Speaker 1: Okay, so I’ll start, I’ll just give you a little bit more background on our project. And then just to get started, we’d love to learn more about your research and your area of expertise. So like I said in the email, the really high level overarching goal of this project is to understand if and how we’re managing for marine and coastal biodiversity in US Marine Resource Management. It’s a really big research question. So we’re taking a case study approach. Have three case studies for this project. One of which was the northern Gulf of Mexico technically, but really more Mobile, Bay, Alabama, which is where Sarah is at University of South Alabama and Stephen who’s a co-PI in the project. Our second was, and we did that in November, our second was the Chesapeake Bay where I sit at Smithsonian and we did that one in April. And then Puget Sound is our third and final. And so initially Puget Sound was selected because Phil Levin, you know Phil Levin, so he was one of our team members initially. but now he’s at the white House, so he’s not a part of our team anymore, which is another reason why Sarah and I are here for two weeks to do a lot of on-the ground meetings and connections. And each of those case studies, Sarah and I are having individual meetings with folks like yourself, and we’re doing interviews with community members who, know, a wide range of marine resource users. So we’re talking with fishermen, with charter rec commercial fishermen, oyster farmers, ecotourism operators, waterfront homeowners. ANd then of course, tribes here in Puget Sound. And then also marine resource managers, both state, federal, and tribal here, and researchers, academics, practitioners, folks like that. And the goal of those individual interviewers is to understand what local components of coastal and marine biodiversity community members value and rely on for different ecosystem services. And then to understand what components of biodiversity managers are thinking about when they’re making their decisions and understand if those two things align. And then in each region, we are running a workshop where we bring all those community members and managers together to have more of a collaborative discussion about management approaches in the area and understand trade-offs for different management interventions and understand what approaches are needed in the future to manage more holistically and to balance access to biodiversity with conservation preservation of. biodiversity. So yeah, that was a lot. But we have some like specific questions to kind of get your feedback and your thoughts on some of those questions. To start, we would love just hear more about your area od expertise and your work here at NOAA.

BD086: Sure. And then remind me to have a question at the end at some point to make sure that just to check to see who you’re contacting. The state agencies in particular. Folks. I serve on the science panel for the partnership.

Speaker 1: The social science advisor?

BD086: it’s the science panel. The arrangement has changed a little bit over the years, but it used to be that the social science advisory committee would inform do work with the science panel so it’s sort of like a more now it’s apart from it a little bit differently but so throughout the years i’ve been on the social science advisory committee now on the science panel so i think there are i just wanted to make sure that seems like a really important resource manager.

Speaker 1: Yeah. Yeah. Yeah. To just finish off that. We met with Scott Redmond and Peterstown partnership. And then, Katrine rattach. Think, and then we’ve met with a few people who are on like the piece of different working groups. I don’t know we met with anyone specifically on like the advisory committee. We’ve heard about it. Don’t think we’ve got

BD086: Scott is probably the best. So I think if you talked to Scott, he would have put you in touch with Nicole, if nothing else. Is at every single Science Panel meeting . think he’s at every PewterSound partnership meeting, seems like. He is the right person.

Speaker 1: He was great. He was so helpful and gave us so many names and ideas. So he was Nicole.

BD086: So my background. So currently, I’m the supervisor for the social science group here at the center. Used to be two groups, we just merged into one group. That was last year. And so I do less research than I used to because of that. But I will say that my expertise so far has been mostly ecosystem service evaluations. And most of that is… I mean, it’s a little bit of a function of where I’m sitting and what I’m supposed to be researching, but yeah, values. So non-market values for recreational fishing on the West coast. We’ve done a number of surveys that started when I was a grad student at University of Washington and have continued since then. Done a few sets of surveys for. The first one was Oregon and Washington saltwater recreational fishing valuation. Then the second one included California as well. We’ve done a steelhead fishing survey and repeated sound. Well, I guess it was mostly Washington state rivers. And they did a shellfish, wreck shellfish harvesting study, valuation study that was specific to repeated sound. Still a while ago, no. And then I’ve done some other research on. That aren’t necessarily would get into the details of management are less relevant to this conversation. Most of my expertise is in valuing components of the ecosystem services are traded in markets. That generally is where i would consider And survey design, I suppose.

Speaker 1: Yeah, so do you mind sharing a little bit more about the steelhead and the wreck shellfish evaluation studies that you just mentioned and kind of, you know, what the research goals were and the key findings?

Speaker 2: I think you’re the first economist that we’ve talked with, so.

BD068: The shellfish, so the goals of the shellfish project where we were going to link, we wanted to… there was this broad land use change survey, experiment that was being conducted. I think it was EPA funded research at the center. Well, it was some broader. There were some center colleagues that were working on it. And unfortunately, that didn’t pan out as they had panned. So was supposed to be we were going to then overlay this. That was going to tell us things like. Harmful algal bloom, as the incidents in Peterstown and pollution events, and how that was impacted by these changes in land use. That was the goal. It didn’t turn out to meet those goals as they had hoped. So we were left with, we were, and at the same time they were doing that, we were building this, our model, and our model was gonna overlay on top of theirs, and we were going to put… economic values on some of those components. So those have incidents and pollution closures affect recreational harvesting and commercial harvesting, but we were focused on the harvesting component because that was less. Less studied there weren’t market data to be able to estimate those values. So we conducted a survey of shellfish harvesters and everything that entails, you know focus groups developing the survey instrument and then essentially what that was is that I’m not sure if you’re familiar here, but it’s a choice experiment of sorts. Does that kinda firm you? I don’t want to jump in and-

Speaker 1: No, no, no, yeah, no. mean, more information is always helpful, but we are- I’ve never done a choice experiment or a survey, but like I know Bobby, for example, has done some cool ones like stripes-ass research.

BD086: So, essentially, that’s what it was. Instead of asking for- on the choice occasion, though, so instead of asking if you would take like trip A, trip B, or none of the above, whatever, it was how many trips would you take? So were trying to understand that they did eat it as well. So like how many times would harvest under particular closure scenarios. Closure scenarios were a function of, whether it was biotoxin or pollution, the spatiotemporal extent. So we describes like how… how many miles they would have to travel to the nearest open beach. And, to all the length of the closures. So like what, what season they happened in. and so, yeah, that was, again, the intent of that was to overlay it on the other model that didn’t really pan out as they had planned. And we have used it for. Some damage assessments. The Coast Guard has used that model a few times for local pollution, local oil spills, and Puget Sound that have affected recreational beach closures. We didn’t get the intended use of the beach. That might also be used for… research that’s currently in progress where there’s something called sound toxins. It’s like an early warning, it’s an early tap warning system. Series of like volunteers essentially, but it’s state, I think it’s grant funded right now. And sound toxins program is, we’re trying to put an economic value on that data source. And one of the effects of that is hopefully to reduce recreational closures or to prevent adverse health related effects. Eating contamination. Shellfish. So we might overlay the model on that data as well. The steelhead survey is another choice experiment of sorts. And so was a survey of anybody who holds a steelhead harvesting cart in Washington state. And it tried, I don’t know how much detail you want. Essentially, it’s a lot of the same. It’s putting a value on the two important attributes there probably were… And then I can see if you want more detail. The attributes were… catch rates. So we were trying to find out basically we were interested in hatchery management practices. And so those can affect both the percentage of wild fish in the river, which was one of our attributes, it can affect catch rates, which was the other important attribute. So those were the attributes in our experimental design. And yeah, so we have, we basically built a model that is hopefully about to be published that is capable of producing like value of trip estimates conditional on those attributes. And then our next step would be to come up with management scenarios that are relevant realistic to overlay on top of that or to feed into i guess I should say. And then understand the impacts to wreck anglers and we chose steelhead there. We could have decided to go with salmon instead, but there we wanted to be able to isolate. Most of the component there, most of the valuation component, it’s non-tribal anyway, is that rec harvesting component. For salmon, we would have had to also value the commercial harvesting side, and we wanted to keep it as clean as possible to try to do this study. Might do something similar for salmon in the future, but wanted to start easier, more direct. I was just going to ask if you could answer my question. This is non-tribal, just state or federal. I think I can speak for me. I have a longstanding interest in trying to quantify or qualitatively assess tribal values, but understanding that there’s a lot of sensitivity around those values. I’ve heard things like thrones don’t want to put. Economic values on something because then it can be taken away and you can just be compensated for. So that seems to be the most direct reason why they completely wouldn’t want to be on board with. There are… there are contexts where those values seem to be accepted, for fishery disaster declarations, which is another thing that I’m involved with every now and then. They seem to be…

Speaker 1: Yeah, Sarah and have learned so much about the co-management processes and dynamics here and it’s been a really big… learning process for us because we haven’t worked in Washington before with tribal dynamics as much. I did a little bit in Alaska, but it was more so on like cultural services and adaptation to climate stressors and ocean certification. That was my postdoc project there. We had some tribal representation at our Chesapeake Bay workshop, but the two tribes that were present, and I think most tribes in Maryland and Virginia are non-federal recognized, so they don’t have treaty rights. So it’s a completely different process. And like one of the terms of like needs or management approaches was to get treaty rights federally recognized, whereas that’s not obviously an issue here. So it’s completely different management and political dynamics.

BD068: Yeah. You might actually know more about that than I do, given what you’ve just studied. But I do find it fascinating, really interesting, and I’d love to know more. Don’t necessarily get the opportunity as much as you’d like to get into that.

Speaker 1: Yeah. We’ve had a really good luck meeting with Tribal DNR. we met with like, i think met with three tribal resource managers and we have a fourth today. We’re going to have to to lay it up this afternoon in Todd’s Aki.

BD086: I’ll think of another name. I was just going to check to see if you were contacting her. It’ll come to mind

Speaker 1: OK, cool. Yeah, that;d be great. OK, great. That was really, really helpful. So to dive into some of our pacific questions around biodiversity. Mostly just the ones that I sent you over email. SO one of the things that we learned very early on in this project, which probably is unsurprising to you, is that people think of and define biodiversity in different ways. There’s a lot of variation in how people conceptualize biodiversity, which can make it challenging to incorporate into management. So the first thing that we’ve been asking folks is what they think about when they think about biodiversity and what they see as the key aspects, specifically to coastal and marine biodiversity. Which has been another challenge here with terrestrial and waterside dynamics of course for like salmon and steelhead, but to the extent possible focusing on coastal and marine biodiversity specifically.

BD086: Good question. So I wrote a couple quick notes this morning. I…first thought was that it’s difficult to me because biodiversity, at least as I think about it, again, I’m an economist, I’m a biologist, I’m not a biologist. And I tend to think of maybe it’s my role in ecosystem service valuation and that. But I tend to think of biodiversity as kind of this general indeterminate good that’s hard to define and probably hard to value and hard to manage because of all of that. It is this term that… I can’t assign like a direct function. Mean, there are some components that are likely to come from increased biodiversity, but not necessarily across the board biodiversity. And so that’s where I struggle sometimes. But not specific to coastal or marine, but the first one that always comes to mind is like a healthy, robust food web. Everything that brings about like resilience. You know, just being more, I think that’s probably the most important term is resilience to me. Every time you think about some sort of change that probably an adverse change in the ecosystem, having more diversity, wether its generic or species seems to allow that effect to be cushioned a little bit. And so that’s where my…

Speaker 1: Okay, yeah. The term resilience has come up a lot in our previous case studies as well. And its another term that like everyone has a different, you know, a different idea of how to define and conceptualize. And we’ve heard this term ecosystem services a lot also. People have often different definitions and ways to conceptualize it. So the jargon is…

BD086: Yeah, absolutely. And I think, again, it’s my framing of I want to get to the point where you can decide which levers to pull or what is more valuable among the ecosystem services. And its tough when some of them have this intermediate… good characteristic where you’re not really sure that they’re the component to be valued. It’s more that the effects that they have are the things to be valued. That resilience, right? If all components of increased diversity don’t contribute to that equally, like what is managing to… that general term really mean? Like, should we be focusing on particular aspects of it? Like if we knew more, and maybe that’s it, maybe if like the science was perfect and we knew exactly what every species contributed to food webs and ecosystem services overall, it would be easier. We could just pull the right levers and the right strings. It would be natural to manage it. But it seems to be tough to manage to something that general.

Speaker 1: Yeah. yeah. Yeah. okay. So you’re saying like biodiversity might not directly provide a service but it’s an indirect it’s indirectly important for the things that then provide the service?

BD086: Yeah, and then I’ll come I guess if I knew exactly how to measure it like I’m always thinking is there some sort of index or something to calculate and if so the components of that index wouldn’t necessarily have the same weight in my head in terms of importance. But I think sometimes it’s talked about so generally that I just walk away thinking, well everybody is thinking that all these components would have the same weight and that’s our best guess and so that seems… this. Not as effective as it could be.

Speaker 1: Yeah, interesting. Maybe if we have time at the end, like we’ve been doing some conceptual modeling. Sarah’s been doing some conceptual modeling for this project. And one of the things we can do when we’re looking at a sociological system is weight, which relationships have more or less effects on the system dynamics. So it sounds like kind of exactly how you’re describing. Yeah. OK, great. And so I probably didn’t actually put this question in the email, but thinking about your work around ecosystem services, one of the things that we’ve been interested in is what specific ecosystem services from your perspective biodiversity provides. And it sounds based on what you just said that like maybe they don’t provide direct ecosystem services. It’s an indirect effect. But I wanted to kind of follow up on that since that was one of the things we’re interested in and see if you had any other thoughts.

BD086: Yeah. I guess the ones that I would, well. I the ones that come to mind are the ones that are likely to have the highest values. Well, I mean, there’s some…

Speaker 1: Sorry, I put that on the email.

BD086: No, no, that’s really good. I mean, some of the things like regulating services aren’t as easy to assign a value to. And I also don’t know, struggling here to think that…Like is it really the diversity that makes it a regulatory service? That really contribute that much to it? Or is it just the existence of some type of this particular species that actually provides that regulating service? If I don’t know the answer to that question. So I’m struggling to think like of these really baseline key components is diversity. How important is that diversity? And I don’t know the answer to that. My cat probably goes to things like species or key species that we all already know that the population is really concerned, keyed in on. But even there I’m not sure if you take something like the southern resident killer whale population here. Again, I’m not a biologist, but I think their dies is like 90% Chinook or something like that. Then is it, bio, maybe he biodiversity there is in the genetic component of the Chinook. ANd then if you have increased genetic diversity for the prey, then perhaps it’s more likely to flourish in ways that would then benefit the southern residents. But then Chinook itself is obviously a key species. So more questions than answers, think. It’s all really interesting. I just don’t know. I can’t put my finger on this would be a key ecosystem service for biodiversity. It’s definitely a component in there somewhere. I’m absolutely certain that it’s extremely important. Because some of those very important, definitely strong, highly valued goods and services. But I don’t know.

Speaker 1: Yeah. OKay. Okay, great. So I think that’s a good segue to those bins, those four key components of biodiversity that I put in the email. And that’s one thing, like, you your answer about you don’t know where to pinpoint, that’s something we keep hearing again, and how to conceptualize biodiversity. We built the framework for a precursor project that our lead PI, Duffy, who’s my supervisor at Smithsonian, did. And he did some oral interviews with researchers and experts, and they came up with this framework of a potential way to conceptualize and bin. Biodiversity potentially to help some sort of decision support framework or tool maybe later down the line. And so we’re wondering if you agree that these are the key components of biodiversity if not what would you change. I

BD086: think so. Did have some questions. Habit forming wouldn’t have actually been one that would have occurred to me. But once I see it written out it’s clear that more diversity and the components that create habitat would… probably provide more value to for whatever species it’s supporting. So that makes perfect sense. I guess, and it’s probably also habitat that’s more resilient to change if it’s not just a single species of tree or whatever we’re talking about here. Coral, whatever it is. So that makes sense, but it wouldn’t have occurred to me. Species of conservation concern, is that the genetic diversity that is that what’s meant by that? I was wondering, so when I would see species of conservation concern and I’m thinking about interactions and talks I’ve heard here at the center. It would, my mind would go to genetic diversity of something like a ESA listed salmon. But that might not be what’s intended here. And so I guess I was wondering what is intended. So people always ask that and we always flip it back.

Speaker 1: That’s similar to our first question about biodiversity. We don’t have definitions for these bins. Part of the reason we’re asking folks is to get their perspective in what they think about when they think about these bins and to help us inform if we should revise the framework. And it’s interesting because your perspective on genetic is actually one we haven’t heard for this bin and actually genetic diversity has come up briefly here and there and is something our team is interested in thinking about the moe traditional definition of biodiversity as habitat species in genetic diversity. Genetic rarely comes up but it’s something our team’s really interested in so I would love to hear more about your thoughts on that.

BD086: It’s probably a function of there’s a few like you know seminal researchers that talk about genetic diversity in salmon species and so that’s just to be bit of in my mind. So that’s probably why. But it does seem like that it might not be where, like if I didn’t have that background, that wouldn’t be at all where my brain was going because I don’t have the biology background to think about the genetic diversity and its importance. But having heard many talks, I now do think about it. So yeah, that’s where I would think species is a conservation concern. But I would also think about it in the food web for all. And that’s kind of the next one. But I would also like if species of conservation like, if we were talking about the Southern Residents or the Chinook, understanding how I guess if my mind is going to food web again, that’s all. That’s the next one.

Speaker 1: Yeah. Okay. You know, no, but that’s important to think about how they’re connected as well.

BD086: Exactly. To separate those two, guess is what saying. Fully. But if I were to fully separate them, it would be due to the genetic component.

Speaker 1: Okay. Okay. Yeah, so then that’s a good segue into the food web supporting species. And I’d to hear more about how you’re thinking about the two being connected. Because what I was talking, when I was mentioning before the conceptual model and how we’re interested in how these components are connected to one another, like that’s one of the things that we are hoping to get at is how are these different components of biodiversity related to one another?

BD086: OK, I’ll start with the connection. And the connection that I was seeing is simply that the species of conservation concern could be that southern resident, for example. That biodiversity would be, well, that’s a really poor example because I’m not exactly sure that their diet is that varied. But if there was something like a protected species of salmon or something like that that has a slightly more varied diet, by making sure that there is sufficient diversity in the prey available. So again, the connection there is simply that the… ecosystem component that I’m trying to protect is the species of conservation concern and but it’s really more a food web. Protection that this biodiversity would be giving. But I said to jump right into the key food web supporting services. That’s where my mind would go first. Know, if you’ve got a single prey source and anything happens to that prey source, that’s your not in a good, not a good spot. So that’s the probably the most direct place for biodiversity.

Speaker 1: So you’re saying when you think about biodiversity, Kifu Web is the first thing that you’re minding us to okay.

BD086: Attributor component that I would think of, yeah, immediately.

Speaker 1: Okay. Okay, great. Are there specific key food rip supporting species that are important here in Puget Sound from your perspective? Okay. No, that’ not time.

BD086: I just know. I mean, I’ve gone to talks where people talk about the importance of particular. For sand and Chinook for certain residents. And so I think my knowledge is limited to those specific dogs. Mainly ESA listed species and the prey for those ESA listed species.

Speaker 1: Yeah. And that’s totally fine. That’s why we’re talking to variety of people to get economic perspective from you and biological perspective from other folks.

BD086: I will get that from somebody else. Mine is very filtered.

Speaker 1: Okay. Great. The last one is harmful organisms.

BD086: I had a question there, so maybe this is my answer. I wasn’t certain how biodiversity factored in there. Mike, and I’ll just give you more questions. Would the diversity be in the increased competition for resources with potentially harmful organisms? Like crowding out potentially harmful organism, that an intent there? Is it increased predator abundance? If whatever is feeding potentially if it’s a species ont hat then yeah would that be a good thing to keep it in check so to speak so I only have questions

Speaker 1: Well, those two questions are, yeah, those are kind of answers. Like if thats’s what your mind goes to, you think about harmful organisms, then that’s what we want to hear. This bin, we get by far the most variation in how people think about it, which is really interesting. Think one of our most surprising and maybe our favorite example is someone thought about sharks as being harmful because they can attack humans. THat was where their mind went. I think a community member said that, which we would have never thought about.

BD086: Like biodiversity would be such a… indirect tool it seems like. If we knew that there were harmful organisms we’d probably know them. Would know what they were and be able to refer to them. That’s the organism we’re trying to eliminate. And it seems like there’s probably a more direct control than thinking about that through a biodiversity lens, seems like. Like if there’s a particular, I mean, guess it’s easier to think about an enclosed ecosystem, like a or something like that. If there’s a particular fish that’s been introduced, it’s eating the native fish, might be able to introduce a predator to that particular fish or something along those lines. And sometimes you have them where they can’t reproduce, right? You introduce a particular type of fish that has no reproductive ability, but it can kill the species of concern. So it seems like that wouldn’t necessarily be a biodiversity approach to it, but that’s where my mind would go from the management perspective is like putting out the fire.

Speaker 1: Okay. I see. I see. See what you’re saying. Okay. Okay. Yeah, so then that us a great segue to our next question is about management. So what management approaches from your perspective currently consider these components of biodiversity? And then what do you think is needed in the future?

BD086: I have some scribbling down. That was tough because I think that these supporting functions that are enabled by biodiversity are really explicitly considered in management for the most part. Just doesn’t seem…It seems like they’re talked about and so is that considered management? I don’t know. There might be a regulation somewhere about and we’re supposed to manage biodiversity but in terms of actually managing biodiversity I don’t know that I don’t have many good examples. Minor exceptions could be the protection of a particular key species. It might be important prey for a bunch of species on local food webs, but again, I don’t know that that’s biodiversity per se. It’s more like we’re saying that we know this one component is important, so we want to protect it. Not generally more diversity here is a good thing. Yeah, I guess that seems like more of a case when we know, and there’s a little bit more knowledge about what component is the most important rather than just more diversity is better.

Speaker 1: Right, right, okay. Okay, and then are there management approaches that you think are needed to better manage for biodiversity?

BD086: Yeah, this was a big question. I mean, you probably know where I’m going based on some of the other things that I said, I think it would help to understand more of the functions of the individual species that might be components of that diversity. Or maybe species isn't the right word if we’re talking about genetic diversity. Understanding…like I’m just not, I am not aware of any easy ways to manage for that more general concept of biodiversity. Seems like some of the things like the, say Peterstown Partnership might be trying to manage like reducing sources of non-point of pollution would likely increase biodiversity or at least. Prevent degradation of biodiversity, but that seems pretty indirect. And that’s don’t think why it’s being, maybe it’s why it’s being managed. I’m not sure. So I can like come up with indirect, broad management tools that might slightly get it biodiversity, but it’s probably not the direct

Speaker 1: yeah, okay. That’s, yeah, we hear that a lot. That’s kind of the answer we get a lot. Okay, great. Yeah, so you just mentioned reducing pollution. And we keep hearing that stressors are more of core focus of management. SO are there any other key stressors, aside from pollution that you just mentioned, that you think are really important in the system or for management dynamics?

BD086: Yeah, I mean, I certainly, I would say that ocean acidification and…so we’re talking about the Puted Sound System. Understanding is that the temperature of the water and the, well, it’s stressor based. I would say temperature acidification. Would say that there’s a lot of thins that are based on the general concept of pollution, whether it’s septic systems in the Puget Sound aren’t necessarily to code and functioning effectively. You a lot of runoff issues with whether it’s from. Ag areas or it’s from roadways and things like that and all the toxins that are in there. Some of those have really known impacts on, let’s say, species and other ones don’t.

Speaker 1: Right. OKay. Okay. Okay. Yeah, so I was thinking, I’m thinking back to, so the last question that we have, we just people who are the most affected stakeholders in the system that rely on biodiversity and are impacted by these stressors and these management dynamics. And so I kind of wanted to circle back to where we started with your research on wrecked shellfish harvest and steelhead harvest. And you were talking about impacts of, was it HABs and pollution on? Recreational harvest, right, for recreational fishers. So thinking more about that connection, like I am intrigued to hear about some of those findings for that and how like those stressors impact the ecosystem service delivery for rec harvest.

BD086: Okay, I would probably say that yes, I’ll get to that in a second. But I think that I guess I would say initially is that they also have other recreational. Opportunities. And so their ability to substitute to others things in the time period that they’re effective sort of persons that blow. But I would, we talked about tribes a bit, I guess my mind would maybe first go to tribal harvesters, whether it’s for subsistence or some other function there in that I don’t know that those To me, the substitutes available seem very different. Then one of them is you're taking away, like you’re treating your tradition right. And the other one, you like fishing, you like to harvest, so it’s more of a like versus tradition. The importance seems like it’s on a different level to me. I mean, we did find that… Most of these have events or pollution events on the wreck harvesting side for shellfish, example, are not there. You can just go 100 more miles or something like that at most. Find an open beach. You can go 30 more miles to find an open beach. That's not that big of a cost. It’s slightly different. I suppose if you live on the town, maybe your family has owned a house in a particular location and you’ve always harvested there and maybe you even have tied, like you access, you have ownership of some of the tight lands. There it becomes a bit more direct, I think, but like the truly wreck shellfish harvester think its for them. For most of them, it’s just a fun activity to go collect some food with their family and they could likely go somewhere e;se and manage. Unless it’s a longer term closure, obviously. Like the closure stuff we’ve had around Seattle, beaches that have been decades. And on the steelhead side, it’s probably a bit more long term. I don’t know if that’s an easy, that seems to be less. The scale of that seems to be potentially bigger. If that doesn’t turn around, then people aren’t going to be able to harvest those species in the not too distant future. But again, I if you talk to most of these recreational fishers, they like steelhead. If salmon are still around you fish for like a closely related species, that might be a really good substitute. If salmon aren’t around, maybe they’ll turn to something else. I feel like they’re pretty able to adapt, at least on a longer time.

Speaker 1: Is there, thinking about shellfish, I’m just curious, there, there must be mostly like obviously beach and coastal, so the travel distances by car versus like steelhead would be more by boat, is that true?

BD086: Yes and no, there’s a lot of people who travel a pretty far distance in their car just to be able to, they just walk on that particular beach but it still might take they might drive a hundred miles to get there. Probably less than steel headers. It seems like a more specialized highly valued activity. People travel from different states to do that. Buy yeah, we didn’t find as many people harvesting shellfish that are only accessible by boat as we thought we would.

Speaker 1: OK, gotcha. Okay, great. Okay, I think that those were all of my questions, unless you can think of anything I forgot, Sarah.

Speaker 2: Okay, so while you’ve been talking to Kelsi, I’m gonna see this. I’ve been working on a conceptual model of what you’ve been talking about. And so just a couple questions. So to orient you, this was kind of the beginning of the conversation talking about some previous research that you’ve done on shellfish harvesting and steelhead. And then here are some of those components of biodiversity that we’ve been talking about. And so a blue arrow indicates an increase. So harmful organisms increase competition and predator abundance of native species and then an orange arrow is a decrease so those two things decrease biodiversity overall. So this section about your previous research is not connected to this directly. So I want to try to see are there specific aspects here that may directly affect biodiversity or some of these other like key components that we talked about?

BD086: I mean I I think that that for the genetic diversity component of biodiversity, I think that would definitely impact wild steelhead. I would think that increases biodiversity is like, well, I guess that's both ways. I would say that some of these have negative impacts, Likely negative impacts on biodiversity like the sewage issues, potential acidification, pollution, Run off from the roadways. And yeah, I mean, this is tribal harvest of shellfish?

Speaker 2: I combined harvest and fishing here.

BD086: 'Cause some of these could also be combined like that. ESA salmon would contribute potentially to non tribal rec harvest and Tribal harvest of.

Speaker 2: Yeah, this was kind of your food web species of conservation concern example. These are very broad categories. And then You talked at the beginning about how you conceptualized biodiversity and how Getting indices or essentially Better data would improve our ability to value and manage biodiversity. And I want to double check that I understood this. So breaking down biodiversity into intermediate components would facilitate this.

BD086: Yeah, that's what that's well, that's where my mind goes anyway.

Speaker 2: Yeah. Yeah. No, that's that's really fine. That's OK. There's no wrong answers here.

BD086: Yeah, that's what it would take for me to Think about managing to it. I guess it's too broad for me to manage as overall biodiversity effectively.

Speaker 2: Those are my main questions. This is starting to become a spaghetti model, but do things make sense here based on what we just talked about?

BD086: I mean, it probably took me a bit to think about each of those, but yeah.