**Interim Exam**

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*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 really knowing the fishery one is working with. Take as an example the reproductive health of a stock. What would need to know about and how you go 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 largest concern right now is that an estimated 1.4% of the stock is actually male! For striped bass they’ve been without their spawning habitat for so long that they wouldn’t be around without enhancements like fish hatcheries and then 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, you look at who the stakeholders are for these fisheries and what they want out of the resource. Some of these are almost entirely recreational. Others aren’t targeted by commercial fishermen but are a nice bonus if caught (mutton snapper). Horseshoe crabs have medicinal purposes but are also used like 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 themselves require totally different kinds of management. If recreational fishermen are involved, they are likely most 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 at times of aggregations.

These are only two of the major categories of diversity showcased in each of these case studies. There’s differences in legal conditions, differences in conservation efforts, differences in ecology and you see all of this diversity on display in how each fishery is managed and how that management is performing. Thus, my biggest takeaway is as simple as my opening line – know thy fishery. You can talk all day about recruitment, MSY, slot sizes but all of these are simply tools. Without the context you’ll never know which tools to actually use and 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?*

First of all, I think it was very refreshing to see how much genuine concern and engagement existed in all of 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 this 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 and how much of this has been reduced by extremely clear rule following and loads of documentation and accounting. And you could observe this real time. Lots of discussion happened around things like whether specific metrics were *specifically* what they were precisely because either it could result in the public losing faith in the process or the federal government coming in with requirements that harsh action be taken. For example in one of the meetings there were results that could throw a fishery into an overfished state which would then result in a rebuilding plan having to be put in place. One got the real sense that if the number had been different there wouldn’t have been anywhere near as much discussion. Along with this precision, care, and accounting came *long* timelines. Folks in this meeting were always talking about multiyear processes, or getting feedback in a year or two. Finally it was interesting how there always seemed to be a step between each group and each other group – the scientists weren’t directly on the council, they were on their own, and the scientists actually doing the assessments were in a completely separate group themselves. Lots of bureaucracy

Contrast all of this with the FWC meetings. The science staff came up, said their piece, which was (as everyone in class noted) in extremely clear and terse language, then there was public comment in which everyone was more or less speaking the same language, and then 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 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 board for FWC literally asked – “are we really in dire straits here?” – and then in response to a “no” recommended a decision that then pretty much immediately passed. Reading a score versus improvisation.

I think however this music analogy works well for the pros and cons of both approaches. With a score (federal) you know what you are going to get and you are more or less going to get it every time. It takes a while to get everyone on the same page and loads of time is spent making everything precise – but the rules are clear and they just need to be followed. The science will be there and it will be used. The improvisation (state) on the other hand is fast, you have the chance of hearing amazing results much more quickly, but it really depends on who’s improvising. You get a clear sense from those meetings that if the board doesn’t like what the science is saying they can more or less ignore it if the public is in agreement. So in general the rules give you guarantees but little wiggle room and the rules can become an obstruction. But the rules also mean you know for sure that the basics will be observed.

*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, needs to be about finding positive sum games. As was mentioned in lecture it’s not about figuring out who is right and getting else to change their tune it’s about finding the right in everyone’s perspective. That being said, before being able to get to the positive sum game part of conflict resolution, other more historic-emotional things usually have to be resolved first because often, when emotions are running high, there’s history and misunderstanding involved and before anyone can get anywhere the air has to be cleared.

Therefore, the first thing I would do is understand the background of each of the groups 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.

Then I believe the first step is 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 and motivations, values, and the like are really what drive conflicts. And to understand those requires empathic listening where the intention is to understand things from a specific person’s point of view, regardless of one’s own viewpoint. To do this I would probably perform a series of open ended qualitative interviews just 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.

The purpose here would be to build a full mental picture of everyone’s collective perspective. People who are truly engaged are rarely ignorant of the issues they just have very different knowledge bases and as a result different perspectives.

However simply listening to people is not enough. To feel heard people need to see that you actually incorporated their point of view. Therefore I would take what I’d learned and create some kind of summary statement that clearly interweaves the points, data, and perspectives of everyone and shows how, where possible, there is a common perspective of our understanding of the space that is creates consistency amongst everyone. Note the point here is not to arrive at a conclusion, just to create a decision-less perspective that covers the data brought forward by everyone.

I would then return to those stakeholders in a collective setting where everyone is present and work on creating agreement around that common perspective. The purpose here, once again, is not to make decisions, but just to ensure everyone is agreed that these are the data, motivations, values, etc. that are at play.

Finally with the raw materials on the table I think folks could workshop toward positive sum games that would cover, to the best extent possible, everyone’s needs. But the important thing to reduce tensions is to make sure people feel heard, show people acknowledging the diverse set of problems, data, and viewpoints, and therefore creating a team of stakeholders, rather than a set of antagonists.

*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. The point of a stock assessment 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. Therefore, biomass dynamics models attempt 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 – r, K, and q. The ideas are pretty straightforward. q relates catch to biomass and effort linearly C = EqB. The notion is that the more fish there are 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 – the more biomass, the more new fish and r represents this relationship. Finally at high levels of biomass Fox and Schaefer recognize that 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 this initial linearity with B and then eventually hitting the carrying capacity means that the most surplus yield happens somewhere between 0 biomass and K biomass. So, if we know r and K (and which model we are using) we can compute the “best” biomass, i.e. the biomass that produces the most surplus yield (which, in theory is all available to fishing).

However to determine r and K we need to know the biomass, and the biomass is unknown. However given a specific biomass, q, and effort we can compute the catch. Given we have catch and effort data we can therefore fit biomass over time, q, r, and K. So a stock assessment involves taking historic catch and effort data, fitting q, r, K, and the biomass over time and then using these to create our reference points.

What are those reference points? Well we generally have two – overfishing effort and overfished biomass. The former is the effort at which we would take the maximum sustainable yield. This is the highest level of fishing effort we could sustain ad infinitum. If we go above this we are fishing unsustainably. Go below this and we’re potentially reducing livelihoods for no reason. Overfished biomass refers to the biomass at equilibrium at MSY. This is important to know because if our estimated biomass falls below this level than the stock can no longer support the MSY effort and therefore must be rebuilt. If a stock does fall below this level it is considered overfished.