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sDiv working group meeting report

"sARDINE"

Working group meeting report

The sARDINE (spatial trends in fish ethodiversity) working group (WG) will examine whether behavioral diversity (i.e. ethodiversity) follows similar spatial trends to other biodiversity components. Specifically, whether behavioral diversity decreases with latitude and increases with ecosystem size, while considering harvest intensity. To tackle these problems the WG is assembling high-resolution fish movement datasets, sampled with acoustic telemetry, throughout Europe. Importantly, methods to quantify behavioral diversity from animal movement paths are not well established, and therefore an initial task for the WG is to derive and evaluate new methods for analyzing behavioral diversity.

The sARDINE WG has been organizing virtually since January, communicated through dedicated Slack channels and shared resources in google Drive. Before the in-person meeting the WG formed subgroups, focusing on data analysis, data management, and manuscript planning/literature review. Early subgroup decisions determined the needs for the in-person WG meeting. Firstly, the data analysis team decided to trial multiple approaches to quantifying ethodiversity which can be evaluated at the in-person meeting. The team decided simulations with known behavioral diversity are also required to test new methods. Secondly, the data management group decided to use only a subset of data for testing with the data analysis team. This way issues can be identified and fixed early on. The database is currently under development, and will be finalized this summer, before populating it with all datasets in the fall. Finally, behavioural diversity/ethodiversity is an underexplored topic, and therefore finding a common understanding regarding its interpretation and relevance was needed. The WG decided to harmonize our understanding by organizing a review focused on the meaning and relevance of behavioral diversity for fish specifically. Based on these early decisions, the objectives of the first working group meeting were to 1) evaluate candidate methods for analyzing behavioral diversity from movement paths, 2) organize a simulation tool on which the methods can be evaluated, and 3) construct a paragraph-by-paragraph outline for the review of fish behavioral diversity.

In the first sARDINE WG meeting we dedicated most time to collaborative work. In the first morning, the WG had a welcome session, with several introductory presentations introducing concepts related to behavioral diversity, and important open questions about how we can conceptualize and work with behavioral diversity. After lunch on the first day we began work on the review paper outline. Time also needed to be spent on the data analysis subgroup objectives and for days two to five, our WG split into breakout rooms, with one room focusing on the review outline and one room focusing on data analysis objectives. Mornings were dedicated to full group updates, and crossover between the breakout groups among members was encouraged and happened throughout the meeting.

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Presentations on day one clarified that we needed to settle on how our group will work with ethodiversity as a concept as ethodiversity consists of traits that fish movement data will not capture, for example vocalizations, aggressive displays, or cleaning behaviors. We agreed to consider our empirical analysis of movement paths to represent a subset of ethodiversity. We also grappled with the terminology, and decided that "behavioral diversity" is a clearer descriptive term for the behavioural component of biodiversity, and we should try to use this term in our work. Moreover, "behavioral diversity" is consistent with other terms for biodiversity components such as taxonomic, genetic and functional diversity.

The data analysis breakout room presented early work exploring hidden markov models, clustering, Lomb-Scargle periodograms and mixed effects models to classify behavioural diversity. Ultimately a trajectory classification method using convolutional neural networks proved to be the most promising. The method is flexible, reproducible, and scored trajectory similarities in a high-dimensional space on which traditional biodiversity metrics can be applied. The WG will fine-tuning this method in the summer. The data analysis room also brainstormed the requirements of a simulation tool for creating realistic fish trajectories with known behavioural variation. By the end of the meeting we had successfully built an early working version of a web-app based simulation tool. In the summer months, we aim to finalize the development of the simulation tool. We aim to have a preliminary analysis of the full dataset before the next meeting.

The review paper breakout room had agreed on an outline by the end of day one. The review paper will cover background topics (briefly) related to behaviour and behavioural diversity, behavioural diversity's relation to other biodiversity concepts, how behavioural diversity arises in fish, how fish behavioural diversity is ecologically and societally relevant, how anthropogenic activities impact fish behavioural diversity, what implications behavioural diversity has for fisheries management and conservation, and a future outlook. By the end of the fourth day, the group had finished sketching all figures and filling in paragraph-by-paragraph outlines for each section. We were also able to spend time drafting sections, populating key tables, and drafting a plan to complete the review paper during this year. We recognized our group is biased towards freshwater fishes, and we identified and invited contributions from experts in specific marine fishes (e.g. reef fish, sharks), to cover the topic of behavioural diversity in fish in a comprehensive manner.

We finished the in-person meeting, tired, but with a sense of accomplishment, as we made substantial progress towards our working group goals. The support from iDiv was instrumental for our productivity. Our cognitive effort with respect to organizing hotels, meals, reimbursements, agendas etc. was minimal thanks to the iDiv team, in particular Ronja Wodner. We received valuable advice from Marten Winter to maximize the success of a WG meeting, such as assigning members organizational roles (e.g. manager of zoom and online participants, or moderator) throughout the in-person meeting, and making a strong effort to ensure everyone has an equal opportunity to contribute throughout the meeting. Our in-person meeting benefited from earlier online WG meetings, to divide tasks among WG members, and prepare materials for review during the in-person meeting. The WG remains enthusiastic about the topic of behavioural diversity and we are looking forward to more progress at our next meeting in December.