Interim Exam

Marcel Gietzmann-Sanders

Summarize the main insights or "lessons" you have distilled from the case study presentations in our class.

Know thy fishery. That's the big one. Folks can talk about all sorts of modeling and management paradigms but at the end of the day there is no substitute for knowledge of the fishery one is working with. Take as an example the reproductive health of a stock. What one needs to know and how one goes about managing this is pretty much as diverse as the species themselves. In my case – with herring – there are spawning aggregations to worry about, spatial heterogeneity of stocks, survival through the first winter, and the impacts of climate change. But then you turn to something like Gag grouper where the biggest concern right now is that only about 1.4% of the stock is male! In striped bass' case they've been without their spawning habitat for so long that they wouldn't be around without enhancements like fish hatcheries and then the sharks in the Mexico fishery that was reviewed are being recruited to the fishery so young they're largely being caught by age 1. Every single one of these cases requires entirely different methods to manage.

Likewise, there is an equivalent amount of diversity in who the stakeholders are and what they want out of the fishery. Some of these fisheries are almost entirely recreational. Other fish species aren't targeted by commercial fishermen but are a nice bonus if caught (mutton snapper). Horseshoe crabs have medicinal purposes but are also used as bait just like herring. Chinook salmon are a major source of subsistence fishing but also have a global market whereas Conch in St Lucia are only being caught by traditional fishermen. Each of these diverse sets of interests require totally different kinds of management. For example, just consider how management targets change. If recreational fishermen are involved, they are most likely interested in catching the largest (and therefore most interesting) fish possible. Commercial fishermen want things like MSY determined and optimized. Subsistence or traditional fishermen will be less concerned with maximizing total biomass caught and instead want their time to be used as effectively as possible which could mean catching fish of very specific sizes or catching fish when natural aggregations occur.

These – recruitment and stakeholders – are just two examples in a smorgasbord of dimensions that give each fishery their specific "fingerprint". There are also differences in legal conditions, differences in conservation efforts, and differences in ecology – just to name a few more. Without a clear understanding of each of these dimensions one will be helpless to manage the fishery well. Therefore, my biggest takeaway is as simple as my opening line – know thy fishery. One can talk all day about all sorts of tools and techniques but without the context you'll never know which tools to use and these case studies make it clear that there really is no one size fits all.

Briefly compare the fisheries management systems that apply to state and federal water off the Atlantic coast of Florida. In your opinion, what are the comparative strengths and weaknesses of the state and federal management systems?

It was very refreshing to see how much genuine concern and engagement existed in all the meetings that I watched, both at the state and federal level. However, the context and temper of that engagement was different in some very curious ways. In general, I think it felt like the difference between an orchestra reading a score and a jazz band improvising.

The federal level is of course the orchestra. Throughout the deliberations there was an underlying sense of tension and anxiety. In subsequent discussions in class, it became clear that this was the result of just how much litigation can occur at the federal level. As a result, people go out of their way to follow the rules and procedures to a t. And you could observe this real time. A lot of time was spent debating metrics specifically because they could be called out by the public or create a requirement from the government for relatively extreme action. Along with this precision, care, and accounting came *long* timelines. Every realistic timeline was measured in multiples of years. Finally, it was interesting to see how broken up the advisory committees were. The scientific advisors weren't directly on the main advisory committee but instead had one of their own – a committee that itself didn't include the scientists running the assessments. Lots of bureaucracy for sure.

Contrast all of this with the FWC meetings. The science staff came up and said their piece (which was in extremely clear and terse language), then there was public comment in which everyone was speaking the same language, and finally the council, in the course of 15 – 30 minutes, discussed what had been heard, asked for a few clarifications from the science staff and then made a decision right there and then. One particularly potent comparison was the anxiety felt in the federal meeting around the specific stock levels, exactly how they were computed, and whether that would require a rebuilding plan (as per Magnuson-Stevens) versus the fact that at some point the chairman of the board for FWC literally asked – "are we really in dire straits here?" – and then in response to a "no" from the science staff recommended a decision that then more or less immediately passed. It's really like the federal level has a score they need to follow to the t whereas the state level has some general chords they need to hit but otherwise can take it as it comes.

There are pros and cons to both. Having a clear "score" means everyone knows exactly what needs to be done and how to do it and this provides the opportunity to *guarantee* things. The science *must* be observed at the federal level. At the state level there is a clear sense that the science is purely advisory. However too much focus on the rules can cause tunnel vision and prevent people from seeing and acting on the bigger picture – especially when improvisation can mean legal action.

You are tasked with engaging stakeholders in decision making for a controversial fisheries management issue. Emotions are running high. What approach(es) would you take to engage stakeholders constructively and manage the conflict. Why?

Conflict resolution, at the end of the day, should be about finding positive sum games. As was mentioned in lecture, it's not about figuring out who is right and getting everyone else to change their tune, it's about finding and accumulating the "rightness" in everyone's perspective. That being said, before one can get to the positive sum game part of conflict resolution, other more historic-emotional things usually have to be resolved first.

Therefore, the first thing I would do is understand the background of each group involved. How have they interacted in the past? What conflicts have arisen previously? Are there different cultural contexts? I would gather this information first to make sure that in my subsequent engagements I don't accidently trigger any existing grudges.

Next it would be necessary to understand what is driving everyone's positions. As was mentioned in lecture and discussed in class at length, positions are just the tip of an iceberg whereas motivations and values are what really drive conflicts. Figuring out what those are requires empathic listening where the intention is to understand things from a specific person's point of view, regardless of one's own viewpoint. Therefore, I would perform a series of open-ended qualitative interviews to get my bearings and provide an opportunity for people to speak freely. I would do this with representatives from each group independently to create a safe space for people to express themselves fully.

However, simply listening to people is not enough. To feel heard, folks need to see that you actively incorporated their point of view. Therefore, my next step would be to weave together everything I'd learned into one consistent framework. This would then be sent to those I'd interviewed for comment and review. The intention here is not to arrive at a conclusion, just to create a consistent perspective that covers the data brought forward by everyone.

Now that all the data, perspectives, motivations, and values are on the table it would be time to bring folks together to workshop positive sum games. In this workshop I think it would be prudent to have a professional mediator to keep the discussions collaborative rather than antagonistic. While the intention is to find a path forward folks believe is fair, the subtext would be about creating an environment in which people feel they are a team of stakeholders rather than competitors for a resource. Trust is a hard thing to build and therefore must be a conscious concern in every interaction – drop the ball for a moment and years of work building trust can just vanish.

Finally, because coming up with solutions is difficult I'd seed the discussion with some example solutions that illustrate the dimensions of compromise that address each group's specific concerns. This would simply be a starting place to catalyze discussion.

Explain the conceptual basis and application of fisheries stock assessment using a biomass dynamics model.

All models exist to help us solve a problem. In the case of stock assessments, the problem is pretty straightforward but also quite daunting. Fish too little and people's livelihoods diminish. Fish too much, however, and a stock can be driven into the ground and those livelihoods vanish entirely. The point of a stock assessment then is to find the balance point – the point where the long-term value of the fishery is maximized. However, we're dealing with a stock which we can only indirectly measure. This is where biomass dynamics models can help us. They give us a way to relate underlying biology to measurable things like catch and effort in order to allow us to back out (from the model) the metrics that enable us to find that balance point.

So, what are these metrics? Well in the Schaefer and Fox models there are three parameters that we can tune – r, K, and q. The ideas behind each of these are straightforward. q relates catch to biomass and effort linearly C = EqB. The notion is that the more fish in your stock the more you catch for the same amount of effort. Fox and Schaefer assume this relationship is linear. The next concept in both of these models is that, when the stock is small, surplus yield (i.e. recruitment in excess of that required to maintain the present biomass) is more or less linearly related to biomass – r determines how large or small that surplus yield is. Finally at high levels of biomass, Fox and Schaefer both recognize that the surplus yield falls off because there is more competition for the niche that species occupies. K then becomes a kind of "carrying capacity" for the species. The combination of these two principles results in a surplus yield curve with a specific peak – and that peak is the MSY we are looking for. So, if we know r and K we can compute the "best" biomass, i.e. the biomass that produces the most surplus yield.

This "best" biomass is one of two primary reference points. If our stock becomes smaller than this we consider it overfished because it is incapable of producing sustainable catches at the MSY level until rebuilding occurs. The other reference point is the effort at MSY – i.e. the effort required to catch the surplus yield at our balance point. If the effort in the fishery goes above this value, we say the stock is experiencing overfishing because eventually that level of effort will result in stock depletion to levels below our biomass at MSY.

How to find r and K? Well for any specific starting biomass, r, K, and q we can compute what our expected catches would be given the historic effort. And the difference between these catches and our historic catches gives us a measurable error. This error term can then be used to drive the fitting of our original parameters which gives us our r and K.