Interviewer: Okay, so our first part will be just quantifying participant expertise. If it's okay with you, I actually went through and filled most of this out, just given that I know you and I've interviewed you before. I figure I'll just send it to you afterwards and you can make sure it looks good. I guess the two questions I don't have answers for are first, how would you describe your overall level of knowledge on the management processes involved with setting regulations for US marine resources and on a scale of extremely, very, moderately, slightly, or not all knowledgeable?

BD001: Okay. So repeat it again for the...

Interviewer: global knowledge on the management processes with broad US Marine resource regulations.

BD001: Okay, I would say like pretty familiar.

Interviewer: Okay, so like very or moderately or very knowledgeable.

BD001: I would say moderately because I'm assuming that encompasses like MMPA and ESA like other. So I would say highly for fisheries, but not as much for others. So those would balance out to be.

Interviewer: Great. And then same question, but instead level of knowledge on the data collection and scientific processes that inform broad marine resource management.

BD001: I would say the same answer, moderately familiar.

Interviewer: Okay, so then let's just jump right into the concept creation. So this will be, these FCMs will be completely open-ended, concept-based, we don't have any fixed concepts. And the plan is to structure it like I did with my equity project. So I'll just go through about four questions, just open-ended, and then we'll build a concept list from your answers, we'll populate them into Mental Modeler, and then we'll build out the rest of the model. So the first question, just really broad, what does the term biodiversity mean to you?

BD001: What does the term biodiversity mean to me? So I guess there's different elements of biodiversity. It's like species biodiversity. There's genetic biodiversity. There's community biodiversity. So I guess it would be assessed in different ways. But in general, it would be having a high number and assortment of whatever attribute that you're trying to measure.

Interviewer: Okay, perfect. So just a little, I guess more specifically, and I think you kind of already answer this, but when you think about biodiversity, what are the key components that you think about? So, you know, you just went through species, genetic, community biodiversity. Are there any other key components that you think about with that term?

BD001: I don't know if like diversity of human communities is now getting included in sort of biodiversity but at least from management perspective I think that's a big factor.

Interviewer: You said diversity of the human community?

BD001: Yeah.

Interviewer: Yeah, okay great. So what do you think the benefits of biodiversity are?

BD001: So I think one of the major benefits is resilience to perturbations. The more diverse the system is in general, the more resilient it is, like a word that has lots of different definitions, but the less change you would expect given a perturbation. If you had a particular species, like a forage species that gets fished out, if there's an assortment and variety of other forage species that would fill that ecological niche, then the system might not be impacted. The predator species might not be impacted or there might not be a change in response to that reduction in forage. And then the same with like any sort of climate stressor or acute stressor in general, I mean, based on ecological theory, the more biodiverse a system is, the more it can adapt to those stressors. And I think the same goes for human communities as well. The more diversity there is, the better pathways to adaptation there would be. So I think that's what you're asking about. What's the main benefit of biodiversity?

Interviewer: Yeah, OK.

BD001: And I think that would be it from a management perspective.

Interviewer: OK, great. So I think, again, you kind of already answered at the tail end there. But what are the benefits of biodiversity to people specifically?

BD001: Yeah. So in terms of ecosystem functioning and the extent which human health is tied to. Ecosystem health. I think that biodiversity is an asset.

Interviewer: Okay, great. And so what does the term ecosystem services mean to you? What do you think about when you think about ecosystem services.

BD001: That's another one that - ecosystem services - I think of a functional role in the ecosystem that provides a direct benefit to society. So like mangroves provide the ecosystem service of storm surge protection to coastal communities. That's what I think of when I think of ecosystem services - a concrete benefit to society that ecosystems provide. I suppose it could be abstract too, like aesthetics or yeah it doesn't necessarily have to be concrete.

Interviewer: So I guess that was gonna be my follow-up. Are there other key components that you haven't mentioned that are essential for ecosystem services or that you think about when you think about ecosystem services?

BD001: In general, I see them as quantifiable or I see them as quantified. Even something like aesthetics, you know, you can quantify like depression rates and coastal communities versus people who don't live next to the ocean or something. I think in general, services are quantifiable even if they're not concrete.

Interviewer: Okay so quantifiable benefits. Okay so is there data that you think we currently need to incorporate biodiversity better into U.S. marine resource management? Are there data gaps or data needs?

BD001: Well, I don't think we have a good handle on biodiversity to begin with. I mean, we know from our surveys the numbers, the relative abundance of species that are out there. So I think we have a handle on that. I guess one thing from the recent ESA status review that I did - genetic diversity - I don't think we have a good handle on how important that actually is to population persistence over time. For a species nearing an endangered species, how important is it to actually maintain genetic diversity in a population? Let's see, other data gaps. I think we don't have a good handle on, like, why the ecological theory is there in terms of the benefits of biodiversity. I'm not sure that we have, like, established cases where it can be shown that higher biodiversity equates to certain benefits. I'm trying to think about what the data gaps are. So I think it's, from personal experience, how you quantify biodiversity and I think there's some gaps into what constitutes a sort of baseline ecosystem state. We talked about this in one of the work groups. In some cases a perturbed system is actually more biodiverse if you look at the, like some the traditional metrics and the natural or virgin unperturbed state of the system is actually less diverse, like it's dominated by a couple species that may have gotten fished out or something. So I think we're also missing information on sort of what the desired or natural or unperturbed state of the system is. And what if that's actually what humans want to achieve. Again are we - I think probably some social science research on like - for these highly managed systems - is the most diverse system actually like what we want to aim for is that going to actually provide the most societal benefit.

Interviewer: Okay great so then I think we kind of circled this but what actions are needed to better incorporate biodiversity into management.

BD001: What actions are needed? You mean on the management side or on the science side?

Interviewer: Yeah so again this is kind of a pilot. Initially we had it framed as what management actions are needed to better incorporate. We've been playing around with what term to use there. We are really trying to get to, you know, how can management better incorporate biodiversity, you know, aside from the data gaps that we just discussed.

BD001: So I guess having some low-hanging fruits, I'm trying to think of where it has been effectively incorporated and I'm thinking of like the habitat protection areas like where you have these you know areas where there's high diversity of like deep water corals that have been projected in the Gulf of Mexico and I think the justification there is that there's - even though we don't fully understand like the functional role of biodiversity - there's some understanding that like if there's these areas where these things are occurring that don't - that are not really widespread, it's worth protecting them just in case they're important. There's some inherent value in having these species around and protected. So I guess the actions that would be needed would be to better quantify areas that would be really important to protect. I guess I have some doubts about how management can actually impact biodiversity. If you're talking about habitat that’s one thing because these corals aren't moving anywhere and they're spawning and just moving their larvae, but still their sessile organisms. If you're talking about trying to manage biodiversity of fish species, closing an area to fishing doesn't necessarily increase biodiversity because things migrate and then you're just shifting fishing pressure. So I'm trying to think like what actions would actually have the capacity to impact biodiversity. Maybe like looking at high bycatch fisheries, like shrimp fisheries I think are where you're trawling a large number of organisms. I don't know, maybe focus on types of gears that have high bycatch that might be impacting biodiversity.

Interviewer: And do you mean, when you say focusing on types of gear, do you mean in terms of we need more data to better understand those impacts or we need management actions that, you know, enforce regulations to mitigate those impacts.

BD001: I think more data to understand the impact that those gears are having on biodiversity. So, I mean, obviously if you're trawling over, you know, 200 year old corals and toppling them over, you could guess that they're not gonna survive, but in terms of like the megafauna and the, you know, the actual impact of some of the gear types on biodiversity at all the levels.

Interviewer: Right, okay. And so what resources do you think are needed to better incorporate biodiversity into management? I think we've talked a lot about data, obviously. Are there any other resources that we need to fill some of these data gaps and do some of these actions that you've been talking about.

BD001: Resources like, in terms of new analyses or, I guess I'm not sure what resources means in like a science management context. Data or science analysis analysis.

Interviewer: Well, this is again another question that we've been going back and forth on. So this is helpful feedback. I think we meant more under the umbrella of management actions, but given that a lot of your answers have been more focused on data, maybe that's just, you know, that's the answer and that's your perception. But I guess if there's not any other resources that you can think of aside from what we've already talked about, then maybe that question is just redundant.

BD001: Yeah, I mean, after the data and the science are there to show how management actions impact biodiversity and the role of biodiversity in functioning ecosystems, I suppose that the management bodies would need some resources in terms of understanding how their management actions impact biodiversity. Like when we talk about climate-ready fisheries, like everyone agrees that's like a good goal, but managers don't understand like how individual actions, like, okay, is this making a fishery more climate-ready or so that kind of needs to be like translated.

Interviewer: Right, so to the average decision maker. Is there anything I'm forgetting about, in terms of that resource question that you wanted to follow up with? You can think of. Okay, and then the last question here is just what barriers are there to incorporating biodiversity into management, if there are barriers?

BD001: Yeah, I think a lack of understanding or appreciation for how biodiversity impacts our human communities.

Interviewer: Okay, great. So those are our core questions. One question that we went back and forth on that you brought up was the question of resilience, and if and how we're going to get to this model, and exactly what you said when you brought up resilience that that can mean different things to different people and depending on the context. So I don't know. I guess I'm intrigued to hear what your thoughts are on, what you think about when you think about resilience, more specifically.

BD001: Yeah, so I guess that sort of textbook definition is, you know, changing from like one organizational state to another and again, that can be like, from a biological perspective, you have a certain set of species and then you might, in a system that's not resilient, it might shift to a separate set of species dominated by other types of species. Or in a human community, it could be different groups of people dominating prior to-- or after a certain ecosystem stressor. So I guess that's kind of how I think about resilience. It's just resistance to change.

Interviewer: Okay, so the next part is to build out the model based on those answers to concepts. Like I said, this is my first time doing this, and I think one of the challenges of this first part of the project is going to be finding ways to condense some of the answers to these questions into concrete concepts to build out in FCM. So we'll see how this goes. Sarah, do you mind? It won't let me share the screen because you're the host.

Interviewer 2: Do you want us to open up Mental Modeler and kind of navigate as we go through? Would that be okay?

Interviewer: Yeah, that's fine.

Interviewer 2: Okay, thank you. So kind of give me a second. Is the password just Mental Modeler?

Interviewer: Yeah. OK. Isn't that great? So I'm just going to quickly go back through our questions. So I think for our first topic about what components you think about for biodiversity. So we have species diversity, and then genetic diversity, community diversity. And then diversity of human communities?

BD001: Sure.

Interviewer: Is that, I think that's the right phrasing.

BD001: Yeah.

Interviewer: Okay, and so then we have resilience. Do we wanna just leave it as resilience or do we wanna make it a little more specific based on our conversation about how to redefine resilience? I think I guess personally I would say that you know just keeping as resilient makes the most sense in terms of keeping it concise.

BD001: That sounds okay.

Interviewer: Okay, and then, let's see, so when we were talking about benefits of biodiversity, we were also talking about resilience there, but then you were talking about kind of climate stressors and the impacts of those on biodiversity generally. So climate stressors maybe is a good concept.

BD001: Yeah I guess any stressor. So climate.

Interviewer: Right okay.

BD001: There's like acute and chronic stressors I guess they tend to think though.

Interviewer: Okay, do you want, should we separate that out maybe or just leave it as stressors broadly?

BD001: I guess we could leave it as stressors for now and then as we fill out the model see if we need to. Yeah.

Interviewer: So then we were talking about ecosystem function and the tie of human health, ecosystem health. So maybe ecosystem function and human health is two separate concepts.

BD001: Yeah, maybe like well-being, I don't know, health. I'm not sure.

Interviewer: And then you were talking about the importance of biodiversity for adaptation and the pathways to adaptation. So, yeah, maybe pathways to adaptation or just adaptation, the concept?

BD001: Yeah, I think adaptation.

Interviewer: Okay. And then, so when we were talking about services, you use the term quantifiable benefits. So we can add that as a concept. We could also add ecosystem services. I guess this is one of the parts where I would, you know, as we go love your feedback, we kind of toyed around the idea of having ecosystem services as a fixed concept in these models. And we're still trying to figure that out. So if you have thoughts on that.

BD001: Yeah I think until we start going through the model it's kind of hard to figure out what's the best.

Interviewer: Okay.

BD001: And then I think maybe ecosystem services and quantifiable benefits are maybe one in the same. But yeah.

Interviewer: Okay.

BD001: I guess I would say let's leave quantifiable benefits if that's okay. We can take out ecosystem services for now.

Interviewer: Okay. And then so then we were talking about data. You mentioned that we need more data on genetic diversity specifically?

BD001: Yeah, I think -- let's see. I don't know if that's a data gap that's in mind just because I was working on it recently. I'm sure there's data gaps for all of the attributes of biodiversity.

Interviewer: Okay, so maybe make it more broad and just say biodiversity data, data on biodiversity?

BD001: Sure.

Interviewer: Okay. And then you also mentioned, you know, we don't have a good idea of the benefits of biodiversity. So, yeah, I don't know. Like data on benefits of biodiversity. That's not very coherent.

BD001: Well, it's kind of like the linkage between, right? It's like the benefits are like the link between the data and the, between the actual diversity and the benefits.

Interviewer: Right, okay. Okay. So I guess maybe let's take out the biodiversity benefits data concept Sarah and then we'll draw that linkage when we get there. Just seeing if there's anything else for any specific data that we want to add in. I mean, one thing you talked about specifically was that we don't have an idea on how to quantify the baseline for an ecosystem state and how we define that. And I think that's a little different than the broad biodiversity data concept. So maybe just baseline data?

BD001: Yeah. Okay. Maybe baseline and societal preferences.

Interviewer: Okay great.

BD001: Like the target, like the target biodiversity.

Interviewer: Yeah okay.

BD001: Because yeah if you're gonna manage for biodiversity you have to understand what you're managing for or towards right so.

Interviewer: Right okay.

BD001: Or like thresholds when one does biodiversity. Region threshold requires management intervention.

Interviewer: Was there any other specific data types that I missed that either of you can think of? I think that that kind of covers what I have.

BD001: I can't.

Interviewer: Yeah, okay. And then when we were talking about managing actions, I know a lot of that conversation led back to data. The one thing that stuck out was you were talking about how we don't have an understanding of how actions and how individual actions and managing actions translate into impacting biodiversity. I'm trying to think about how to put that in a concise concept.

BD001: Yeah, it's like the ability of management to actually affect change.

Interviewer: Yeah, right.

BD001: That sounds good to me.

Interviewer: Is that OK? OK. And then I think hand in hand with that, when we were talking about barriers, what about lack of understanding for biodiversity and its impacts? I think that covers what I have. Is there anything else that either of you can think of that I missed? Okay. So that’s everything I have in my notes. So um maybe let's just start on the left and work our way over. So what would an increase in community diversity impact in our system that we built out? Are there any concepts that as we increase community diversity they would be directly impacted from that increase.

BD001: I might need you to blow that up or I can move it to another screen but I'm going to be staring sideways just so I can see it on my other screen. I'm just looking away from you. Okay so community diversity. So I think it would impact resilience and human health, well-being and adaptation. And ecosystem function. Yeah, I think that's it.

Interviewer: Okay, great. So as we increase community diversity, would that have a positive or negative impact on resilience?

BD001: Positive.

Interviewer: Okay. Positive. Okay. And do you think that has a low, medium or high impact on resilience?

BD001: Oh gosh, I'm not gonna be able to score. I have no idea. I know I feel like all these like I just don't know if it would be - it's kind of case dependent, right? It depends on the system and the - yeah I don't know that I can score them as low, medium, high.

Interviewer: No, that's great feedback. OK, so we can just do negative then. If there are any concepts as we go that you think you could score, I would say let's add in the score just so we have it. But otherwise, we'll just do it as 1s or 0s.

BD001: Yeah, because something like genetic diversity, I mean, that's going to depend on the species. If you're talking about abalone or something, it's probably a lot more important than red snapper or something. So it's all going to be kind of case and ecosystem dependent, I would think.

Interviewer: Right. Have you worked with qualitative network models?

BD001: I think a little bit.

Interviewer: OK. That's what I did in my NOAA postdoc mostly. It was essentially an FCM just without the weight. And I think sometimes when you're doing some big picture more abstract modeling like this, that's what's necessary. Cause there's, like you're saying, there's so much uncertainty or, you know, case by case, um, specifics needed to weight. So that's really good feedback. Um, okay. So then let's, let's go to genetic diversity. Same question to increase genetic diversity. What would it impact?

BD001: Yeah, I think this one's going to be again, very case dependent. That's hard because it just depends on the species. For some things, it might make a big difference. And for others, it might not. So I guess probably ecosystem function to some extent. Yeah, and again, it just depends. Resilience, it would impact the resilience of that species, but I don't know that it would, we're talking about overall ecosystem resilience or like community resilience. I don't know how important genetic diversity really is because it depends on the role of that species. Like if you lost all of, you know, species A, but you had like 20 other species that filled that ecological niche, then it's probably not going to impact overall resilience as much as if it was like a keystone species, right?

Interviewer: Right. So what if we broke out resilience to species resilience and community or ecosystem resilience, then do you think, from what you just said, do you think genetic diversity would have a positive impact on species or keystone species resilience, or is that still going to be dependent on whatever specific species you're talking about.

BD001: Yeah it's still gonna be very case dependent I think.

Interviewer: Okay so then maybe that's not necessary then Sarah. Okay so and so would that be a positive or negative impact on genetic diversity to ecosystem function?

BD001: A positive.

Interviewer: Anything else for genetics?

BD001: I think the management policies, I don't know if we're looking at the back arrows, I think that the management policies to genetic diversity, I think that's one area where it probably has an impact because something becomes locally depleted and you knock out a subpopulation and then that's gonna impact the genetic diversity.

Interviewer: Okay, what about human communities, diversity of human communities?

BD001: Let's see. Yeah, this is one that's also really case dependent. I don't know that it impacts anything. It's probably impacted by.

Interviewer: Okay. Okay. Yeah, this is hard because, you know, when I do, when I build out FCMs like this, my, you know, my process is that, you know, when someone says what you're saying that it's case dependent, then we'll break out the concept into those more specific concepts so that we can draw the relationship and, you know, quantify it with the weight. But with our research questions being so broad at this stage, we really can't do that unless we're talking about a specific site system, right?

BD001: Yeah. I mean, if you're looking at Alaska where there's tribal communities, I mean, they're not very diverse, right? It's all the same kind of people living in the same sort of ways and the same sort of customs. But that's totally different from the Gulf of Mexico where you have very different groups of people. Not that like diversity is bad or good. It's just sort of case dependent. Like what's the starting point of diversity for those communities and the user groups?

Interviewer: Right.

BD001: Context.

Interviewer: Right.

BD001: Like Alaska, having low diversity is not like reducing well-being, it’s just that there's an isolated community - it’s the extent of the isolation, right?

Interviewer: Right, right. Okay. Okay. And then what about species diversity? What does that impact?

BD001: I think that would be kind of similar to community diversity. Yeah, definitely adaptation. Yeah, I would put them to all this adaptation in human health, well-being, ecosystem function and resilience.

Interviewer: And would that be positive to all of those consistently, do you think, or is that also case dependent?

BD001: It's also case dependent. Although I think in general, adaptation is gonna be facilitated if you have higher diversity, because if you have changing conditions, then you're gonna be able to, if you've got one thing to fish versus 10 things, you could fish. But in terms of ecosystem function, it could go either way.

Interviewer: Okay.

BD001: Yeah, I didn't - human health well-being - like if you had a community that was highly dependent on one particular species or like had customs, traditions around a small set of species that could kind of go either way.

Interviewer: Right, okay. So just to go back quickly then to community diversity, I want to make sure we have that right because we have positive relationships to each of those and you know is there uncertainty with those relationships? Should we leave those as a neutral relationship or should we leave them as positive do you think?

BD001: Um, yeah, I guess it'd also be case dependent. Um, for the, yeah, for the ecosystem function and the human health. Because if you had, again, if you had like a new community coming into an area because of climate change and you have like one ecosystem becoming displaced by another that's not necessarily gonna - you're gonna have higher community diversity but not necessarily more well-being or ecosystem function. It's kind of like an ecosystem disturbance.

Interviewer: Okay, this is helpful. Okay, so I think we've done the biodiversity metrics. What about resilience? What would an increase in resilience impact in the system?

BD001: Let's see. So I would say human health and well-being. But it's not always a positive. I read this article the other day about sort of the assumption that resilience is always good. It's kind of, it can be damaging. There's some communities that want to change. Right? Like the status quo isn't really good. And so being pushed to change is actually a positive. So yeah, I guess assuming resilience is always a positive thing, that can be sort of a damaging assumption, in some cases.

Interviewer: That's really interesting. When I was working in Alaska with Alaska Natives, I heard something kind of similar, where they said-- they had a hard time with the word resilience, because they said resilience has always been our way of life. Like - that's a more westernized way of thinking about it.

BD001: Yeah, I remember going to Everglade City and visiting, what's that old hunting lodge that they have there? And I was talking to the waitress about like, oh wow, it looks like, you know, the hurricane really impacted the area. Like a lot of stuff is different. There's a lot of things closed, and a lot of venues are closed. And she said, yeah, but it's really better now because it just washed off and washed out like all the really unattractive infrastructure. (laughing) Snarky comment about like, like basically kind of got rid of all the, the unattractive elements in her view. So I thought that was interesting. She welcomed change spurred by hurricane Irma.

Interviewer: I haven't heard that one before, that's funny. Yeah. OK. And then, OK, so we have-- OK, was there anything else for resilience that we wanted to connect it to? What impact?

BD001: Stressors are probably linked to resilience, right?

Interviewer: And is there a direction we can assign to that? Or do you think it's also uncertain?

BD001: Yeah, I think in general, high stressors are gonna lower resilience 'cause resilience is just the ability to maintain something, right? So if you stress it, it's less likely to maintain.

Interviewer: Anything else for resilience?

BD001: I think the effective management policies can go to resilience. This, I think. Well, and then let's see, would resilience and adaptation be linked? Maybe. Is it that way or is it the other way around? (laughing) One is changing and the other is not changing. So it's like, I don't know, maybe delete that. I have to think about that a little more. They're kind of opposite concepts. So resilience is maintaining a status quo and adaptation is changing too and inevitable. When the status quo is no longer inevitable, or is no longer feasible. Yeah, I have to think about that.

Interviewer: So effective management policies to resilience, is there a... is that positive or negative, do you think?

BD001: That’s probably positive, but there's probably some negative cases. But overall.

Interviewer: Okay, if there's nothing else for resilience, maybe adaptation is a good place to go next. What we were just talking about. So what would an increase in adaptation impact in the system?

BD001: Maybe human health and well-being, people can adapt to change. I think ecosystem function probably goes to adaptation. I think the more functional it is, the more it can adapt.

Interviewer: So, okay, so an increase in the ecosystem function is positive for adaptation. And then would adaptation to well-being, is there a, is that, would that be positive or negative, do you think?

BD001: Generally positive. Yeah.

Interviewer: Okay. So anything else for adaptation?

BD001: I don't think so.

Interviewer: Well, then what about stressors? What would an increase in stressors impact? We already have resilience. Is there anything else?

BD001: Potentially going to ecosystem function.

Interviewer: Would that be positive or negative?

BD001: High stressors would be lower function, so it's negative. And I think stressors could affect all the types of diversity, but again, it's case dependent.

Interviewer: Okay, generally it would be anything negative. Okay, so do you think we could make those negative or should we leave them as a mutual relationship now?

BD001: Yeah, I think that would be kind of case dependent because again, what it was, the natural state, if you have one type of ecosystem, like stressors, like sea level rise, or temperature increases and you have like mangrove communities overtaking marsh grass communities. So that would be an increase - stressors are gonna increase community diversity. Whereas other stressors are gonna decrease. Yeah, I think it's highly case-dependentt.

Interviewer: Anything else for stressors?

BD001: I think that's it.

Interviewer: So what about ecosystem function? What would an increase in function impact?

BD001: Let's see. Is human health and wellbeing - do we have services? Did we put the ecosystem services somewhere?

Interviewer: We left it as quantifiable benefits.

BD001: So I guess I would route that through quantifiable benefits and then to human health and wellbeing.

Interviewer: Okay, so yeah, so that's indirect, okay.

BD001: Yeah.

Interviewer: And can we assign a positive or negative to either of those relationships? Do you think?

BD001: Probably in general positive. More functional, the more benefits and then yeah. There's probably some feedbacks like ecosystem functionality maintains diversity, but I don't know. Yeah, I'm not sure. A little bit abstract. Yeah.

Interviewer: Okay, so is there anything else for ecosystem function that is impacting?

BD001: I guess resilience too. Yeah, more functional, the higher resilience, I think it would be positive.

Interviewer: Okay. Is there anything else that quantifiable benefits impacts? If we increase it?

BD001: Probably it's linked to like the diversity of the human communities, but I'm not sure in what way. Because yeah, if you had like, yeah, it would just be case dependent.

Interviewer: Okay. And then what about well-being? Is there anything that increasing well-being would impact in our system?

BD001: Let's see, I think that's kind of an end, like an end point, right? I mean there's probably some like human well-being functional society would like cause us to put more value on science and data. Like there's probably some feedbacks there or something, but those are a little bit abstract, I think, for too many degrees removed. I don't know, I think mostly that well-being is just sort of an end point, right? Like societal goals are just the end.

Interviewer: Yeah, it's a receiver variable for sure.

BD001: Yeah, thank you. Yeah, thank you, the receiver variable.

Interviewer: OK, so I think we've done our blue nodes. So then let's move maybe to our data. So what would an increase in biodiversity data impact in this system?

BD001: So I think that data would all just point to the effective management policies. And I think that's it. Because the data, unless they're rooted through some analysis or action, aren't really impacting anything else, right?

Interviewer: Right. Okay. And would that be positive or negative? Or neutral for now?

BD001: I think in general the more data you have the better your management policies are so this would all be positive.

Interviewer: Okay, um, so then okay that's good with all three data or is there anything else we should connect there.

BD001: Yeah, I don't think anything else.

Interviewer: Okay.

BD001: The data are just informing decisions.

Interviewer: Yep, okay. So then for our management concepts, is there anything else that affected management policies impact that we haven't already drawn?

BD001: Genetic diversity. I think the policies would impact species diversity. That's really case-dependent and I think mostly a function of what the natural state of the system is. Like if you had a dominant species that was really overfished and then you cut back on overfishing and it came back and dominated, well it's going to decrease diversity. So, there we go.

Interviewer: Okay. Anything else for management policies?

BD001: I guess it depends on what kind of management, like I don't think that management, at least fishery management really has an impact on community diversity. I think those are shaped by more global forces. If you're talking about like regional ocean planning bodies or something, this might potentially impact community diversity. So maybe a neutral for now, an uncertain link to community diversity? Yeah, it's kind of scale dependent. Like wind farming, like having, you know, a mandate to produce vast areas of wind farming that's probably going to have some impact on community diversity because you're bringing all this new substrate into an area where it wasn't there. So yeah, that's one case.

Interviewer: So what I was going to say is we had this idea of rephrasing that question to what mandates do you think about specifically, but we ultimately decided on that question and that's gonna lead to very case and system specific answers. And so, yeah, exactly what you said, I think. There's some things we need to figure out. And then I guess the last one is lack of understanding. Just when it's an increase in the lack of understanding impact anything in the system.

BD001: I think that's kind of like data, but it's just analysis. I guess you could route the data through the understanding. Yeah, and then route that to the effective management policies. I think that's how it would go.

Interviewer: So remove the direct linkages between data and policies?

BD001: No, I wouldn't remove those because I think that, like I said, like with the coral, sensitive coral areas, like we don't necessarily have to understand the impacts. It just, we have some sort of theoretical or some inherent belief based in theory that like species are worth protecting. Regardless of the understanding, we make those policies based on data. Yeah, like we're protecting, like we're not letting right whales go extinct.

Interviewer: Is there a sign that we can assign to those, a sign that we can assign?

BD001: Seeing more data leads to more understandings. Oh, so yeah, if you want to switch, maybe just say understanding of biodiversity. (laughing) We can avoid like the double negatives. Yeah, no positives there. And then more understanding creates more effective management policies, so yeah.

Interviewer: Okay, great. Okay, I think that that is all of it. Is there anything, Sarah, that you caught that I missed?

Interviewer 2: I think you covered everything.

Interviewer: Okay, great. I saw that you've been saving here and there. I wanna make sure. I have had mental modeler crash during these before and it's a nightmare, so.

Interviewer 2: Yeah, I opened it up and I just remembered that warning that Steven gave us when we first looked at this. I was like, oh man, I have to make sure this is getting saved.

Interviewer: Yeah, I hate that it's, um, yeah. Okay, great. So, um, I guess that is that that's how we have this structure out. Clearly there's some kinks that we need to work out. Um, I don't know if you have, you know, now that we've finished the model, if you have any other thoughts or suggestions, Mandy, on how we can approve this approach?

BD001: Not right away, but I can ponder it and think about it. I mean, I guess the stuff that comes out are kind of dependent on the concepts that come out are dependent on the particular questions you ask at the introduction. But that's not necessarily an issue.

Interviewer: Yeah, I think that the concept list was really productive from my point of view, but building out the linkages is a little more uncertain. And I don't know, you know, it's making me wonder if we even need to build out the full model at this stage. And maybe the goal and the output of this stage is to produce a concept list that could be indicators or produce a framework that then we go and we narrow in on case studies with specific themes.

BD001: Mm-hmm.

Interviewer: Just thinking about that. Okay, the last two questions that we were planning to ask is just to assess future research needs. So we were gonna ask, how do you think research can better inform US marine management regarding biodiversity? How can how can research better inform management in specific regard to biodiversity?

BD001: Yeah, I think we kind of touched on this before, but until the, until you make very specific languages between biodiversity and ecosystem services and function, I think it's difficult to convince management that, you know, biodiversity is something worth considering. Beyond the basic, like, society agrees that it's not right to let things go extinct and we have to maintain some, like basic level of biodiversity where I have to keep my species alive.

Interviewer: Okay so in what ways are that you know of are researchers and practitioners currently collaborating with managers. Does that collaboration exist and are there ways that those interactions could be improved.

BD001: I mean research is working on biodiversity. Yeah. I don't know. I don't know a lot of folks who are just focused on biodiversity questions and I haven't seen any interactions in the management realms beyond the coral. Again, I keep coming back to the coral habitat areas. Yeah, the sanctuaries, I guess in some sense, look at expanding areas based on just numbers of species. Yeah, I don't know. Sorry, I have trouble answering that one..

Interviewer: I think that's the point of the question, is kind of the thought behind that is that it seems academic research in particular isn't informing management right now in regards to biodiversity.

BD001: Yeah, yeah. There's probably some cases, But-- and I email you if I think of it.

Interviewer: OK, that sounds good. And then just the last question, and I know you're part of the task force, so you've been in these conversations already. But we were just going to ask what themes or specific case studies you think should be prioritized with the goal of improving marine resource management.

BD001: Yeah, you mean of the ones that we've discussed?

Interviewer: Yeah, I guess because you're part of the task force and the theory would be with non-task force members, it would be to, you know, get some input specifically from managers on where the gaps are in terms of specific study systems or use cases with, you know, specific ecosystem services or other issues in management that need to be addressed.

BD001: Yeah, I might want to ponder that one for a while. I actually do have to, I'm sorry, have to be home by two. I do have to run in a couple of minutes. But an immediate answer is not jumping out on that one. I guess it just depends on what we want to look at, like a highly re-engineered system like the Gulf of Mexico versus Alaska where you've got, it's being re-engineered by climate forces, but not really management. They're just very different case studies. I don't know if I have an opinion on which is better. Which is very distinct. But if you want like the last couple of questions, if you want to just pop them in an email, I can give them some more thought and give them back to you.

Interviewer: Okay, that'll be great. All right. That is it. Thank you. I'm sorry that took a little more than an hour, but thank you so much for your time. I appreciate it. So it's very helpful.

BD001: Oh, no worries. Yeah. Sorry. I have to run.

Interviewer: No, this is this is perfect.

BD001: Well, thanks. It's good to see you ladies and uh, yeah, let me know if there's anything else and I'll if I have any other thoughts I'll just put them in email.

Interviewer: Okay, that sounds great. Thank you so much. Have a good one.

BD001: Bye. Thanks.

K. Bye.