Integrating science into conservation decision-making: an interview with Jim Nichols

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James D. Nichols has been a wildlife biologist with the US Geological Survey for more than 40 years and a long-time collaborator on conservation research projects in India. At the Student Conference on Conservation Science, Bengaluru $SCCS-Bengaluru$ in September 2015, Dr. Nichols spoke about ways to integrate science into conservation decision-making, drawing upon his own experiences working with wildlife managers in North America. Hari Sridhar spoke to Dr. Nichols after the talk, to find out more about his work.

Hari: In your talk at SCCS-Bengaluru, you said that the way in which scientists usually engage with park managers and conservation decision-makers is inefficient. Why do you think so?

Jim Nichols: I guess the first thing I should say is that inefficiency is not a horrible crime. It is just that, in the conservation world today, our dollars and efforts are so limited. If we can do better within our limited means, why not do so?

I think the inefficiency comes via a lack of communication and a lack of a central programme within which everyone works. What often happens - or at least what I have seen in my world - is a group of scientists interested in a particular system will get money for studying that particular system, claiming that what they learn will be useful to conservation folks. They will then go out and perform the study, learn something and then give that information to the manager or conservation guy who is actually on the ground doing things. I don't claim that what is learnt is never useful, but very frequently it doesn't hit the mark. In other words, what scientists learn is not exactly what the decision maker needs to make a conservation decision. And that's where the inefficiency is. So then you basically have two groups who are angry at each other – the scientist says, 'oh this guy is not paying attention to my work', or 'he is not reading the right journal' or something, and the conservationist guy says 'well, the scientist is pursuing his own interests rather than thinking exactly about what I need to help me make my decision'. It is in this sense that I view what we do today as inefficient.

H: Do you think part of the problem is that the scientist and decision-maker don't work together right from the beginning?

JN: Yes, one way that ought to hold promise for getting rid of this problem is having scientists and conservation folks working together from the beginning, and treating science basically as a useful piece of a much larger conservation programme. That way the science itself ends up being directed at things that are most useful to the conservation decision maker. What might these be? Mainly, trying to predict the effects of the usually pitifully small number of actions we can take on the system that we are working on. Once the scientists recognise exactly what the decision maker needs, you are ensuring that the kinds of hypotheses tested are directly relevant to the decision process.

H: In your talk you called this process 'Adaptive resource management'. Is this something that has been around for a while in a formal way?

JN: Okay, that's an interesting story. The fundamental idea of adaptive management is trying to manage in the face of uncertainty. As a conservation guy, if you knew exactly what to do you don't really need this. But we are involved in so many situations where there is a lot of uncertainty. In such situations there are two approaches one can take - the old approach would be to have scientists go out and study the problem for a long, long time – 5-10 years – and then provide results that hopefully reduce the uncertainty associated with the management problem - uncertainty associated with how actions translate into responses. The claim of adaptive management is that that's foolish for a couple of reasons – first is time - bad things continue to happen when the scientist is off trying to learn stuff. The other problem is when the scientist comes back at the end of 10 years or so, almost invariably there is all kinds of uncertainty still left -you never just solve everything completely. And so a guy

named Buzz Holling ended up saying ‘why don’t we go ahead and begin management right away – let’s not delay, but what we will do is try to embed science within the management process so we learn while we are doing’. So, it’s a ‘learning by doing’ kind of an idea.

H: Can you give us an example?

JN: The United States Fish and Wildlife Service $USFWS$ has, for a long time, been responsible for hunting regulations for ducks in my country. In 1995, there was a political play on this whereby a state got hunting regulations tilted in its favour. They had gone around a process which had been in place for a good 30 years. When this happened, virtually one congressman from every state which had not benefited from this play wrote to the Secretary of Interior saying ‘boy, you really messed up’. People were really, really mad and brought all kinds of political pressure to bear.

I’ll back up a tiny bit here - there was a visionary guy named Fred Johnson who, in the early 1990s, realised that for this kind of duck harvest management, adaptive management will be a really smart thing to do. So he formed a working group, of which I and a small number of others were part. From 1991-95 we developed an adaptive management framework for duck hunting, basically saying that if ever the situation came up, this is how we would go about attacking the problem. So when this problem happened in 1995, we went before the USFWS director and made our case. At that time the director was looking for any process that she could claim was transparent and defensible. And so it was just the perfect time for us to march in and present our adaptive management plan, and she readily agreed. For the next six months, folks, where I work, had to drop everything else to take this forward. All the modelling and optimisation stuff that had to be put in place was a huge effort - we called it our ‘Manhattan project’. Anyway we $ledbyJohnson$ got the thing together and since 1995 this adaptive harvest management has been implemented for our biggest population of hunted ducks - mid-continental mallards. It has been a success story in the sense that it has reduced the contentiousness that accompanied the establishment of hunting regulations each year. It has reduced the uncertainty - to begin with we had four competing models - four different scenarios of how hunting regulations might affect populations – and now we have ended up having a pretty high degree of confidence in one model, a little confidence in another, while the other 2 are not good predictors at all. And so this adaptive management tenet, of learning while you are doing, has absolutely happened - we can show you how our formal degrees of confidence in different models have changed over time. The idea is that you don’t just learn, but while you are learning you use what you have learnt. Our idea of what is the optimal/smartest thing to do has changed – we are giving the two best models more and more influence - not in a folksy way but in mathematical way - in the optimisation process. We are not only learning by doing but we are using what we have learnt at each time step.

H: This process requires the scientist and manager to work together, to collaborate right from the beginning. Does that mean that the managers need to have an appreciation and an understanding of the numbers that go into it?

JN: I think it is important. However, there are degrees. I don’t think it is important necessarily that the manager know all the details of how we build our models, how we estimate things like survival rates, and certainly how we do the optimization - that stuff gets fairly ugly. But I do think it is important that the managers have at least a folksy understanding of how the process works. It is very important for those of us who do the more detailed mathematical stuff try to explain what we are doing to the managers, to the degree possible. A lot of interaction is needed.

H: Is communicating the uncertainty and likelihood of error in science particularly difficult, especially since people usually think of science as ‘truth’ and ‘fact’?

JN: Yes it is. Getting the ideas of uncertainty across, in terms of how we quantify it, how we can make statements about it, and I guess most importantly how we deal with it when we have to make decisions is difficult. But it shouldn’t be difficult - I mean think about your most important decisions – choosing somebody to marry, how many children to have, where to send your kids to school - every decision we make is characterised by uncertainty. Yet we find a way, through intuition most of the time, to make the ‘right’ decisions. All we are doing differently here is using a mathematical formalism in the place of intuition, not because formal is necessarily good, but because very often the optimal solutions are different from what we might have thought of intuitively. My intuition doesn’t work as well as I would like it to. The other reason to use formalism is transparency – we can show people exactly how we arrived at a decision step-by-step. Anyway, communicating the uncertainty is a big deal for sure.

H: Especially because managers are likely to be making most others decisions based entirely on their intuition?

JS: Sure, and I get that and maybe that is good a lot of the time. What's most interesting is that the managers who are most interested in listening to our ideas are often the ones in the most contentious situations. Now if you are a manager and nobody is complaining to you about the decisions you are making, why bother with this tedious process? But the folks we see who are most interested in this stuff are like the USFWS in the duck case. THE USFWS was getting it from both sides - people suing them, taking them to court for allowing hunting and others being angry because they couldn't shoot enough. Endangered species folks are very interested in this approach. Why? Because they are constantly getting thrown into court and need to defend the decisions they have taken in a detailed step-by-step fashion.

H: You speak about court cases. At least in working with the manager you might have the luxury of time - you can sit with him or her for a few days/weeks and explain all this stuff. When you have to make a case using numbers in a short period of time in front of a judge, is that a lot more difficult, to get them to appreciate the nuances of numerical arguments?

JN: It's difficult for sure. The only court case I was in happened before we adopted this adaptive management sort of approach. It had to do with setting of hunting regulations for one species of duck. The law stated that the regulations had to be set in a manner that was not 'arbitrary and capricious'. So all we had to do was bring in all the computer print outs and convince the judge that we were trying really hard to figure out how this population was doing and what regulations made most sense. That basically won the day in that case. But I would approach it differently if I find myself in court again in the future – I would actually try to lay out the details of how we come up with a particular decision.

Your question brings to mind a famous murder case in our country – the OJ Simpson case. In that case, one very important consideration was how likely it was that the blood at the crime site - which was a very close match to OJ Simpson's – how likely was it that it came from someone else. The probability turned out to be very small. Unfortunately, the guy who came up with the probability made a mistake initially and then revised it. Now, the mistake was ridiculously small – the number was different only after 10 decimal places so it did not change the inference in any way. But yet it allowed the defence to say 'hey wait, this guy messed up. He gives us one number one day and another number the next day. Why should we to listen to him?" Just an illustration of the danger and difficulty of presenting and defending numbers in a court case.

H: Do you think this process of adaptive management you describe is suitable for certain kinds of systems more than others – e.g. simpler ecological systems where one or two factors are dominant; systems where management interventions are simpler? Or do you think it is useful no matter what the complexity? What if your interest was in a community of organisms and if there were multiple problems that interact?

JN: I think there are two situations where it is not useful. If you really have certainty - if you know, for example, that villagers inside a protected area are 100% the reason for the problem with tiger prey numbers and you know that you can somehow find them a better livelihood outside the protected area, then your problem is solved - there is no need for adaptive management. Adaptive management is designed for situations where there is uncertainty. It is also setup as a recurrent management decision process. In other words, if you are making a one-time decision, and you are never ever going to revisit that decision, and you are not going to make similar decisions in similar situations elsewhere, then there is no need for adaptive management, because there is no need for learning. But given there is uncertainty and a need for recurrent decisions it is useful no matter what the complexity of the situation. It is useful but more difficult.

Some people use that to say that's way too complicated and that we can't possibly go through all these steps and get agreement. But my claim there is that there is no alternative. What's the alternative? I guess you just do whatever you feel like and hope it works, but there is no alternative that I would know how to defend.

H: You spoke about how environmental variation can influence all of this and therefore needs to be incorporated. But what about externalities that influence the management decision itself, e.g. factors outside a park that influence a manager's decision? Is this process insulated from all of that and are you working with the assumption that the manager has full control over decision making and

implementation? Or are you moving to a process that also incorporates externalities - political pressures, changing societal values etc.?

JN: Okay, I guess there are two things I want to say in response. So far we have been lucky that the USFWS, has always accepted and implemented what we come up with every year. But the USFWS director has the power to override what we recommend and say 'you know, I am going to try something different this year'. I don't think anybody would ever do it because they would have to defend it, and it would not be possible to defend it. Basically you have to answer the question - 'why is it that you are doing something other than what's been shown to be the smartest thing you can do given your objectives'. That's a hard thing to answer. But you are right, in many cases the ultimate decision maker could override you. In the case of the red knots and horse shoe crabs the decision maker is the Atlantic States Marine Fisheries Commission – so the first thing we made sure was that the main decision maker is at the table when you are going through all this stuff. You don't just do it in a vacuum and say – 'hey, I came up with a smart way to make decisions for you guys'. So we had them in from the very beginning and they have now formally accepted our process, although they always have the power to override. The second point I want to make is about other externalities – if it turns out, as you say, that political support or societal values are changing. We try very hard to ensure that all relevant stakeholders, all people who even think they are stakeholders or should be stakeholders are included in the first part of this setup phase when we are coming up with the objectives. The 'kiss of death' for one of these projects would be to have one group that thinks it should be part of this process but is not included. Then, even if you come up with suggestions that are consistent with that group's point, they might not support you because they are mad at not being included. So, it is crucial that politicians, members of civil society, different groups – conservation groups, hunter groups, etc. - whoever thinks they have something to say about this, is brought to the table when the objectives are being discussed.

H: In terms of the kinds of interventions possible – is this process more useful in the case of interventions that have a very direct bearing on the problem e.g. allowing or not allowing hunting of a species, as against interventions that might only have an indirect impact, e.g. controlling tourists in an area that houses an important species?

JN: Yes, it is easier to think of it in the former, but I almost think that adaptive management may even be more important in the latter, because there is probably greater uncertainty. For example, I am involved in a re-introduction programme for this duck species called Steller's eider in the Yukon-Kuskokwim delta in Alaska. And there one of the things we talk about is public education. We debate about the importance an education programme that might help reduce hunting by local indigenous people. That's a potential action in which there is a great deal of uncertainty about whether or not it will be useful to the project. But I think the less certain we are about its influence the more important it is to use a process like this to help you learn how relevant the action might be.

H: Is this process used widely now?

JN: No, not at all. I am not even sure of a number. I am involved in I guess five different formal programmes right now. As I said earlier, the difficulty is you can't just convince people by giving a talk or making a presentation. There's a long way between that and getting it done. In each one of the five programmes I am involved in I have had to spend a lot of time and effort and basically be a part of that programme for a number of years. Obviously, I am not the only guy - I have got a small number of colleagues who have done exactly the same thing. But what that has resulted in is a relatively small number of places where this form of programme has been carried out. In the duck world for example, it has been extended now to a number of different species and populations. My vision for the future, for conservation biology, is that this will be something much more common place, that it will be the norm, but it's nowhere close to that right now, either in the US or anywhere else in the world. That vision maybe way further off than I would like it to be. But I think the more case studies we present that show that this thing works – that it is transparent and gives defensible results - my hope is, the more widely it would be adopted.

H: The dynamic - between manager and scientist – seems crucial for this process to work. Does the fact that you work for a government agency make for an easier, more equal, working relationship with managers, as compared to, for example, if you were from a university?

JN: I don't know. I would like to think that a university person could do it. We have this umbrella agency called the Department of the Interior and the USFWS is part of that Dept. I happen to work for the US Geological Survey- it seems strange but they do have a biology group. The idea is that all the science folks work in this

Geological Survey and the folks concerned with on- ground management are in places like USFWS or the National Park Service. So even in my case we do have this separation - yes, I work for a government agency but I am identified as a science guy. And a lot of the time I think the successes that we have had have been in spite of, rather than because of, our organisational structure. In other words, because we think it is very important to interact with managers, if I was developing big organisations I wouldn't separate managers and scientists organizationally). So even though I am in the government, there is still this big distinction made – maybe not quite as much as between university and managers. Even the mechanics of promotion are different – we are evaluated on scientific stuff, managers are evaluated for different things.

H: You mentioned earlier in the conversation and in your talk that while science can aid conservation decision-making, the choices we make and the values underlying them need to come from society. Therefore, do you also feel that scientists should have limited, clearly-defined roles – restricted to their research - in conservation?

JN: That's a good question. I hadn't thought about it exactly that way so my top of the head thought is: the role of the scientist is very clear in the process I laid out. In coming up with objectives scientists should have no more say than anybody else in the public. They do they have a place at the table, but it absolutely is not any more important than that of anybody else. Like I said earlier, you want to make sure that all the stakeholders are there and the scientist is just one stakeholder at best. Now with regard to the second step - coming up with management alternatives – there scientists have a somewhat bigger role, but again, the manager is most important here, because he or she knows what's feasible much better than a scientist. The steps where the scientist has the most important role is in the development of models, development and implementation of the monitoring programme and the implementation of the decision analysis. That's interesting - the way I see adaptive management it seems like there are very clear roles for people.

I'll also add that I see a very important role for social science within conservation science. In the process I envision, social science is extremely important in setting objectives. In the cases I have been involved in - I was never trained in that social science stuff – but yet I was sitting there in the front of the room trying to get people who hate each other – or rather hate each other's ideas - to come up with a compromise set of objectives. I am guessing a social scientist or somebody who is trained to do that will probably have done that a lot more effectively than I was able to. So there is a role for social scientists in this, not necessarily in the development of models or monitoring, but there is a clear role.

H: But you often find scientists going beyond their science and becoming advocates for particular causes. Often, they weigh in on conservation issues that they might not have researched themselves. Do you think that part of the problem is a mixing of personal values and professional responsibilities, i.e. that many scientists in conservation get into the field because of their interest in protecting wild species and places?

JN: I have no problem in a scientist expressing to people what his or her values are – that doesn't bother me at all. Any stake holder should be able to do that. But that my values should be privileged over yours because I am a science guy and I know more than you – that I disagree with. The reason why I value a species might be because it plays an important ecological role. Someone might value it because he or she like's going to bed somehow knowing that it's out and would feel poorer if it wasn't. Other people might have other - economic - priorities in mind. So there is no reason why scientists' opinions should be taken any more importantly than anyone else's, with respect to objectives.