2023 MT ASA Annual Meeting – Discussion Time!

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Intro: Our discussion exercise is based on a recent judicial opinion written by the United States Court of Appeals and decided on June 16, 2023. It describes an appeal made by the Maine Lobsterman's Association against the NOAA's National Marine Fisheries (NMF) Service. The opinion revolves around analysis of available data to inform decisions regarding risks to the population of North Atlantic right whales protected under the endangered species act. The text of the opinion contains statistical language and provides an example of things that can be encountered working as a statistician, particular in politically sensitive situations such as those surrounding management of endangered species. For the sake of time, we have pulled out a few pages of excerpts from the opinion - the entire document can be found here: https://law.justia.com/cases/federal/appellate-courts/cadc/22-5238/22-5238-2023-06-16.html. Different color font is used to highlight text particularly relevant for our discussion. There are also various news articles out there, most from the lobsterman perspective.

Goal: Discuss challenges arising in this situation relative to the role of statisticians and implications of specific wording/phrases used in the opinion. What are some potential implications of this judicial opinion on work of statisticians related to the Endangered Species Act?

Some prompts to start things off:

(1) What are dangers of ignoring quantified uncertainty and focusing only on point estimates? On the other hand, do you think lawyers and policy makers generally have a deep enough understanding of what statistical quantities of uncertainty capture to be able to use them responsibly? Contrast implications of ignoring vs. potentially mis-using.

(2) What are some potential implications of assumptions made for statistical modeling, particularly when data are limited, as in the example? How should these assumptions be accounted for or integrated into the conclusions and decisions? Consider a statistician's role be in making and justifying assumptions.

(3) Giving the "benefit of the doubt" to the species appears to have historically offered a path forward in the face of uncertainty. Consider implications of the court's rejection of that approach on how statistical modeling might be done and results interpreted and justified.

(4) Discuss implications of phrases like "will *likely* jeopardize", "effects reasonably certain to occur," and "the best scientific and commercial data available."

(5) Specifically consider the statement using "reject the null hypothesis" wording: "*The Service must lend expert assistance to the action agency, make a prediction about effects and, if the agency cannot reject the null hypothesis (no jeopardy) as unlikely, then grant a license*" Discuss the implications relative to theory of statistical null hypothesis testing, common misinterpretations, and specifically for situations with substantial uncertainty.

(6) Broadly consider the role of uncertainty quantified through statistical methods/modeling and its use in politically sensitive decision making such as the example here. How might it be used formally and informally?

Factual and Regulatory Background

This case arises from the Service's efforts to protect the North Atlantic right whale from mankind in general, and lobstermen in particular. We begin by providing some background.

A. The North Atlantic Right Whale

The North Atlantic right whale is distinguished by an enormous mouth, a black stocky body, and the lack of a dorsal fin. It feeds by "taking in huge drafts of water filled with small copepods, krill, and other zooplankton." Eric Jay Dolin, Leviathan: The History of Whaling in America 21 (2007). "Right whales are migratory mammals." Defs. of Wildlife v. Gutierrez, 532 F.3d 913, 915 (D.C. Cir. 2008). The whale's range includes the coastal waters of the eastern United States and Canada, but it occasionally wanders as far as Iceland and Norway. Although the whale's range is broad, the Service has designated its "critical habitat," see 16 U.S.C. § 1532(5)(A), as the whale's traditional foraging grounds in the Gulf of Maine and the Georges Bank, and its calving grounds in the warm waters of the southeastern U.S. 81 Fed. Reg. 4838 (2016), codified at 50 C.F.R. § 226.203. The North Atlantic right whale has been listed as endangered for almost as long as the Government has kept a list. See 35 Fed. Reg. 18,319, 18,320 (1970). For several years, the whale population recovered slowly, peaking at almost 500 in 2011. Its recovery has since stalled, however; a recent Service assessment puts the number of right whales left at only 368. See North Atlantic Right Whale (Eubalaena glacialis): Western Atlantic Stock 17–19 (May 2022), https://perma.cc/UW24-7TQ2.

Several factors may explain the recent downward trend. The availability of food is one of them. To sustain its massive body, an adult right whale must feed upon dense groups of copepods. In the past, the Gulf of Maine provided an ample supply. Following abrupt warming of the Gulf in 2010, however, the whale's favorite prey is no longer as abundant. Right whales need large stores of blubber to calve, so having less food has led to a decline in the birth rate. Less food has also altered the whale's migratory patterns; the Service has seen "a shift of right whales out of habitats such as the Great South Channel and the Bay of Fundy, and into [other] areas such as the Gulf of St. Lawrence in the summer and [waters] south of New England and Long Island in the fall and winter." See also Leah M. Crowe et al., In Plane Sight: A Mark-Recapture Analysis of North Atlantic Right Whales in the Gulf of St. Lawrence, 46 Endangered Species Research 227, 243 (2021) (showing the Gulf of St. Lawrence "is currently an important habitat for approximately 40% of this species from the beginning of May to December"). This is significant because the migration into Canada has made the whale more likely to get entangled in the heavy fishing gear used to harvest Canadian snow crab. Indeed, most right whales die from vessel strikes or entanglement in fishing gear. Entanglement may also reduce calving rates. Whether and to what extent the federal lobster fishery is responsible for hampering the right whale population is the question at the heart of the scientific controversy giving rise to this litigation.

B. The Agency Actions

In 2017, 17 right whales were killed by vessel strikes and fishing gear, five found in the United States. and a dozen in Canada, leading the Service to declare an "unusual mortality event" for the whale under the Marine Mammal Protection Act (MMPA). 16 U.S.C. § 1421c. At the same time, a new study documented the whale's sudden decline. See Richard M. Pace, III, et al., State–Space Mark–Recapture Estimates Reveal a Recent Decline in Abundance of North Atlantic Right Whales, 7 Ecology and Evolution 8730, 8739 (2017). The Service responded by taking action under the ESA and the MMPA.

1. The biological opinion

In light of the new study and the elevated number of right whale deaths, the Service reinitiated a formal consultation under § 7 of the ESA for fisheries that may harm the right whale, including the lobster fishery. See 50 C.F.R. § 402.16(a)(1)–(2). The Service

administers both the ESA and federal fisheries, so the consultation occurred in-house: The Sustainable Fisheries Division consulted with the Protected Resources Division, the former being the division that manages federal fisheries, the latter being the experts in protecting marine mammals.

In a typical consultation, an agency proposes an action and the Service prepares a "biological opinion" documenting the effects of the action. 50 C.F.R. § 402.14(h). If the Service finds the action will likely "jeopardize" a protected species by appreciably reducing its chance of surviving, then the Service proposes "reasonable and prudent alternatives," if there are any, that reduce the increased risk of extinction.

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The Service concluded the federal lobster fishery kills many right whales. In the biological opinion, the Service's first task was to describe the "reasonably certain" effects of the fisheries on the right whale. 50 C.F.R. § 402.02. It began with this preliminary qualification, quoting the legislative history of the 1979 ESA amendments:
Data are limited, so we are often forced to make assumptions to overcome the limits in [sic] our knowledge. Sometimes, the best available information may include a range of values for a particular aspect under consideration or different analytical approaches may be applied to the same data set. When appropriate in those cases, the uncertainty is resolved in favor of the species . . . . We generally select the value that would lead to conclusions of higher, rather than lower, risk to endangered or threatened species. This approach provides the "benefit of the doubt" to threatened and endangered species.

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The Service faced the unenviable task of dealing with these known unknowns. To do so, the Service made certain disputed assumptions about the unknown data and the unseen deaths. After making these assumptions, the Service concluded the fishing gear used in the lobster and Jonah crab federal fisheries kills about 46 North Atlantic right whale each decade, which would decimate the right whale population in less than ten years. The Service also estimated that federal fisheries entangle more than nine percent of right whales each year. To reach this estimate, the Service put aside the data on confirmed entanglements and relied instead upon a "scarring analysis" from a 2019 study, noting "This approach provides the benefit of the doubt to the species and a more conservative estimate of total right whale entanglements."

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In response to public comments criticizing the Service's assumptions, the Service said it "recognize[d] that the assumptions may be considered pessimistic," but said it had no choice: "[G]iven Congressional guidance on implementation of the ESA," the Service said, "we need to give the benefit of the doubt to the species." The congressional "guidance" repeatedly referenced by the Service was a single sentence in a 1979 conference report, to wit: "This language continues to give the benefit of the doubt to the species, and it would continue to place the burden on the action agency to demonstrate to the consulting agency that its action will not violate Section 7(a)(2)."

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The ESA Does Not Require a Substantive Presumption in Favor of the Species

Section 7 imposes some duties on the action agency (here the Fisheries Division), and other duties on the Service (here the Protected Resources Division). The action agency must ensure an action is "not likely to jeopardize the continued existence of" a protected species. 16 U.S.C. § 1536(a)(2). A key term limiting this duty is "likely." Id. We give the term its "ordinary, contemporary, common meaning." Food Mktg. Inst. v. Argus Leader Media, 139 S. Ct. 2356, 2362 (2019). In 1979, when the term was added to the ESA, "likely" meant "probable" or "[i]n all probability." Black's Law Dictionary 834 (5th ed. 1979). Indeed, elsewhere in the ESA, the Service has read "likely" to mean "more likely than not."

We see no reason to depart from that usage. Section 7, therefore, requires the action agency to avoid acts that will more likely than not jeopardize a species. No more, and no less. In so doing, the action agency must "use the best scientific and commercial data available."

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The Service's role is thus a limited one. The Service must lend expert assistance to the action agency, make a prediction about effects and, if the agency cannot reject the null hypothesis (no jeopardy) as unlikely, then grant a license. For our purposes, what matters is that the core of the Service's remit in the decision making process is to "form a scientific judgment." Massachusetts v. EPA, 549 U.S. 497, 534 (2007). Nothing in § 7 requires "distorting the decision making process by overemphasizing highly speculative harms" whenever the available data is wanting. Robertson v. Methow Valley Citizens Council, 490 U.S. 332, 356 (1989) (holding NEPA does not require a "worst case analysis").

Statutory history reinforces this reading of the text. Before 1979, the ESA provided that agencies must "not jeopardize" a protected species. 16 U.S.C. § 1536 (1976). This absolute negative proved a blunt instrument. In the famous "snail darter" case, the Supreme Court halted work on a dam that had cost $100 million (in 1978 dollars) to save "a relatively small number of three-inch fish among all the countless millions of species extant." TVA v. Hill, 437 U.S. 153, 172 (1978). This waste was ordained, held the Court, by the "institutionalized caution" of the ESA, which admitted of "no exception." Id. at 173, 194. Under this absolute veto, agencies had to "prevent the loss of any endangered species, regardless of the cost." Id. at 188 n.34 (cleaned up). The result was "breathtaking": A "newly discovered species of water spider or amoeba" could spell the end of any public or private action touched by the hand of the federal government. Id. at 203–04 & n.13 (Powell, J., dissenting). More to the point, under an absolute negative, scientific uncertainty could paralyze government, or force industry "to spend billions to save one more fish." ...

In 1979, the Congress lightened the load to avoid paralysis. Among other changes, the Congress replaced "do not jeopardize" with the tentative "is not likely to jeopardize," and required "each agency" to rely only upon "the best scientific and commercial data available," not the best data possible. Pub. L. No. 96–159, § 4, 93 Stat. 1225, 1226. This history shows the Congress did not want economic activity stopped in its tracks whenever complete data was lacking. After all, "[d]ecisions regarding endangered species are often characterized by insufficient data" and "considerable uncertainty." Nat'l Research Council, Science and the Endangered Species Act 157 (1995). To say uncertainty is a reason to veto a federal action is to say that many valuable activities must cease, even if the risk of jeopardy is not "likely," but speculative.

The Service's Biological Opinion Was Arbitrary and Capricious as Well as Contrary to Law On appeal, the Service argues the "relevant text says nothing about how an agency must handle uncertainties in the data," and this silence means the Service had discretion to do what it did here. What is not prohibited, the Service reasons, is permitted; the only limitation being the highly deferential arbitrary and capricious standard of review for agency predictions "at the frontiers of science."

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2. The Service's change in position is arbitrary and capricious

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The Service argues that it complied with its interpretive rule because it picked the "conservative" outcome or the "worst-case scenario" only when there were "two or more reasonably likely outcomes," but that is just not so. By the Service's admission, it relied upon worst-case modeling that is "very likely" wrong, based upon assumptions the Service concededly does not believe are accurate. Projections that are "very likely" wrong are not reasonably certain to occur.

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It is not the province of a scientific consultant to pick whales over people. The Service must strive to resolve or characterize the uncertainty through accepted scientific techniques, not jump to a substantive presumption that distorts the analysis of effects and creates false positives. When the Service applies a substantive presumption to distort the analysis, the public can have no confidence that "economic dislocation" is needed to protect a species and is not the result of "speculation or surmise" by overly zealous agency officials. Spear, 520 U.S. at 176–77. We recognize the Service has a difficult task. Under brute uncertainty, the Service may have no way to attach even rough probabilities to the range of possible outcomes. See Frank H. Knight, Risk, Uncertainty, and Profit 20–21 (1921) (distinguishing "risk" from "true uncertainty," which is not susceptible to measurement). We do not deny this, nor do we require scientific reasons or calculated probabilities when no reasons or calculations are possible. In most realistic cases, however, the Service will be able to make a scientifically defensible decision without resort to a presumption in favor of the species. When it does so, the Service's predictions will be entitled to deference.

If brute uncertainty does make it impossible for the Service to make a reasoned prediction, however, the interpretive rules supply a ready answer: The Service lacks a clear and substantial basis for predicting an effect is reasonably certain to occur, and so, the effect must be disregarded in evaluating the agency action.

C. The Error Is Not Harmless

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Here, the Service announced at the outset that when it made assumptions about the known unknowns, it would "generally select the value that would lead to conclusions of higher, rather than lower, risk to endangered or threatened species." All of the assumptions the Service made are thus tainted by the presumption in favor of the species. Some of the assumptions the Service made along the way are quite important—as we have explained, the Service ultimately concluded the lobster and Jonah crab federal fisheries kill 46 whale deaths per decade, a staggering departure from the two documented deaths known to have originated in all U.S. fisheries over a period of nine years.

This conclusion rests upon uncertain assumptions. Take the Service's decision to allocate half the deaths of unknown origin and half of the undocumented deaths to U.S. fisheries. This allocation is of great importance to the analysis, but it has little empirical support. As shown in the chart above, most documented deaths from entanglement of known origin, particularly in recent years, have happened in Canada. Right whales have also migrated away from the Gulf of Maine. Moreover, before 2017, Canada did little to survey the Gulf of St. Lawrence, where many whales had relocated, so the dataset used by the Service may well understate the role of Canada in the decline of the right whale population. See Crowe et al., at 247 ("[S]ubstantial[] undetected mortality of these right whales probably occurred in the [Gulf of St. Lawrence] in 2015 and 2016."). Or perhaps the detection bias runs in the opposite direction, as the Service implies. What matters for our purposes is that the Service is making a highly discretionary judgment under uncertainty. That judgment may (or may not) be rational enough to pass muster under arbitrary and capricious review, but that is beside the point. We have no way of knowing how the Service would have made this discretionary judgment had it not applied a general presumption in favor of the species, so we cannot conclude the error was harmless.

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