man: Peril and Hope for Africa's Wildlife (1994).

crash due to poaching. The question of trade in ivory invokes values that go beyond simply how many elephants there are. Some argue that no killing should be allowed of these animals. Others observe that elephants are not as popular among local communities who live with them as they are among people living far away.[226] Tensions run high.

Despite these value differences, the debates that have dogged CITES for years generally invoke the data about elephant populations and ivory trade, rather than invoking values. Within these data discussions, there is also recognition of significant uncertainty, ranging from information gaps to uncertainty surrounding socioeconomic factors such as trends in market demand, price fluctuations, and access to weapons for poaching. The way in which the parties have navigated this uncertainty and the underlying value disagreements provides an interesting lesson in the role monitoring can play in CITES and its limitations.

In 1997, the parties voted on and passed a form of compromise. Certain geographically-defined species would be down-listed to Appendix II with zero quotas, but with provision for sales of stockpiled ivory by designated countries to designated countries. At the time the parties agreed to down-list certain populations of the African elephant, they also established two monitoring schemes: Monitoring the Illegal Killing of Elephants (MIKE) and the Elephant Trade Information System (ETIS).

Two sales of ivory have occurred since then and significant resources have been invested into MIKE. Yet, the parties are no further to agreement on whether ivory should be the subject of trade. Although MIKE is an improvement on a situation with no resources, it is also rife with data deficiencies and holes.[227] Much information is simply unavailable because of constraints on capacity to collect the data. Other information is available, but may not be entirely accurate. One review of MIKE, for example, points out that methodologies of counting can themselves have an element of choice, in turn leading to an element of uncertainty about the accuracy of results.[228] This is not to suggest that MIKE isn't useful or that we should expect one hundred per cent accuracy in information. It does demonstrate, however, that perfect information is unattainable.

Most importantly, MIKE cannot—and never could—provide causal analysis. While MIKE can give indications of elephant numbers and whether they are stable or declining, and MIKE and other reports can provide documentation of increased poaching, this in itself does not prove that the increase in poaching is a result of any or all of the ivory sales, nor can it prove that the poaching is not related to those sales. Commentators

226. *See id.*

227. *See supra* notes 45-46 and accompanying text.

228. G.C. Craig, *Monitoring the Illegal Killing of Elephants: Aerial Survey Standards for the MIKE Progrmame*, Version 2.0, CITES, MIKE Programme, (2012) (describing the various methods for doing aerial surveys of elephant populations where the particular context helps determine the appropriate methodology to use).

disagree.[229] Uncertainty in this context is linked the complexity of the situation, coupled with lack of complete data. Too many variables in the face of too little complete information means there will never be certainty on this issue. Yet prior value positions still influence how groups interpret that data.

The parties have not responded by explicitly invoking precaution or even seeking out full information before allowing additional sales. Instead, they have begun the process of developing a decision-making process for the sale of ivory, implicitly favoring process over substantive commitments to a particular position.

E. *Analysis and Conclusion*

The evidence suggests that the parties to CITES implement precaution by focusing primarily on monitoring and information-gathering for adaptive management. It is important to note that even proposals that do not succeed can provide evidence of support for listing by many parties, given that listing requires a two-thirds majority of the parties present and voting. Thus, it would be a mistake to believe that a failure to list a species or up-list a species is an indication of the majority view. However, the fact that a vote failed at a CITES CoP can indicate that the parties do not agree on when listing is appropriate.

Where enough information—a kind of threshold level of information—-is available to indicate a threat, it seems a two-thirds majority of CITES parties can be attained for a proposal to list a species on Appendix II. However, in the absence of that level of information, even Appendix II listing may not be available, as with the three shark species at CoP 15. Further, where sufficient information exists for the parties to support an Appendix II listing, yet uncertainty remains, the parties seem unwilling to rely on Appendix I listing and a complete trade ban as a precautionary measure. Instead, the parties have placed significant efforts and resources into increasing monitoring to close the information gap before supporting a complete ban. This is evident in the outcome, albeit close, of the polar bear up-listing proposal and the continued split-listing of the African elephant and periodic sales of ivory.

Across the board, the parties to CITES prefer to invoke and support monitoring and adaptive management approaches over precaution, rarely invoking precaution in listing proposals or discussions. Where precaution is invoked, it does not appear to have persuasive effect on the parties' votes. The listing criteria themselves, although they are the only instance of explicit reference to the precautionary approach, define that precautionary approach by reference to monitoring and adaptive responses. In

229. *See, e.g.*, E.H. Bulte, R. Damania & G.C. van Kooten, *The Effects of One-off Ivory Sales on Elephant Mortality*, 71 Human Dimensions of Wildlife Mgmt. 613 (2007); D. Biggs, F. Courchamp, R. Martin & H.P. Possingham, *Legal Trade of Africa's Rhino Horns*, 339 Sci. 1038, 1039 (2013); Environmental Investigation Agency [EIA], Stop Stimulating Demand!: Let Wildlife Trade Bans Work (2013), *available at* http://eia-international.org/stop-simulating-demand-report.

addition, the recent guidance CoP Resolution on Non-Detriment Findings abandoned the expert workshop's references to precaution in its text, but explicitly endorsed adaptive management and monitoring.

Thus, to the extent that the parties to CITES are willing to acknowledge precaution or a precautionary approach, they do so in a way that will limit its role to one primarily of monitoring and information gathering. The concrete examples of debates about species reinforce this view that many parties are more comfortable pushing for increased monitoring than they are supporting additional listing.

IV. A Dual Role for Precaution in Wildlife Trade: Procedure and Substance

The emphasis described above on monitoring and adaptive management as means of implementing precaution suggests that the parties to CITES have a particular and narrow view of uncertainty. The primary focus of the parties appears to be on data gaps, treated as largely temporary. Even where they are not temporary, in that one hundred percent complete data is impossible, the suggestion is that enough data can give rise to sufficient levels of certainty to inform decisions using modeling and extrapolations.

What is missing is engagement with the levels of uncertainty and complexity that go beyond past or current data gaps. The uncertainty surrounding these particular debates—and debates about wildlife trade more generally—is not only uncertainty related to data gaps that can be remedied with more research, as discussed in Part II above. Even if capacity problems could be fully resolved, the kind of capacity problems that currently plague MIKE and non-detriment findings, uncertainty persists because of the lack of historical baseline data, complexity and variables, and the lack of a fixed equilibrium that can provide a template to guide action.

This response of the parties to rely on monitoring and adaptive management is necessary for management of wildlife trade. However, this approach is not sufficient. In part because of the deep uncertainty, and in part because of the nature of scientific conclusions, science and more data cannot fully resolve the questions that face the parties to CITES, even though it is a critical component of decision-making. The contested discussions about polar bears, sharks, and ivory all demonstrate that science does not give one clear answer to the parties about what to do. When this uncertainty is overlaid with the different values at play, the science becomes more contested and it becomes even more difficult to base decision-making entirely on science.

Yet the fears that have motivated many commentators and parties to turn away from explicit references to the precautionary principle or approach are real. If decision-making is seen as counter to the science, or in spite of the science, it begins to seem unanchored and lacking any grounding in conservation. This in turn raises the very real concern that conservation efforts could fail and the consequences be worse than if no action had been taken at all. This Article's two-prong approach to precaution that can

be applied to decision-making by the parties to CITES both at CoPs and in national implementation of CITES navigates this concern and attempts to root decisions in science, while recognizing the limits of science and the need for transparency at the point that science can no longer provide the answer.

This Part first addresses the way in which precaution can play a role in adaptive management and monitoring, a procedural role.[230] It goes on to outline a substantive role for precaution to supplement this procedural role.

A. *Precaution in Adaptive Management: A Procedural Role*

Precaution is critical as part of monitoring and adaptive management. Indeed, precaution is part of monitoring, allowing us to ensure, as Doremus says, that we are "learning while doing."[231] Acknowledging different types of uncertainty, Cooney proposes turning to adaptive management principles such as incremental action, constant monitoring, feedback, and an ability to adjust conservation measures in the face of new information as a means of implementing precaution in biodiversity conservation.[232]

This is a procedural role for precaution. This procedural role is not just a checklist, but requires deep understanding of the uncertainties that inform scientific decision making. In this context, precaution plays more than one role. It can ensure that the type of experimentation and action taken is not likely to lead to irreversible consequences, such as extinction, but is intended to promote learning.[233] It also ensures that scientific processes and the uncertainties inherent in them are made explicit.[234] In turn, this might lead to decision makers seeking out additional sources of information,[235] and ensuring full and transparent debate.[236] Precaution in this context could also serve to encourage decision makers to develop triggers that will allow for responses if unforeseen, harmful consequences result from a particular decision.[237] In advance of decisions, this form of precaution can also be incorporated into forms of environmental impact assessment, allowing decision makers conducting impact assessments to

230. *See also* Wiersema, *Adversaries or Partners?*, *supra* note 144, at 230–31, 235 (arguing for a dual role for the precautionary principle in wildlife conservation treaties).

231. Doremus, *Precaution, Science, and Learning*, *supra* note 17, at 550.

232. *See* Rosie Cooney, *The Precautionary Principle in Biodiversity Conservation and Natural Resource Management: An Issues Paper for Policy-Makers, Researchers, and Practitioners*, IUCN Pol'y & Global Change Series, no. 2, 2004, at 26–27, *available at* https://portals.iucn.org/library/efiles/documents/PGC-002.pdf.

233. Doremus, *Precaution, Science, and Learning*, *supra* note 17.

234. *See* Peel, *supra* note 7, 224–227.

235. *Id.,* at 225–227.

236. *Id.,* at 224–225.

237. *See* Jorge Rabinovich, *Parrots, Precaution and Project Elé*, *in* Biodiversity and the Precautionary Principle, *supra* note 83, at 173, 180.

address uncertainty and engage with it.[238] Indeed, for some commentators, well-implemented adaptive management will be sufficiently precautionary for most situations.[239]

In this, the parties to CITES are performing well, but they could do more. To promote the precautionary elements of adaptive management and the role that monitoring can play in avoiding extinction, the parties should explicitly discuss precaution as an aspect of that monitoring and adaptive management. In addition, the parties should be explicit about the layers of uncertainty with which they are grappling. Specifically, maintaining the role of the precautionary approach in the listing criteria as it currently appears is critical. Further, in guidance on non-detriment findings, and in implementing that guidance, the parties could draw explicitly on the work of the expert workshop on non-detriment findings. There, experts repeatedly acknowledged a role for precaution even as they urged adaptive management and monitoring. If the parties explicitly acknowledged precaution, it is more likely that the precautionary elements of adaptive management would be implemented by those parties' Management and Scientific Authorities.

Precaution as part of procedure could also play a more explicit role in the listing debates. Listing is a tool that allows for monitoring. Thus the absence of threshold data should not be seen as a reason to exclude species from Appendix II listing or even a trade ban through Appendix I listing. Further, recognition of scientific uncertainty and complexity as part of adaptive management should allow the parties to take uncertainty into account in their evaluation of the predictions about the effect of trade on markets, accounting for variables and the interaction of different threats.

Nevertheless, procedural approaches can only address uncertainty where new information that can resolve that uncertainty can be obtained. To address other forms of uncertainty, adaptive management and monitoring will be insufficient.

B. *Precaution as a Substantive Decision-Making Tool*

Adaptive management alone for the implementation of precaution and navigation of uncertainty is necessary, but not sufficient to ensure CITES' goals are met. Even those in favor of limiting precaution to adaptive management acknowledge that where risks are high, the calculations may be different. Rabinovich, for example, despite advocating for sustainable trade for some species, says that "[t]otal bans are not necessary, except in cases where a species is in a serious threat category (for example endangered or critically endangered), or when it plays an important role in

238. *See* TUCKER & TREWEEK, *supra* note 92, at 88 (describing the fact that impact assessment is "routinely constrained" by scientific uncertainty, but that environmental impact guidelines and regulations have very little on "dealing with uncertainty and the appropriate use of the precautionary principle in such circumstances").

239. *See, e.g.*, Rabinovich, *supra* note 237, at 186; Stephen P. Mealey et al., *Precaution in the American Endangered Species Act: A Precursor to Environmental Design*, *in* BIODIVERSITY AND THE PRECAUTIONARY PRINCIPLE, *supra* note 83, at 189, 200.

a complex ecological situation, and when the degree of uncertainty is very high and ecological relationships are poorly understood."[240]

Adaptive management does not on its own reverse any burden of proof, or provide a value judgment about the risks the parties should be willing to bear. The procedural, adaptive management version of precaution is preventative, but not quite fully precautionary.[241] It does not fully account for the fact that even if precaution is implemented within scientific processes, science still leaves policy decision makers with uncertainty.

Indeed, following the approach the parties to CITES have followed, relying on monitoring and preferring science-based decision-making has not removed the value choices at play. Decisions about wildlife trade involve values as well as data. Some of these values are explicit in CITES decision-making, others are less explicitly acknowledged, but nevertheless inform decisions.

Values that are both explicit and implicit are cultural and personal beliefs about the appropriateness of utilization or consumption of species. This has played out most overtly in the context of charismatic megafauna and iconic species, such as elephants. The debate centers around how significantly conservation strategies should rely on sustainable utilization. Some participants in the debate are also informed by what we might traditionally regard as animal rights perspectives. These add moral concerns about cruelty and killing of other species to questions about whether species should be captive-bred, culled, ranched, and killed for their parts even if done sustainably.

Less explicit, but nevertheless real, are political concerns that inform decisions about listing. These can include reputational concerns and concerns about participation in other fora. This can operate either in favor of listing and limiting trade or against it. In response, the parties have had extensive debates about the proper role of secret ballots in listing votes.[242]

For many commentators, the reality of these value conflicts reinforce the view that decision-making should be based solely on science. This may be one reason why the parties have shied away from invoking precaution as a basis for listing. Under this view, where uncertainty arises, it should be corrected with additional monitoring and adaptive management techniques.

However, if scientists cannot resolve value preferences, and additional monitoring and adaptive management cannot lead us to complete certainty, the value and political conflicts will remain. Decision-making cannot avoid having to grapple with uncertainty.

At this stage of decision-making, precaution can play a role without undermining the input of scientists and objective criteria. The parties to CITES can be guided both by the underlying substantive message of the

240. Rabinovich, *supra* note 239, at 186.

241. *See* Trouwborst, *supra* note 80, at 118.

242. *Summary of the Sixteenth Meeting of the Conference of the Parties to the Convention on International Trade in Endangered Species of Wild Fauna and Flora: 3–14 March 2013*, 21 Earth Negotiations Bull. 1, 3–4 (2013).

precautionary principle or precautionary approach, avoidance of serious and irreversible environmental consequences, and by the substantive goal of CITES itself, ensuring that species do not go extinct as a result of international trade.

In its simplest application, this could lead to simply allowing more listing, which in turn allows for more data gathering and monitoring as well as putting in place a substantive precautionary buffer. This is not quite enough, however. Simply favoring listing alone, for example, does not address what the parties should do with regard to impacts on species that do not arise directly from trade, but may nevertheless interact with trade to produce an unintended and harmful consequence for a species survival. This is true for the polar bear, threatened primarily by climate change.

A more nuanced and appropriate way to apply precaution in substantive decision-making would not simply favor listing without more, but would allow listing to play a role in a strategy that could account of all sources of uncertainty. In the case of whether to ban trade or allow even restricted legal trade, acknowledging the full range of relevant biological and socio-economic uncertainties calls for the application of precaution. This can be implemented by listing species and supplementing that listing by placing resources into approaches that have been only partly tried to date, like increased enforcement, domestic trade bans, and demand reduction campaigns. Listing and trade bans can also provide time for the procedural aspects of precaution to be implemented with adaptive management and monitoring. In this sense, the substantive and procedural roles for precaution work together.

This approach to precaution is substantive because it requires the parties to take the scientific information they have and make a decision about what to do. This decision must be informed by that science and also by recognition of uncertainty and the need for precaution in pursuit of CITES's goal of avoiding extinction due to international trade.

In the case of ivory, and in upcoming debates about rhino horn, this means that until more information is available, the parties should oppose allowing trade while they grapple with the uncertainty involved, rather than favoring more trade until proven wrong. This approach would also change how the parties approached the shark species debates. Instead of waiting until more information—even at a threshold level—became available before listing on Appendix II, the parties could have recognized the multiple sources of uncertainty and used precaution to justify listing. This would in turn have begun the process of protection while the parties gathered more information, serving both the procedural and substantive roles of the precautionary approach.

For the polar bear, recognizing uncertainty in all its dimensions means recognizing that some information will not be obtainable and that variables could interact in unforeseeable ways. Thus, it is not enough for the parties to consider only the direct impact of commercial hunting on polar bear numbers, because the variables could play out in a way that leads both trade and climate change to result in population decline. Acknowl-

edging uncertainty requires moving away from narrow compartmentalization of the environment.

Ultimately, this approach creates a presumption in favor of listing for species that are threatened, even if trade is not the most direct cause of that threat. This is a modified way of reversing the burden of proof. The presumption is consistent with the mandate of CITES.[243] The text of CITES itself sets out the irreversible harm that is to be avoided and demands of the parties that they avoid that harm. A presumption in favor of listing would ensure that where the parties seek to allow trade in a species that is threatened, the parties should be asking for more proof that allowing trade will not result in irreversible consequences. Where parties are seeking to list a species to allow for more information gathering and even interim protection, the requirement for proof of the impacts of trade on species should be lesser because of the application of precaution and the need to recognize multiple sources of uncertainty.

This application of precaution does not undermine science. Instead, it draws heavily on science and the lessons of ecology to ensure that decision-making accounts fully for all sources of uncertainty.

Conclusion

Wildlife trade is big business and rife with uncertainty. This Article evaluates how the parties to CITES have navigated this uncertainty. It concludes that the parties have relied on monitoring and adaptive management to implement a form of precaution. As part of this approach, to counteract the effects of uncertainty and the value debates that arise in this context, the parties to CITES have sought to rely on science-based decision-making to minimize—or perhaps hide—their disagreements. They have shied away from expressly relying on precaution as a tool to manage uncertainty and have not, therefore, fully engaged with deeper layers of uncertainty. The result is a necessary but insufficient implementation of precaution.

The Article suggests two responses. First, the parties should continue to promote monitoring, information gathering, and adaptive management, being more explicit about the need for precaution in implementing those strategies. Second, they should recognize the limits of this procedural role for precaution and supplement it with a substantive role that favors listing as a precautionary measure where a species is threatened, even if that species is threatened by many factors in addition to trade. While not everyone believes listing is itself precautionary, this Article takes the view that listing can serve a precautionary function. It can do this by allowing both increased monitoring and a slowdown of trade while parties pursue other strategies and determine what they can learn. This approach is not counter

243. *See also* Ed Couzens, *CITES at 40: Never Too Late to Make Lifestyle Changes*, 22 Rev. Eur., Comp. & Int'l Envtl. L. 311 (2013) (proposing a system in CITES that would whitelist all species and require delisting for any trade, thereby completely reversing the burden of proof).

to science, but consistent with it, complementing science with both procedural and substantive precaution. Within CITES, listing is the tool that can allow both of these roles for precaution.