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BD031

**Interviewer 1:** Ok, great. So to start, we were just hoping that you would tell us a bit about your area of expertise and your current work priorities.

**BD031:** Ok. So as I was saying before, habitat type work is critical, essential to my job and my role under the Office of Habitat Conservation. Specifically, I work with habitat restoration. So I was mentioning my prior position out in Miami, um, that - about 10 years of work there was associated with the large scale everglades restoration projects. They’re ongoing, led by the army corps of engineers. In that respect I’ve worked with salinity regimes and freshwater management. Changes in flows and timing, and whatnot, and how hope for everglades restoration will affect other habitat conditions. So most of my work, honestly, is in the near-shore restoration situations, and so working with pink shrimp as an identifier indicator species for everglades restoration. My current position, I work in the deep water horizon program. My primary role within the program is looking at our primary habitat restoration projects. So, let me take a step back and note that the DWH programmatic restoration, the DARP, damage assessment restoration plan, identified on the restoration side of it means to directly restore for the fish and the birds that were entered in the study. That’s what I call direct restoration. So that usually means some sort of change in mortality reduction. Working with fisheries to reduce by-catch. There were a couple of projects proposed to fisheries to try out alternative fishing gears that may reduce by-catch and things of that nature. Um, parallel to that, the pragmatic restoration plan identified habitat restoration as a means to indirectly restore those injured fish and birds. So separating from oysters and qualls and things like that. Thinking shrimps, etcetera. Crabs. So my current role is looking at how our habitat restoration activities, in order to address that and call out in the DARP how our habitat restoration actions prove or provide habitat value benefits for those injured fish and birds.

**Interviewer 1:** Awesome, ok. Great. So, to dive into our specific interview questions, so I think I probably said in the email. The goal of the project is to understand if and how we manage for biodiversity in US marine management. And so, as we’ve been working on this project, we’ve been learning that the term biodiversity itself means different things to different people, and of course it can be measured in multiple different ways. And so as a starting point, we’re wondering what you see as the key aspects of biodiversity.

**BD031:** Oh, um, I guess at the highest level, or in layman's terms, just the communities that are present at a location at a point in time. Those organisms acting together that lead to, or maximize ecological function, productivity, ecological resilience. Um, certainly as you called out there’s many metrics that one can use to try and inform how that’s being deducted, or how that’s assessed. I see biodiversity acting at multiple spatial and temporal scales. So I’m always taking into consideration improvement and processes or the phenology of those processes. As well as the relative habitat value, whether it’s a degraded habitat or a habitat that’s not yet forming, if you reference idealized conditions. So the biodiversity in a location, you know, thinking of a smaller more localized scale. Um, whether that habitat is performing or able to support biodiversity in those idealized conditions.

**Interviewer 1:** Ok, great. So, some of our previous research has generalized four key components of marine biodiversity. And we’re trying to use this to think about a way to build out a framework for marine biodiversity like we’re talking about. Specifically for marine resource management. And so, [Interviewer 2] do you mind? I see that you’re already copying, putting those terms in the chat. Um, I’m a visual person personally. Um, so, those terms are habitat forming species, species of conservation concern, harmful organisms, and key food-web supporting species. And so, we’re wondering if you agree that those are the components of marine biodiversity? If we’re missing anything, if there’s anything you would change, or what your general thoughts are on that framework.

**BD031:** Um, well I do see something missing and it sounds like I was mentioning that in terms of habitat restoration, whether the full complemented species are present in you seeing a restored area. And so, in habitat forming, I see as my case in the Louisiana marshes, which are kind of harsh, because it’s a vegetation community and it’s providing that value. Um, but I don’t see any of these other ones listed in - maybe that falls into key food-web support? But, maybe not, because there could be more minor species that are playing a key role but also contribute to a broader resilience. You know, prey switching or something like that where that key-food web source is not at it’s maximum.

**Interviewer 1:** Ok. Is there - so, is there a concept or a term that you think of that would capture what you just described? I’m trying to think.

**BD031:** Mm, um, maybe species richness? Just to communicate composition.

**Interviewer 1:** Ok.

**BD031:** Yeah, and not to say that these four that you have listed are not, you know, I would agree with each of them as well, but…

**Interviewer 1:** Ok. Great. So, I think you already answered this in your first question, but I’ll ask anyway just to cover our bases. Do you consider these four components of marine biodiversity in your own research, and if so how? So I know obviously we’ve been talking about, like, habitat forming species. But, it would be great to hear a little bit more about specifics, thinking about this framing. How this framing lines with your own research, if that makes sense.

**BD031:** Mhm. Um, habitat forming I gave the example of our tide vegetation communities in Louisiana marshes. Um, I’m also delving into more offshore realms, so looking at interactions. One of our restoration sites in the DWH program Red Large is mesophotic and deep ethnic communities. There’s a number of projects that are focused on those NDBC species habitats, and there’s some species that work more directly with thim. So I’m looking, I’ll hopefully have funding approved soon for a project that will be looking at water column productivity and how it interacts with those NDBC communities. So kind of cross-habitat forming species to, and how it welds to other communities that associate and interact with them. Species of conservation concern, I certainly recognize that it has a place. That certainly - that keystone, umbrella species concept certainly helps with conservation and habitats at large. So sometimes you can rally behind them. Me personally, I don’t work as much with that topic. Um, harmful organisms I think about harmful algal blooms and the variety of effects on habitat productivity as well as invasive exotic species. It’s a big issue in the Gulf of Mexico and I personally think that we should be doing more to monitor and consider those impacts, changes in salinity and changes in freshwater management, what that may do to potentially increase productivity and how that might affect cascades to food-webs and all that. Um, so food-webs themselves, we’re thinking about - like I mentioned the example with the NDBC and water columns, those interactions and food-webs and how the overlying dio-vertical migrators and mesopelagic areas interact with and provide conduits for productivity directly support other communities like NDBC. The same mesopelagic species are touching on interactions, are also supporting higher trophic levels, etc.

**Interviewer 1:** Ok, great. Perfect. Thanks. So thinking about management, shifting a little bit to think about marine resource management, do you think that these components of biodiversity that we’ve been talking about, both in the framing and along the lines of your research as we’ve been talking, are they explicitly considering research management right now, and if so what approaches or policies?

**BD031:** Um, yes they are. In a myriad of ways. Um, we have under Maddison Stevens we have habitat areas of particular concern, concepts that can be identified for habitat-forming species and how they support commercial fishery species of interest. ESA regulations on species of conservation concern, and how that leads to improvements or increases in habitat protection and conservation. Um, management of harmful organisms. Yes, but I think that’s less so. I think there’s some controls on importation and what-not. Best practices to try to reduce the movement of harmful or invasive organisms. Management of freshwater and nutrient regimes to try to minimize harmful algal blooms and things of that nature. Um, key food-webs. Certainly it’s growing in interest, and I think we as a management community at large are embracing more and more so EBFM and EBM. So thinking about key food-web issues, how to manage fisheries. How to manage a species directly, but also how it cascades from one to another. Support thinking about fisheries, especially with what’s going on in the Atlantic coast there. Also the Gulf of Mexico, but I think the Atlantic’s a bit more controversial or ahead of the curve, perhaps, in the sense of identifying those issues and manage for them.

**Interviewer 1:** Ok, great. Are there approaches that you think are needed to better manage for biodiversity in the future?

**BD031:** I think we as a community, ecological community - for me personally it’s kind of difficult to…. Like we know biodiversity is a goal, and we want to maintain that for resilient systems and what-not, but really how to directly manage for biodiversity sometimes becomes difficult. Maybe it’s invasive species management, that would be a good example, but EBFM and that sort of thing moves forward. Grasses would be an example. But I think, you know, we generally think in the single species construct. You know, what’s an indicator species. You rarely see restoration goals set biodiversity targets. It’s more what is the set index that we should be looking for in this referenced condition, and how does that compare to our habitat restored areas or our habitat conservation areas. Try to assess improvement. So I think it’s less, to a lower degree, incorporated in our decision making process.

**Interviewer 1:** Mhm. Ok, great. I think maybe that is a good spot, [Interviewer 2], to transition? If that’s ok with you. Ok.

**Interviewer 2:** Yeah.

**Interviewer 1:** So, have you ever heard of mental modeler, or fuzzy cognitive mapping? I know Mandy uses it alot. Yeah. So, we’re using mental modeler as a tool to assess how the different management approaches that we’ve been talking about relate to biodiversity. So, while we have been talking, [Interviewer 2] has been building a map of the concepts you’ve been talking about, and some of the relationships that you’ve been describing. And my hope for the rest of our time is that we could finish filling out the relationships between the system components that we’ve been discussing.

**BD031:** You’ve been working on the fly there quite well, [Interviewer 2].

**Interviewer 1:** Yeah.

**Interviewer 2:** Thank you.

**Interviewer 1:** Yeah so, [Interviewer 2], do you want to go through and tell us what we’ve got here?

**Interviewer 2:** Yeah, so, it’s kind of messy and not really organized because I tried to keep the arrows from touching each other. So, the gray boxes in the middle are those four bins of biodiversity that we have identified in our framework. The orange concepts at the top left are things that you’ve said you think of when you consider biodiversity. And then all the blue are either just management directives or specific policies that your work considers or that considers biodiversity in general. So things really specific like ESA and then also contribulations or habitat restoration broadly.

**BD031:** Ok. Um, just as a detail, I know I mentioned it to Maddison Stevens, central fish habitat, CFH, is another construct under that initiative mentioned directly. Uh…

**Interviewer 1:** Yeah so, is there anything else that you want to change in terms of the concept list before we start drawing relationships?

**BD031:** Um, I would - well. Sorry, that’s going to have a more… ok, um no. I wouldn’t change or delete any of this. I can add more arrows if that’s the intent.

**Interviewer 1:** Yeah.

**BD031:** Um, so I see DWH, restoration damage assessment, habitat restoration, um, that would connect also to by-catch. Not necessarily regulations themselves, I mean it’s not something we as a program have to be careful with. As a restoration program we’re not influencing regulations directly, you know that’s others’ jobs. We’re not the fishermen council, we can’t tell them what to do, we can provide them guidance and evidence and whatnot. So it’s not exactly the best arrow because you have regulation there, but maybe by-catch reduction and information. If you could broaden that a little. Uh… I think habitat restoration leads into EBFM. Ideally we would have a better understanding of what our, and that’s hopefully what I’m going to achieve with some of my work, is how habitat restoration improves habitat conditions of productivity and how that can feed into EBFM. We’re certainly pushing for more habitat representation, ecosystem models, and what not. Uh, by-catch leading into EBFM. I think - well. EBFM, it’s more of a broad term, but I think almost all of those blue boxes could lead into it. I don’t know whether it’s really implemented to any degree yet or not, but it theoretically could, should at least. Um, as well as harmful organisms. Well, I guess EBFM and harmful organisms are a two way arrow. Species richness, I would connect that down to habitat restoration and EBFM. Ecological function could point to habitat restoration. Um, I know it’s getting messy. Habitat value productivity could go down to habitat restoration. Species of concern, up to EBFM. Um, and that could link to also habitat value productivity, thinking about conservation and what’s most important for a habitat for those species. We could keep going on, but…. Ecological function could go into essential fish habitat, just thinking about identifying those areas of high ecological value, functional value, and then feeding those into management for identifying that information that would allow management to make decisions of where and when to place or identify those areas. Habitat forming could go to EBFM, or actually down to, yeah. Um, I don’t know. Is that sufficient for now?

**Interviewer 1:** Yeah!

**BD031:** I’m sure we could sit there and, you know.

**Interviewer 1:** Yeah, if that is - if those are the key relationships that you see, then that’s great. The last step that we could do in mental modeler is we can assign weights to the relationships based on which relationships are driving system dynamics. So usually what we do is we ask if they have a low, medium, or high impact. So we just set them to a standard 1, but if there are specific relationships that you think are more important to the system, relative to one another, then we can change the weights since we have some time. But if you don’t see -

**BD031:** No, yeah -

**Interviewer 1:** Sorry go ahead?

**BD031:** Sorry. And that’s based on my own experience?

**Interviewer 1:** Exactly. Yeah, your perceptions of how the system works.

**BD031:** My expert opinion, ok. Um… I’m kind of a little hesitant in a way, To be honest. Certainly I think by-catch would be weighted, so connections there would be skewed with it. Especially like how it feeds into EBFM. Food-web, or sorry, key food-web supporting species, I think would also be a weight connected to EBFM.

**Interviewer 1:** So you’re saying those couple of relationships would have higher weight in the system then the others? Ok.

**BD031:** Yeah. I think habitat value, like the connection, definitely personally in my work, habitat productivity and how it relates to habitat restoration to support that would be weighted. Again, that’s coming from my perspective in the work that I do. Being able to identify if that restoration is achieving goals. Being able to quantify or articulate what those values are. I don’t know, I feel like - I mean just for your notes. In a way it’s always, I don’t want to say jaded, but tinged with or biased by each person’s perspective. You know, if you’re talking to a stock assessment modeler they’re going to give you totally different weights then what I know as a restoration ecologist.

**Interviewer 1:** Right, absolutely. Yeah.

**BD031:** Perhaps that’s part of your intent!

**Interviewer 1:** It is, yes. Ok, great. So, um, since we have some space and time, are there any key stressors that impact biodiversity in your system that we could add to the map, that are important?

**BD031:** Key stressors? Oil spills, changes - well, climate change at large, and I think all the cascading effects. Changes in precipitation patterns, change in freshwater flows, change in salinity regimes, all those kinds of cascades. Changing temperatures, especially with that, species distributions, phenology and species reproductive capacity, stuff like that. All kinds of cascading effects, right? Um, other anthropogenic activities? Wind, offshore wind, is a hot button issue that’s receiving lots of attention. So we’re trying to mitigate things like climate change, but there’s going to be set-backs on those activities. Uh, vessel traffic, i’m thinking in the Gulf of Mexico, or just any vessaloids or especially the effects on recruitment of fisheries, or on marine animals behavior.

**Interviewer 1:** Ok, great. So you were just saying vessel traffic has impacts on marine animals, so I imagine species of conservation concern would be an impact?

**BD031:** Yes. Yes.

**Interviewer 1:** Are there other impacts that vessel traffic has on these other components of biodiversity that we have? Then we can draw the relationships.

**BD031:** Oh yeah. Um, so I would connect that with EBFM, EBM at large or as a broader concept. It would perhaps influence species richness and habitat value productivity? It’s interacting with species that use localization or hearing. I’m thinking about certain fish in coral reefs that require certain sounds to be able to identify potential areas of high value. Certainly key food-web and what not? Though that might link more with species of concern, but being able to identify, utilize, overlap with key food-web species and they have requirements or what not. So they’re then choosing lower-quality areas or lower quality prey. Yeah, I think that’s good.

**Interviewer 1:** Cool. What about oil spills, are there relationships we can draw there - impacts oil spills have on biodiversity?

**BD031:** All of them? I mean, if it's a big enough spill. Working with DWH, I mean we’ve noticed the direct effects on habitats themselves. And so cascading effects on key food-web species, species of concern, ecological function…. Oo, sorry, vessel traffic. I just saw that, we should link it to importation controls. Sorry, I know it’s not necessarily a control, but because of vessel traffic they’ll need to increase chances of evasion to support…. Um, alright. It could affect harmful organisms, ecological resilience, species richness, ok.

**Interviewer 1:** Ok. And what about our remaining stressors? So, climate change?

**BD031:** Climate change? Everything. Sorry, that’s a lot of arrows.

**Interviewer 1:** No, some of these - it’s so crazy, you should see some of them. This really, this is not that um… there are not many arrows compared to some of the other ones we’ve tracked.

**BD031:** Alright. Um, what do we have there.. Tropicalization of species distribution could be linked to key food-web, could be habitat forming species, could be species of concern, habitat value productivity, species richness…

**Interviewer 1:** And are these all negative effects? So like increasing the effects of species redistribution, would that have a negative effect on these species? Or, what are the dynamics there.

**BD031:** Not necessarily all negative. Um, I think just a concept, we’ll have to continue to monitor and continue to build our understanding of how those shifts are changing. It could increase opportunities for productivity in certain areas, while at a sedimentary range degrade those. So, it would be semi-neutral if there’s space for those species distributions to move. Think Northern Gulf of Mexico, where there is no place. But down at the South Atlantic, you can see that species can move up the coast. In the Gulf of Mexico, there’s obviously a land barrier there, so moving up more is impossible.

**Interviewer 1:** Right, ok. Ok, yeah. So let’s leave these as question marks, [Interviewer 2].

**Interviewer 2:** Yeah. I accidentally deleted a concept, so we’re re-adding some arrows. But I’m caught up.

**BD031:** Ok. Um, I think it all depends on context too. Like if you’re thinking about the tropicalization or changes in temperature, if you’re thinking about one specific location, if they increased temperatures to extremes that have negative consequences for productivity at large.

**Interviewer 1:** Right, ok. How do any of these management approaches that we have in the map, how do they impact - I guess all the stressors. But I’m specifically thinking, since we’re talking about tropicalization of species distribution.

**BD031:** How do they currently? Or how should they?

**Interviewer 1:** Um, I guess how do they currently now, for mapping purposes. Since these FCMs don’t have spatial dynamics, or temporal dynamics I should say, but i would also be interested in hearing your thoughts on how they should be in the future.

**BD031:** Well, I think of that in terms of habitat areas in particular, of concern. To be able to maintain ecological resilience as best we can, we can use that to mitigate and protect those critical habitat areas from further anthropogenic sources of degradation and hopefully increase their resilience? But I see that as a - I don’t know how that management council would… I would think in the future the council needs to, and I’m sure that they are, consider these sorts of climate change stressors and effects and how we’ll be looking to citing areas that may be sub-optimal or more on the northern edge of their range. So, just forward looking by incorporating that future uncertainty and maybe looking about where that might land.

**Interviewer 1:** Ok.

**BD031:** Um, ESA certainly has its ways of trying to maintain biodiversity through species concern. Basic monitoring would also be checking for changing distribution between different species, so I see that being related. Um, I will say clearly that our Deep Water Horizon restoration work to some degree considers climate change, but it’s not a driving factor. So there’s actually a lack of incorporating that. Most of our restoration is on an outlook of a twenty year project, give or take, or maybe even shorter. So, it’s not intended by design to have that sort of element added into it. Um, but in other ways it is also impacted by climate change I think. Um, like through marsh restoration activities in Louisiana, it’s creating marsh that will increase the habitat value and the coastal resilience value of those habitats. We build a marsh - it’s a big marsh platform after construction, and it slowly degrades over time and provides that barrier, that coastal barrier. I guess, buying us a little time in that respect.

**Interviewer 1:** Ok. Great. What about offshore wind? How does that relate to the system as we have it?

**BD031:** Um, it could affect habitat forming species, it could form it’s own habitat itself. So it would interact, maybe positively, maybe negatively. In a similar way that abandoned oil rigs are treated in the Gulf. Certainly interactions with species of concern, citing cases of whales bumping into new offshore wind platforms. Could be harmful organisms as well, invasive species are certainly well known to adhere to oil rigs in the Gulf. Sorry, a lot of my examples are of course thinking about places where I’ve worked before.

**Interviewer 1:** No, that’s perfect.

**BD031:** Um, could interact with food-web. Key food-web. Surely with a structured habitat, it can serve as a concentrator of biomass. So changing group dynamics. Ok.

**Interviewer 1:** Ok. And then -

**BD031:** Yeah, because mostly looking at the gray ones, the gray boxes…

**Interviewer 1:** Yeah, I was just going to ask, any and all of them. Any connections that you can see that we would be able to draw. I think the main ones, I mean any of the orange ones too, but how - do any of the blue boxes, the management boxes, relate to offshore wind?

**BD031:** Yeah, I think they’re, yeah. I think that in order to characterize that box, EBM/EBFM, there’s enough distinction… are you talking about EBFM or EBM and certainly EBM brings in offshore wind, EBFM does not consider it as much. So I think we’ve been kind of using them interchangeably, but still I cringe. Um, invasive species monitoring, definitely ESA, to offshore. Potentially fish habitat also, I’m thinking a lot about citing those lease laws that are talked about, and such. Um, habitat restoration. We’re trying to do habitat restoration in an NDBC environment where they’re in the offshore realm as well. I think working in those areas with respect to ongoing projects like that is important.

**Interviewer 1:** So habitat restoration impacts offshore wind, or vice versa?

**BD031:** Yeah, vice versa, sorry. We wouldn’t want to put a farm location or a tower where we’re actively doing restoration or something of that nature, right? Um, I think it could interact with species richness across, and ecological resilience. I think also, those stressors interact, maybe that’s your next step as well, but interact with stressors.

**Interviewer 1:** Yeah. Ok, yeah. Are there any relationships there that we can draw between the pink boxes?

**BD031:** Uh, vessel traffic and offshore wind. Oil spills, vessel traffic, offshore wind, I think those are all related.

**Interviewer 1:** So, would an increase in oil spills, how would that impact… or yeah. Is it offshore wind impacts oil spills or oil spills impact offshore wind? I want to make sure we have the directionality right. Or both.

**BD031:** Uh, I think both? I mean, we can definitely see as we convert more towards wind-based energy we could have reductions in oil spills so it could be a positive benefit. But also, oil spills and what not could be complicated by other structures in the area, being able to conduct all the activities needed post oil spill.

**Interviewer 1:** Ok. Anything else that we need to add in this crazy web?

**BD031:** Um, climate change and offshore wind could interact in kind of a similar vein than the oil spills. It may be able to reduce, you know, as we become more aware, more accepting that climate change is an issue, maybe we do work towards some of our goals there? So thinking, i get that’s more than the outcomes of climate change, but just kind of that at large.

**Interviewer 1:** Right, ok. Great. Well, that looks great to me. If that looks good to you, then we can stop there. That was fantastic.

**BD031:** Thank you, that’s interesting. Doing all this on the fly.

**Interviewer 1:** Yeah, it sometimes can be an exhausting interview process. People can think that we’re just chatting and then it’s like no no, you have some modeling homework.

**BD031:** Oh we have to do some real work? Huh?

**Interviewer 1:** Yeah. Ok, well that’s all we have. We really appreciate your time. This was really informative and we learned a lot, so thank you again.

**BD031:** Yeah, thank you. And if you need to follow up, feel free to reach out as needed.

**Interviewer 1:** We will. Thank you.

**BD031:** Alright, take care.