Socialecological affective arrangements: diving with a small sea of many seas

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ABSTRACT: Environmental change and ecosystem degradation engender deep affective experiences, shaping governance agendas and sustainability transformations. This grounds the need for a better alignment between knowledge production and emotional and affective ways of knowing to overcome the so-called knowledge-action gap. This paper explores how affects and emotions– understood as more than human relations– both shape and are shaped in socialecological phenomena. Drawing on relational accounts of affectivity by J. Slaby, portraying affects and emotions as co-constitutive of socio-material niches rather than enclosed within individual minds, we advance the notion of Social-Ecological Affective Arrangement (SEAA) *as a historically and geographically situated, heterogeneous formation of socialecological entities and practices mutually and recursively affecting-and-being-affected*. We dive into this concept with the Mar Menor, the first legal person ecosystem in Europe, which has experienced a process of eutrophication over past decades. We develop an integrated qualitative and quantitative methodology to operationalize the concept into a mapping apparatus. This *mapparatus* extracts socialecological affective relational structures from qualitative interviews, which are then explored with network analysis tools. We apply this methodology to eight interviews to social actors engaged in conflict and cooperation dynamics in the Mar Menor, illustrating the visual and analytic value of the concept and methodology mapping a SEAA of many SEAAs. The SEAA concept, we argue, helps foreground affective experience as a crucial source of socialecological information and understand why people think-feel and narrate different worlds in every situated environmental issue.

KEYWORDS: affective arrangements, affects, emotions, relational turn, socialecological systems, Mar Menor

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1 Introduction: Why Affect Matters for Sustainability

Affects and emotions mediate our interactions and bonding with places and ecosystems, playing a crucial role in how we are constituted as sentient beings in relation to our environments (Cunsolo Willox et al., 2013; Brugnach, 2017; Juan M. Zaragoza Bernal, 2021; Nightingale et al., 2022; Siqueiros-García et al., 2022). As such, environmental change and ecosystem degradation engender deep and often ambivalent affective experiences and a wide range of societal responses, from trauma and paralysis to conflict and collaboration, from denialism to stewardship (Norgaard, 2006; González-Hidalgo & Zografos, 2020; Neckel & Hasenfratz, 2021; Strzelecka et al., 2025). These responses, in turn, shape political agendas and the advancement or blockage of sustainability transformations (Durnová & Karell, 2023; Bogner et al., 2024); Brugnach et al. 2025).

Environmental knowledge is still too often reduced to scientific facts produced and validated by scientists in papers and reports that are opaque to the majority of the population. At the same time, it is now more evident than ever that facts are continuously being weaponised in manipulative, denialist or polarizing dynamics pushing back against the suggestions of those reports (Durnová, 2019; Powell, 2024; Liste et al., 2026). Because facts are entangled with fear, livelihoods, pain or desires, affective relations that keep being overseen in environmental assessment procedures(Nightingale et al., 2022). Many have argued for a better alignment between knowledge production and emotional and affective ways of knowing as means to overcoming the so-called knowledge-action gap (Hertz & Bousquet, 2025; Nightingale et al., 2022; Sorman & Galende-Sánchez, 2025). Affects and emotions provide crucial information for understanding how scientific facts and narrations get dynamically intertwined with people's values, needs and actions (Durnová & Karell, 2023; Slaby, Scheve, et al., 2025). Yet, how to analyse the roles affects and emotions play in complex environmental dynamics, integrating a new layer of information in socialecological systems models, is still an underexplored question in sustainability science.

Affect theory suggests that affects and emotions are the very relational substance out of which subjectivity emerges (Colombetti, 2017; Slaby & Von Scheve, 2019). Despite epistemic divisions between cognitive and sociocultural approaches to affects and emotions, different authors concur in seeing them as both subjective and intersubjective, both drivers and results of individual and collective actions, pertaining to all living beings (Fuchs & Koch, 2014; Roelvink & Zolkos, 2015; Colombetti, 2017; Durnová, 2019; Slaby & Von Scheve, 2019). Within the environmental humanities, there is a growing body of theory focusing on the materiality of affects and subjectivity, on how they both emerge from and sculpt more-than-human relational entanglements (Adams-Hutcheson, 2019; Verlie, 2019). In the words of Slaby et al. 2025 (p.2), affect and emotion are "where meaning and mattering are fought out and lived at the same time." This understanding of affects and emotions as materially-semiotically relational offers a conceptual bridge with socialecological relational approaches (Brugnach et al., 2008; Mancilla Garcia et al., 2020; West et al., 2020, 2024) that,

in our view, enables novel explorations of more-than-human relationality in environmental problems.

The aim of this paper is to adopt and adapt the concept of affective arrangements introduced by (Slaby, 2019; Slaby et al., 2019a), elaborating the notion of *SocialEcological Affective Arrangement* (SEAA) into operational terms that make it applicable to the study of environmental problems. In doing so we explore the intersection between affective relationality and socialecological research. We navigate this concept with the Mar Menor (small sea in English), a saltwater coastal lagoon in Southeastern Spain experiencing a process of eutrophication, which has transformed its ecological qualities and triggered an important sociopolitical conflict (Boix-Fayos et al., 2023; Cabello, 2024; Rashidian et al., 2025; Zaragoza et al., 2025). The Mar Menor has recently become the first ecosystem in Europe with legal personhood (Vicente-Giménez & Salazar-Ortuño, 2024), a milestone in global environmental governance unfolding in a challenging context.

In previous research, we explored the intense emotional repertoires emerging around the Mar Menor. Zaragoza (2025) shows how emotions such as grief, anger, and hope are central to how socioecological degradation is perceived and acted upon, particularly in a context where ecological damage is not immediately visible and must be mediated through scientific knowledge and memory. He demonstrates that affective responses to the lagoon's ecological crises play a key role in transforming scientific information into shared values, motivations, and collective action. The concept of affective relationality (Slaby & Von Scheve, 2019; Slaby, Von Scheve, et al., 2025) has also guided the interpretation of a knowledge co-production experience co-led by the first author, with J.M. Zaragoza participating as study participant (Cabello 2024). Among other goals, the co-production process aimed at unpacking the polarizing dynamics in the area dividing, on one side, inland farmers' communities and agricultural organisations and, on the other side, coastal municipalities and environmental organisations (Cabello & Brugnach, 2023).

The point of departure for the co-production process was understanding the affective experiences participants had in relation to the lagoon and its deterioration through qualitative interviews. This led us to conceive the Mar Menor as *a sea of many seas* (Cadena & Blaser, 2018), a social-ecological body multiple (Mol, 2002), as there were different ways of enacting what 'a degraded lagoon' is (Cabello 2024). In the context of analysing the interviews three years later, we ask: what is the affective relationality of the Mar Menor eutrophication? How do narrated 'facts' of the eutrophication problem align, or not, with emotional attachments to the lagoon? To dive with the Mar Menor as a sea of SEAAs, we develop a methodology to extract socialecological affective structures from qualitative interviews, that we call a *mapparatus*, inspired on relational interviewing and coding (Ayata et al., 2019; Mancilla García et al., 2024), and to analyse those structures with mixed qualitative and network analysis.

The SEAA concept, we argue, provides a meso-scale vocabulary for how emotions and affects – understood as more than human relations– modulate socialecological dynamics, and helps get "to the heart of the matter" (Slaby 2025, p. 3) of why people think-feel and narrate different worlds in every situated environmental issue. As a sea of SEAAs, the Mar Menor can be seen as a dynamically patterned assemblage in which water bodies, nutrient particles, laws, microalgae and dying fishes relate together with memories, fishing, agricultural or bathing practices through deep affective bonds, caring efforts, sadness, rage and blaming dynamics. Different material-affective entanglements co-produce different Mar Menor SEAAs that yet interfere with each other in societal dynamics of conflict and cooperation (Brugnach, 2017; Venot & Jensen, 2022).

The paper is organised as follows. In section 2 we introduce the notion of affective arrangements as defined by (Slaby, 2019; Slaby et al., 2019a) and our derived notion of SEAAs. Section 3 describes the methodological proposal for arranging SEAASs. In section 4 we dive with the Mar Menor as a sea of SEAAs, exploring the lagoon's affective relationality at different levels. Section 5 concludes the paper with a discussion of the main conceptual and methodological contributions and limitations of the approach, its governance implications and questions for future work.

2 Social-Ecological Affective Arrangements

2.1 Affective arrangements

Affective arrangements is a theoretical concept proposed by (Slaby, 2019; Slaby et al., 2019a) to situate the analysis of affective relations in the concrete sociomaterial constellations in which they unfold. Slaby (2019, p. 109, italics original) defines it as "an array of persons, things, artifacts, spaces, discourses, behaviors, expressions or other materials that coalesce into a coordinated formation of mutual *affecting and being-affected*". Among others, the concept is inspired by those of *apparatus* (Barad, 2007, 2015) and *agencement* often translated as *assemblage* (Deleuze & Guattari, 1987) to emphasise the *heterogeneity* of the elements assembled. Despite their heterogeneity, elements in an arrangement present a "characteristic mode of composition and dynamic relatedness" (Slaby et al. 2019, p. 2), a certain patterned regularity and intensity thresholds that makes it possible to distinguish it from a less enmeshed background.

Taken like this, affective arrangements share many similarities and conceptual roots with recent adoptions of process-relational ontologies within sustainability theory (Brugnach, 2017; Mancilla García et al., 2020; West et al., 2024), and in particular with the different applications of the notion of *assemblage* (Hertz & Bousquet, 2025; Lejano, 2017). It invites a kind of 'arrangement thinking' (Slaby et al., 2019b) that pays attention to the patterns in which practices, devices, living beings, things, spaces and temporalities continuously

entangle in socialecological processes. What affective arrangements bring is a focus on *affects* as the core relational dynamics constitutive of social and material life. So, what are affects?

In its most common definition, an affect is an interaction producing a difference in a body, i.e. a conscious or unconscious bodily response (Brennan, 2004; Massumi, 2002). Slaby & Mühlhoff (201, p.27, italics added) draw on Deleuze's reading of Spinoza to foreground a relational conception of affects as "material and ideational relations that, *in the short term, increase or diminish their agentive and existential capacities* in relation to their surroundings and all other actors and entities present in a situation". In this perspective, we here adhere to the view that affects are intrinsically linked to dynamic notions of power that consider the ways bodily encounters transform agencies (their *potentia*[1]) and contribute to processes of becoming (Mühlhoff, 2020; Slaby & Mühlhoff, 2019). Crucially, affects are not exclusive to humans. They connect human and more than human bodies in recursive dynamics of affect-being-affected that, in the long run, modulate –create, drive, transform– individual and collective capacities and subjectivities (Roelvink & Zolkos, 2015; Slaby & Von Scheve, 2019). It is important to note that, in its broader meaning, any kind of body (not only human, animal or even living) can be said to "affect-and-be-affected". In this sense affects also traverse human bodies, what we often thematize as emotion.

The notion of affect has been often opposed to that of emotions to emphasise the pre-reflective character of most bodily engagements (Massumi, 2002; Mühlhoff, 2020). Our senses and our skin continuously feel and react to a world full of intensities without us even noticing. *Emotions,* on the other hand, respond to conscious experiences that we can narrate in ways such as "I fear floods". A key proposal of the affective arrangement framework is to conceive emotions as episodic realizations of affects that can be identified and categorised by a human body (Von Scheve & Slaby 2019). As Cunsolo Willox et al., (2013, p. 16) put it, emotions are "the spilling over of the effects of affect on a given body", they are the ways we make sense of the *feelings* and sensations we experience in our bodies (Damasio, 1999).

Emotions imply a double 'move while being moved' (Fuchs & Koch, 2014). On the one hand, they reflect our evaluative orientations of concrete situations. Thereby, they demarcate our field of concerns helping us recognise what we care about[2]. On the other hand, e-motions

[1] Strictly speaking, it is impossible to fully get rid of the concept of *potentia* to account for affects. For affect would risk collapsing with the wider notion of cause and effect. Thus, not any difference in a body qualifies as an affect, but only those that increase or decrease its potency, its capacity to act. An underlying metaphysical problem is that *potentia* thus understood is an abstraction, and does not exist in isolation as a determinant of affect; but only relationally, in relation to some horizon of action. Potentia is always *potentia for*; for some action, for somebody. That is, for a body capable of self-defining an activity. And not all bodies can do that (Barandiaran, 2017; Barandiaran et al., 2009). However, for the sake of this paper, we shall bracket a more detailed and strict discussion of the concept of affect.

[2] As extensively documented by sociology and history of emotions, individual and collective concerns and values are culturally and historically constructed, so are the linguistic categories we learn to read our bodily sensations and narrate our emotions (Scheer, 2012; Boddice, 2018; Moscoso, 2021). The idea of emotions being preceded by judgement of situations is however controversial within philosophy of emotions, and some

move us. They prompt us into engaging with the situations and actors that matter to us and shape how we tend to act in situations of fear, shame, anger or excitement, affecting and moving in turn those who witness our facial and bodily expressions (Von Scheve & Slaby 2019). The analyses of affects and emotions, therefore, are not opposed but complemented in affective arrangements. Where affects enable approaching wide relational dynamics between living and non-living entities, emotions, as a specific type of affect, help illuminate the historically acculturated ways in which human subjects feel, make sense of, and further engage with concrete phenomena.

2.2 SEAA: Socialecological affective arrangements, a definition

Socialecological research is undergoing a shift from the complex systems approaches in which it was originally anchored towards process-relational (PR) thinking, highly influenced by posthumanist perspectives and relational thinkers like Giles Deleuze, Donna Haraway or Karen Barad. PR approaches have contributed to a diagnosed need for theoretical grounding of socialecological analysis, proposing an ontology that withdraws divisions between "the social" and "the ecological" to emphasise their intertwinedness (Mancilla Garcia et al., 2020). They have also deepened reflexive practices among sustainability scholars, placing attention to how researchers, their backgrounds and chosen methods, their passions and frustrations, co-constitute the research process together with the very socialecological systems they study (Haider & Rieser, 2025; Mancilla García et al., 2024).

We aim to contribute to this PR shift by 'emotionalizing' socialecological analysis. Affective arrangements and its wider conceptual umbrella are uniquely positioned for this, as they share theoretical roots and a general style of thought that comes with interdisciplinary endeavours to complex societal challenges. Moreover, affective relationality comes with an ambiguity that holds several dualities within: affect/emotion, mind/matter, human/more-than-human, individual/collective (Anderson, 2009). It is precisely this ambiguity that offers a nuanced landscape to think-with *socialecological affective arrangements*. The challenge lies in describing socialecological interactions as affective, having emotional relationality within but not reducible to it, inquiring how emotions entangle within other material processes and practices.

We define a **socialecological affective arrangement** as a *historically and geographically situated, heterogeneous formation of socialecological entities and practices mutually and recursively affecting-and-being-affected; expressed and enacted, among others, through human bodies and their emotional affection*. The **formation** is a dynamically (historically) and spatially (geographically) patterned mesh of affective relations between processes. The **processes** are, in turn, structured patterns of change in heterogeneous *entities* (understood as processes of

authors of this manuscript disagree with it (see Zaragoza Bernal, 2021). However, this controversy does not fundamentally affect our conceptual proposal in this paper and, for the sake of space, we prefer not addressing it here.

individuation: like humans, plants, rivers, memories, laws, or technologies), and *practices* (like fishing, governing or breathing). **Affects** are valenced interactions between processes, constituted by the resulting enhancement or diminishment of the capabilities of the processes and/or the formation(s) they participate in (including the very arrangement). Therefore SEAAs are formations of affective relations between socialecological entities and practices that modulate effective capabilities of heterogeneous processes and/or the very same formation.

What is unique to a SEAA as compared to an affective arrangement? First of all, the geographical (Anderson, 2009; Bondi, 2016; Jankowski et al., 2025). SEAAs are not located in site but in a place, not in a Christmas family reunion but in a larger territory in which biophysical processes, such as weather changes or water flows, influence family reunions along the year. This also brings a different temporality, as socialecological processes are rarely momentarily observed, but involve historical processes and path-dependencies along which emotional episodes evolve, sometimes sediment in affective states, habits and relatedness patterns (Siqueiros-García et al., 2022).

Second, the entities are socialecologically relevant, meaning they can be any type of actor (as in assemblages or Action-Network Theory) as long as their affective relatedness can be recognised as a typical socialecological phenomena: a fisheries collapse, a human-animal conflict, the management of a forest to which communities are spiritually connected, the eutrophication of water ecosystems caused by anthropogenic nutrients. Considering the distinction between affect and emotion outlined in the previous section, we shall distinguish between sentient, emotionally-affective, narratively active agents (fishers feeling grief for dead fish, farmers feeling pride of their practice, citizens feeling outrage for politicians inaction) whose emotions (sentiently, biocognitivelly, and culturally framed modulation capacities) are constituted through their coupling with sentient non-humans and non-sentient entities/practices, processually-affected and affective (lagoon waters, nitrogen molecules, fishes, legal rights, harvesting routines), that are individualized, named, regulated, brought forth, made sense of, and ultimately experienced by human narrators. Yet, this analysis can show how, in a SEAA, neither entity is primary: human anger gains force from algal blooms' vivid green; the lagoon's juridical personhood is animated by citizen affection. Affect is always co-constituted—*no feeling without the mesh, no mesh without the felt.*

Thirdly, affective relations in a SEAA include socialecological material affects (nitrogen triggering eutrophication process; increasingly intense storms flooding farms and affecting farmers production) and emotions (frustration for seeing your farm overrun). Considering ecological processes as affects represents a big leap from its common understanding in cultural studies as preconscious forces invisibly connecting human bodies. It also bears risks of reification and reduction to variables that can be quantified, as socialecological analysis commonly does. Nevertheless, materializing affects helps attune affectivity to the material agencies of environmental change as already proposed in environmental humanities and affective geographies (Neimanis, 2017; Adams-Hutcheson, 2019; Verlie, 2019). It also

provides an analytical pathway for the mixed-methods explorations that are common in both socialecological and affective relational research (Biggs et al., 2021; Kahl, 2020).

In the next section, we further develop the SEAA notion by navigating the affective situation of the Mar Menor lagoon as perceived by local inhabitants in a specific historical moment, showcasing how qualitative interviews and network analysis can be combined within this framework to deliver a systematic and formalized construct, a *mapparatus*, that puts the notion of SEAA into practical and replicable use.

3 Methodology: *mapparatus* for a SEEA in the Mar Menor

3.1 Brief history of the case and of the research context

The Mar Menor lagoon made headlines in international media through the images of masses of dead fishes accumulating on its shores in 2019 and 2021. These events were caused by episodes of aquatic hypoxia (rapid drop of oxygen levels in the water) within a long-term eutrophication process. They were preceded by an unexpected shift in lagoon's waters by the end of 2015, with microalgae colouring it green for over a year. In October 2022, after major social mobilization and a citizen-led legal initiative, this ecosystem renewed its fame by becoming the first in Europe being recognized as a legal person. Two rapid shifts in a territory that has seen a tremendous transformation brought for by the construction of a large water transfer from the neighbouring river basin: expanded processes of urbanisation, touristification and vegetable production for exportation, over the past 50 years (for an extensive account of this history see). Eutrophication indicates a process of enrichment of nutrients (nitrogen and phosphorus mostly) in water bodies, shifting ecological conditions once the concentration surpasses threshold levels. It is a worldwide 'wicked' socialecological phenomenon (Levain et al., 2020), linked to expansive trends of urbanisation and agricultural productivity, activities normally associated with the generation of those nutrients via wastewater and fertilizers (Juan Manuel Zaragoza, 2026).

The first author of this paper arrived at the Mar Menor in February 2021 with the intention of exploring the role(s) of knowledge co-production in conflictive socialecological issues as part of her postdoctoral research[3]. The idea of paying attention to emotions was already travelling with her. She was already collaborating with an important environmental NGO in the area, and worked together with another researcher they were hosting[4]. The first year went on understanding the history of the place and the existing controversies around the causes and solutions proposed to the lagoon's eutrophication (Zuluaga-Guerra & Cabello, V., 2023;

[3] This research followed the guidelines of and was approved by the ethical committee of the first author institution. All participants were duly informed and asked for informed consent, both oral and written, before the interviews. Their names and personal data have been anonymized except for ResearcherH, J.M. Zaragoza, who is a coauthor of this paper and accepts his identity being disclosed.

[4] The full research process was co-led by Paula Zuluaga Guerra, supported by the New Water Culture Foundation (https://fnca.eu/).

Cabello & Brugnach, 2023; Cabello Villarejo & Serrano, 2024). Controversies were multiple, but the most tangible one revolved around the weight of agricultural responsibility in the problem, with a strong confrontation between environmental and farming narratives. During that year, she met J.M. Zaragoza, an expert on philosophy and history of emotions. He accepted being part of a knowledge co-production experiment involving persons enacting different Mar Menor seas.

Methodologically framed within the umbrella of Transformation Labs (Charli-Joseph et al., 2022), the co-production process was designed as a dialogue space in which to open conversations around matters of concern in a care-full environment (Cabello, 2024). The process started with an in-depth individual interview with participants in March 2022. The interviews explored how participants affectively encounter the lagoon and its eutrophication, and understand their narratives about the problem. Fourteen persons were interviewed, yet only eight of them participated fully until the end of the knowledge co-production process: three farmers, three biologists experts in the lagoon, one fishermen and one researcher (J.M. Zaragoza). Only two of those eight participants were women, all were middle aged (40-55). Our SEAA conceptual proposal presented above and the analysis process below stem from the experience of those eight interviews, and the data they produced.

3.2 Arranging the arrangement through qualitative interviews

Relational approaches require thinking with concepts and methods as apparatuses (Barad, 2007; Slaby et al., 2019b; Mancilla García et al., 2024), that is, devices with the capacity of arranging things, people (including researchers) and meanings in new ways. Drawing on anthropology and feminist scholarships, both PR socialecological research and affective relationality conceive interviews as situated encounters where data and knowledge are co-produced out of the interaction between interviewer and interviewee (Ayata et al., 2019; Mancilla García et al., 2024). This perspective invites attention to the affective qualities (such as bodily expressions and surrounding elements) arranged along the interview process. In addition to the interview, the coding process can also be approached relationally, using categories such as relations, practices or processes of becoming.

The interviews aimed to elicit conversations about emotional experiences of the lagoon. Aware that people might be reluctant to share at a personal level in this cultural context, they were designed as a staunchly deepening conversation. Interviewees were first asked about their daily activities and relations in work and leisure time. One of the interviewers made the questions while the other drew described interconnections in a big paper. A picture of the Mar Menor was then introduced on top of the drawing. With the lagoon materialized on the table, interviewees were asked about their relation to the Mar Menor; their opinion about its current situation and the causes behind it; the impacts eutrophication had on their relational life, including their work, their relations and them personally; and their views on

the legal personhood citizen initiative (accepted to be processed by the Spanish Congress in January 2022) as a potential solution to the current situation.

3.3 Building the *mapparatus*: relational coding of interviews and network formation[5]

For analysing the interviews, we combine qualitative and network methods. We think this combination is well suited for the purpose of this paper, which is to offer a bridging *mapparatus* between two research domains. Whereas methods exploring affective relationality are mostly qualitative and non-representational (Kahl, 2020), socialecological research is more prone to mixed methods approaches (Biggs et al., 2021). Socialecological networks in particular have been widely used in combination with narratives and other qualitative approaches (Eakin et al., 2019; Koch et al., 2023; González-Mon et al., 2025), and provide a way of structuring and visualizing complex relational information, which can be further unpacked through thicker qualitative descriptions.

The coding process proceeded as follows. We first revisited the interview recordings and captured in the transcript those affective qualities that could be perceived through listening, triangulating annotations with field diary notes. Second, we coded (using QualCoder)[6] the transcripts to abstract data that can be codified into a socialecological network. We identified text segments conveying affective meaning related to the Mar Menor. Each segment was treated as a micro-episode in which an affective configuration momentarily coheres. Segments were coded for simultaneously three categories, ensuring exact overlap: at least two *relata* and one *affective relation* between relata, either attributable to the interviewee as a node and to another relata (e.g. "I was deeply affected by the contamination of the lagoon") or by the interviewee to other relata (e.g. "farming activities pollute the lagoon").

We interpreted the annotations within the wider affective context of the full interview using the audios and fieldwork notes to iteratively refine the identification of affective relationships. Following our conceptual framework, relata were classified as *Entities* (people, organisations, institutions, algae, nitrates, ships, water flows…), *Practices* (e.g. farming, fishing, governance) and *Narrators* (interviewees). Affective relations were classified as *Emotions* (e.g. sadness, hope, anger) and general *Affects* (e.g. deteriorate, flourish, care, enable, pollute, confront). The classification of a relation as an emotion responded to direct

[5] Generative AI models (ChatGPT-4o, Gemini 2.5) where used on the early stages of this manuscript, with the purpose of cross checking the consistency of the first draft definition of SEAAs and designing a preliminary prototype of the mapparatus pipeline and data structure.

[6] All edges and nodes are stored in Zenodo 10.5281/zenodo.18600157. Following our ethical protocol, we do not include the semantic content of the edges as it contains numerous personal references that might make interviewees recognisable. We acknowledge this hinders the full reproducibility of this research. The Mar Menor is a sensitive case that requires special ethical caring.

mentions of emotional categories by interviewees, and in some cases to our interpretation of their (verbal and non-verbal) affective expressivity.

To explore the alignment between 'facts' and 'emotions' in the eutrophication problem, we classified affective relations by type of narrative as *egoaffective* and *alteraffective*[7]. *Egoffective* narratives are specified by human narrators (interviewees) bringing to the surface processes and relations that affect their lives directly. *Alteraffective* narratives are those where narrators bring affects other than those directly involving themselves. In the Mar Menor, egoaffective relations include all emotional (direct connections to interviewees) but also other affects such as bonding through recreation practices or confrontation with politicians or other people. Alteraffective relations include mostly material affects describing the causes of eutrophication similarly to a causal loop diagram.

Coded segments were exported and transformed in network structured datasets (Source, Target, Affect, Affect_Type, Narrative_Type, Interviewee, Valence). This structure enables the application of network analysis techniques in combination with qualitative interpretative analysis of the coded text.

3.4 Network analysis of the *mapparatus*

To provide a visual account of the Mar Menor SEAA, we aggregated the eight interview networks into a single dataset and imported it in Gephi (Bastian et al., 2009). We next proceeded to build a directed graph of relata (entities, narrator and practices) constituting nodes of the graph and affects constituting the connections or edges. Edges are not aggregated by the tuple. We runned the Force-Atlas2[8] (Jacomy et al., 2014), a *continuous force-directed* algorithm that simulates the network as a physical system: every node repels every other (Coulomb-like force) while edges act as springs that pull their incident nodes together (Hooke-like force). The system iterates until a quasi-stable spatialisation emerges.

[7] We draw inspiration from the social-network analysis terminology of ego-network and alter-networks depicting the network of relationships around a particular node. Note however that all alter-affective arrangements reported by a person usually affects her or, said it differently, her emotions (as specific kinds of affects) are always shaped by the way she experiences the reported alter-affects; thus reflecting the double-domain co-constitution we explain in the previous section.

[8] We chose the AtlasFore2 layout for two mutually reinforcing reasons: first, the position of each relata is not fixed a priori; it materialises from the constantly updated balance of relations or affective tensions. This mirrors our theoretical claim that human and more than human entities and practices acquire meaning through ongoing affecting-being-affected rather than through static attributes. The layout therefore performs, in miniature, the process ontology we defend. Second, ForceAtlas 2 obeys two intuitive heuristics that match a SEAA interpretive needs: nodes that share many or strong edges are pulled into visual proximity, allowing dense affective constellations to appear as clusters; sparsely connected drift to the periphery, spotlighting marginalised processes, while antagonistic elements are pushed apart identifying more polarised actors (see Figure 1 and 2 in the next section).

To analyse affective patterns across the sea of SEAAs, that is, the different interviewees, we conducted a node-level analysis building in our previous work in the Mar Menor (González-Mon et al., 2025). We divided the network along egoaffective and alteraffective edges and hypothesised:

1. Alignment of facts and emotions: interviewees with similar emotional attachments within the Mar Menor territory (egoaffective relations) should have closer framings about "why eutrophication happens" (alteraffective network); that is, their reported affective arrangements should overlap.
2. Polarization: both networks present a divided structure between farmers vs rest of participants representing environmental positions.

These hypotheses were explored through several methods. We first generated the two mode network for both the egoaffective and alteraffective networks and calculated degree and betweenness centrality measures using (Csárdi & Nepusz, 2006) in R (R Core Team 2018). This analysis allows understanding which entities play a stronger connecting and/or bridging roles across interviewees. We then examined each network through a different cluster method. This is because the networks are structurally different in that one contains the interviewees as entities and the other doesn't. In the egoaffective network, we explored affective patterns between interviewees whose SEEAs become connected when sharing entities. For this purpose, we projected the two mode network onto a matrix that establishes relations between interviewees for every connection to an entity they share (link weight: number of entities they "share"). This matrix provides an estimate of which actors are more strongly connected by sharing the same entities in their egoaffective narrations about the lagoon and its crisis (see Figure 3-A). We analysed it in Gephi applying Modularity clustering algorithm (Blondel et al., 2008).

In the alteraffective network, we inquired how dissimilar are interviewees' framings of eutrophication. We created adjacent matrices for each interviewee and imported them in a multiplex network using the multinet package (Magnani et al., 2021) in R (R Core Team 2018). Using the R Igraph package (Csárdi & Nepusz, 2006) we calculated the Jaccard distance between the matrices (taking any value between 0-similar to 1-different). The resulting distance matrix is visualized and clustered using a heatmap (see Figure 3-B). This method allows discerning which interviewees are closer in their causal descriptions based on the distance between their relations to different entities.

4 The Mar Menor as a small sea of many SEAAs

In this section we describe some of the results obtained with our methods articulated. We start with a microanalysis of Farmer P.[9] affective relationality with the lagoon through a

[9] We have chosen FarmerP among the 8 interviewees whose SEAA to analyze here because he plays a central role on the network analysis of the SEAA of many SEAAs we analyze later. Also, as we shall see in section 4.3, he is a

qualitative description of his SEAA and our conversation. We then move to visualize the sea of SEAAs, assembling the eight interviewees in a single network to finally discuss the network hypotheses of polarization and alignment.

4.1 A small SEAA

Farmer P. suggests meeting midday at a terraced cafe. He lives nearby, 3 minutes walk to the Mar Menor shore. It is a bright spring Sunday. Whenever the farm rhythm allows it, he tries to be off during weekends to enjoy with his beloved family. He has two kids and his wife came years ago from Latin America and settled in his, at the time fastly growing, town. Farmer P. participates in agricultural unions and the irrigation community annual meetings. He joins demonstrations for the agricultural sector, and those for the Mar Menor. We don't need to ask about the Mar Menor for him to make clear, from the start of the conversation, how much he worries about it, “all my childhood is this”. He wakes up every morning and checks with the lagoon, and the winds “it is really important to know where it comes from, a neighbourhood can blow herbicides onto you. The sea, the sea tells you where it comes from and what wind it is. And the intensity, if it is rough…” In the evening, back from the farm, he visits the Mar Menor again to have a look “it is more green, less green [laughs]. Or how the algae are. That’s what I do every day, every time I get off my door”.

When we ask about his emotions, he is blunt: eutrophication makes him “sad, sad, sad…[shouts]Of course! sadness, because… for those who live in La Manga, or only come during summer…but for those of us here…”. He used to have a boat and sail with family to visit the small islands in the lagoon. He used to bathe every day. He still does during summers, even if his neighbours call him off, even if his kids don't join him anymore because they can’t dive, “you cannot see in this water”.

He is also enraged. He confronts people in social networks and local politicians who, in his view, do not care nor act upon the problem “after what happened to the Mar Menor, I do not believe in politics”. He tells us about a program on national TV dedicated to the lagoon he had recently watched. He was affected by the display of scientific controversies “they have been discussing for years about extracting aquifer water, but now, the aquifer can’t be touched […] now the solutions are “in the origin”, that’s how they speak, and what means“in the origin”? it means controlling fertilization, using less fertilizers”.

For Farmer P., one of the key problem lies in the rapid urbanization of the area, which magnified both floods and wastewater leaks to the lagoon “for 25 years, untreated sewage was directly dumped to the lagoon. Then they opened the treatment plant, but it wasn't dimensioned for that urban growth”. He gets passionate about wastewater, there is a sense of injustice in the way he feels this problem is overseen. Moreover, he declares himself

bridge in-between the polarizing tension among participants and his SEAA is rich and representative of the complexity of the lagoon and socialecological affects that traverse it.

restrained by the new regulations imposing inspections on farms and planting shrubs which require significant investment. He complains farmers need to fertilize and it is impossible to control 70.000 hectares "Now, they tell me I have to use only 170 kilos of nitrogen per hectare and year. Ok, sure, I comply with the law. But here is the problem: we have been cultivating for 40 years, using the Tajo water. That is on the aquifer, it goes to the Mar Menor through the *ramblas*, and the aquifer is rising. What do they do? nothing!".

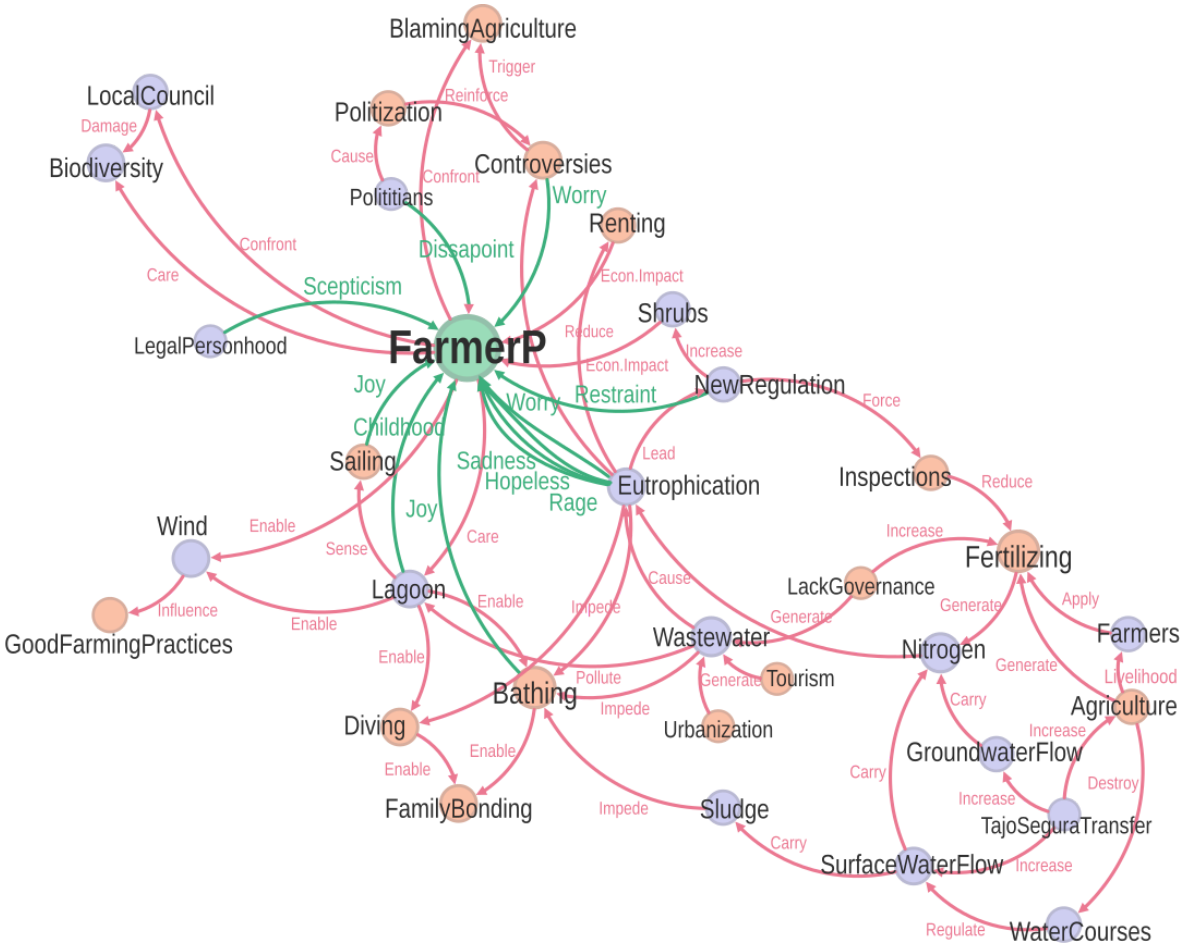

Figure 2 Farmer P SEAA. Nodes represent the heterogeneous elements that compose the socialecological arrangement—green = narrators, orange = practices, purple = entities. The ForceAtlas2 algorithm was applied to the raw network data. Node size is proportional to the number of affects or incoming connections (In-Degree). Relations are classified in emotions (green) and other socialecological affects (red).

Figure 2 presents the SEAA of Farmer P., resulting from encoding our conversation with our *mapparatus*. The image shows how his emotional relations (green) and the consequences of its deterioration intertwine with other socialecological affects (red), connecting different more-than-human entities and practices. Many of these nodes are shared by other interviewees, enabling an assemblage of the sea of SEAAs.

4.2 A sea of many SEAAs

In the Mar Menor SEAA(s) (Figure 2), algal blooms, fish die-offs, childhood memories, legal initiatives, water recreation and productive practices interact with blaming dynamics, public controversies and a widespread perception of bad public governance through water and nutrients flows as well as through sadness, hopelessness, loss, rage or social unrest.

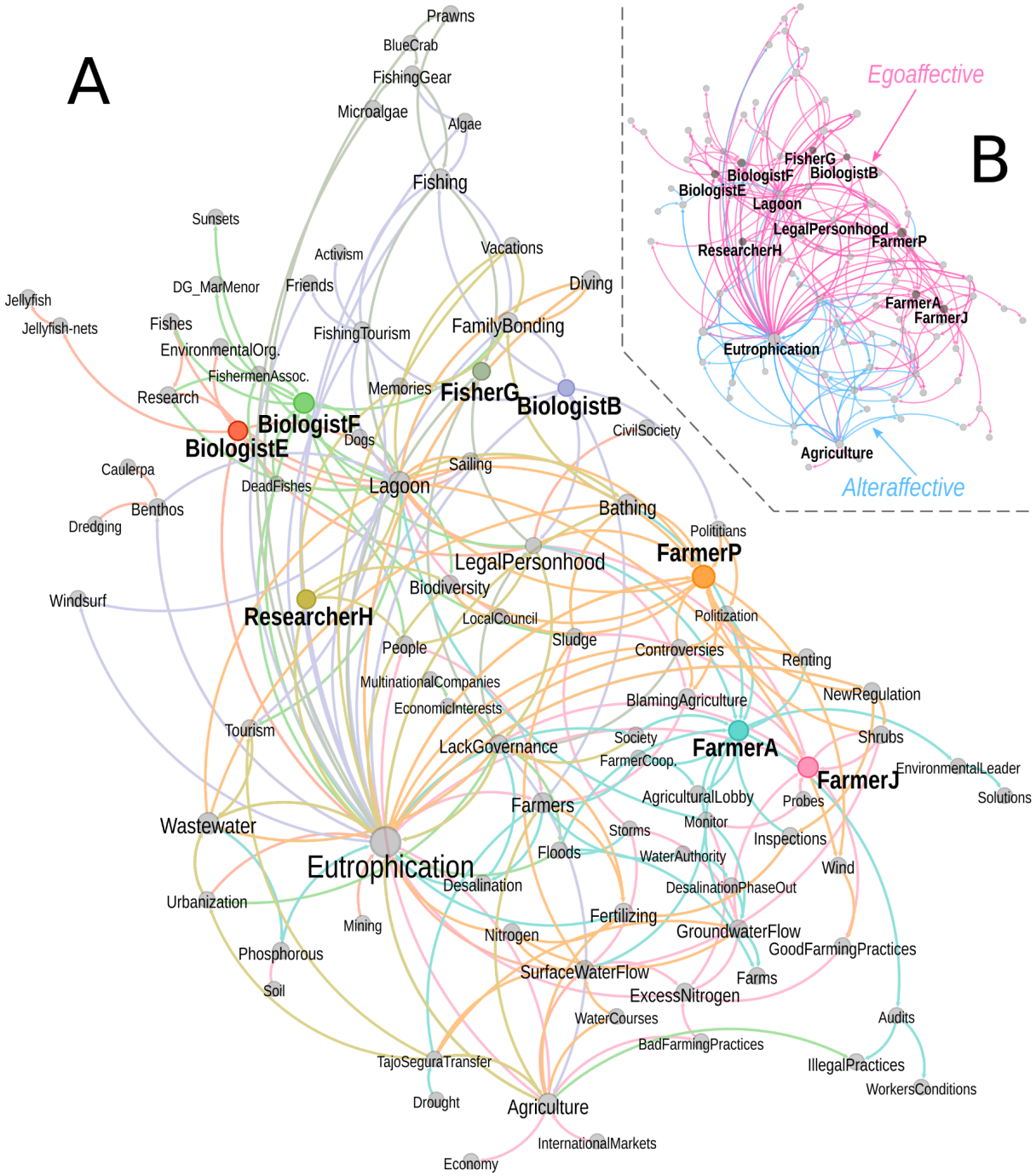

Figure 3 The Mar Menor sea of SEAAs. Panel A depicts links representing affects (colored according to the first narrator that reports them). Nodes represent the heterogeneous elements that compose the socialecological arrangement: narrators (colored) and practices and entities (in grey). Node and label size are proportional to the number of affections or incoming connections (In-Degree). Panel B depicts the same network but relations are classified as egoaffective (pink) or alteraffective (blue).

During our conversations, connections to the lagoon were mostly narrated in terms of practices that enable family and more than human bonding (vacations, bathing, diving, sailing, spending time at the beach, fishing). These practices entangle interviewees and the lagoon through emotions such as joy, childhood feelings or nostalgia. Only one interviewee, Farmer J., never really enjoyed recreating in the lagoon "it's always been too muddy, I prefer diving in the big sea, the Mediterranean". For the rest however, the lagoon is deeply ingrained in who they are "I obviously feel it as a loss. Losing the Mar Menor. I was raised here, with my family. I learn to swim, to dive, here. It's been seven fisher generations here…well, my father was the last one…(his voice slightly cracks)".

Eutrophication occupies a central position in the arrangement, as it intertwines emotionally loaded narratives around the lagoon's shifting conditions with causal framings for what is happening. Problem framings (alteraffective network) identified similar processes driving eutrophication: the Tajo-Segura water transfer, the associated expansion of agriculture and urbanisation, and the poor public governance (highest degree and betweenness centrality). Yet, as expected, interviewees substantially differed in the details of how those processes are connected with the lagoon, with farmers providing richer explanatory pictures for water-nutrient flows and ("good", "bad", "illegal") farming practices related to the agricultural world, displayed on the bottom right side of Figure 2. On the other hand, biologists and Fisher G. shared details on how lagoon's processes were affected by eutrophication (affections to benthonic vegetation, expansion of new invasive species, deterioration of fishing gear), shown on the top half of Figure 2.

Interviewees also differed in the type of consequences they were facing after the eutrophic events took place (egoaffective network). The most central entities in the egoaffective network are lack of public governance, family bonding and bathing in the lagoon, followed by other practices like diving and sailing, all of which have been restrained by algae proliferation, the greeny waters and the layers of ("nasty") sludge and mud accumulated on the lagoon' bed. This is experienced as loss and deep sadness by those who cannot share this relational legacy with their kindred. In response, biologists experts in the lagoon had engaged in new projects after eutrophication, they have become activists and expanded their connections through the wide network of environmental organisations. For farmers, the picture looks quite reversed, as they share a perception of being publicly appointed for polluting the lagoon while suffering sanctions and the costs for changing their practices (which gets captured by the centrality of nodes "blaming agriculture" and "controversies" on the farmer's side of Figure 2). They all mention the new regional regulation imposing

controls over fertilization and planting shrubs on farms to retain water flows. They have an ambivalent relation to these shrubs, as they see them as just small patches for a gigantic problem, but still take care of them as new inhabitants in their farm.

Lack of governance of the eutrophication problem and its causes appears again as the most central entity in the egoaffective network (measured highest degree and betweenness centrality). Farmers feel emotionally drained by how public authorities have poorly planned the territorial transformations along previous decades, leading to a situation they perceive as unfair and stalled. Other connections to governance refer to the prospects for the legal personhood initiative to spark more ambitious public action. Relations to the legal personhood were also quite emotional, as the initiative raises a variety of reactions from hope and admiration for being capable of organising society in a common purpose, to skepticism and fear of being weaponized against farmers.

4.3 Polarized SEAAs?

The node-level analyses of the egoaffective and alteraffective networks grouped interviewees in two, farmers and the rest (Figure 3). This result supports our hypothesis: our Mar Menor SEAAs are divided between "the land" and "the sea" (Levain et al., 2020), both in the way interviewees are bound to the lagoon and feel the impacts of eutrophication and in the way they narrate the causes of the problem. It also shows how framings of the eutrophication problem align with how interviewees are affectively related to the lagoon's deterioration.

However, there are significant nuances. First, none of the clustering procedures showed a very high significance which is rather normal considering the limited number of interviewees. The egoaffective network Modularity had a low resolution (0.9) indicating small and not strongly demarcated groups. On the other hand, most Jaccard distance values of the alteraffective net are lower than 0.35, meaning that even if some interviewees are closer than others, the structure of their problem framing do not sharply differ. These results speak of a connected rather than strongly polarized network, with some actors playing bridging positions. This is the case of farmer P. in the egoaffective network (Figure 4A), who has a higher number of connections (shared entities) than the other farmers with the rest of interviewees, or Fisher G. in the alteraffective network (Figure 4B), who shares entities with all farmers, biologists and, especially, with ResearcherH (J.M. Zaragoza).

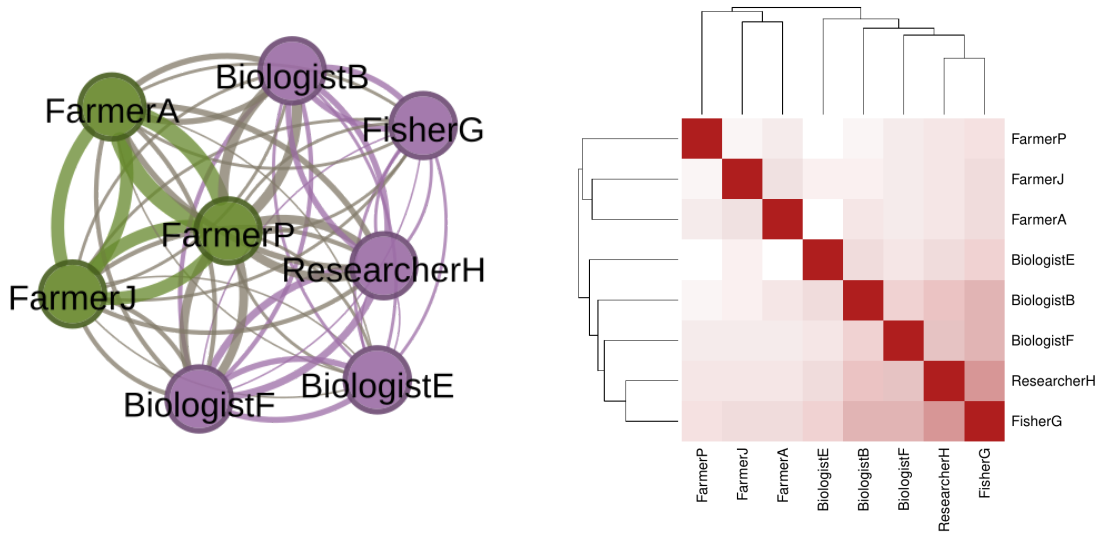

Figure 3 Results for clustering processes in egoaffective (A -left) and Jaccard distance heat map comparing alteraffective (B-right) networks.

5 Discussion and outlook

With the SEAA concept we make a double contribution. On the one hand, we expand and specify the concept of affective arrangements (Slaby, 2019; Slaby et al., 2019a) for socialecological agencies with geographical relevance. On the other hand, we expand the relational turn in sustainability science (Brugnach 2017, Mancilla Garcia et al., 2020; West et al., 2020, 2024) bringing a new conceptual and methodological tool for 'emotionalizing' socialecological research. In this section, we discuss the main methodological and conceptual threads opened by SEAAs, as well as their implications for governance.

5.1 Methodological inquiries into future SEAAs

Following an ethico-onto-epistemological position (Barad, 2015), proposing the SEAA concept is necessarily situated in the experiences we had in the Mar Menor and in the type of methodological apparatus we craft. Drawing on our previous mixed-methods explorations (Charli-Joseph et al., 2018; González-Mon et al., 2025), we have integrated relational approaches to interviewing and coding with a structured procedure for deriving socialecological affective networks. This *mapparatus* opens an interdisciplinary pathway for qualitative and network scholars to collectively explore affective relationality.

As a concrete example of application, knowledge co-production research often applies system mapping techniques such as Fuzzy Cognitive Mapping (Herreros-Cantis et al., 2025; Barbrook-Johnson & Penn, 2022) to explore how diverse participants frame environmental problems. SEAAs, in conjunction with systems mapping, offer an innovative tool for situating problem statements in their specific affective worlds. In this way, they circumvent the methodological limitations of the separation between qualitative and quantitative

approaches. The visual richness of network analyses can be used within co-production workshops to enhance participants' understanding of differences and ambiguities (Brugnach, 2017; Özkaynak et al., 2023). Moreover, the *mapparatus* can be applied longitudinally along co-production processes in order to trace concrete relational changes and learning (Charli-Joseph et al., 2022; Cabello, 2024; Seiferth et al., 2025).

Another methodological avenue for future research comes from defining affects and emotions as valenced relations depending on whether they increase (+) or diminish (-) entities capacities. Albeit contained in our network dataset, we did not yet explored this extra layer of information for it requires a more refined theoretical elaboration of the multidimensional political roles of emotions than can be made in this paper (Durnová & Karell, 2023; González-Hidalgo & Zografos, 2020). Future work might explore the affective states of full SEAAS, the so-called affective atmospheres (Anderson 2009, Verlie 2019) through different methods for capturing the valence and potential weight of relationships between network components.

A final point on methodology concerns the constraints imposed by data. Thinking SEAAs with the interviews of (a limited number of) human beings required centring those as narrators whose perspectives compose the sea of SEAAs. Other methods for mapping socialecological relations such as multi-species ethnographies (van Dooren et al., 2016; Tsing et al., 2020) may provide more decentralized accounts that make full justice to the relational ontology underpinning the SEAA concept. Additionally, cultural and interdisciplinary studies of affect and emotions have developed a full repertoire of qualitative methods beyond interviews to capture affects and emotions (see Kahl, 2020).

5.2 Analytical pay-offs of the SEAA concept

The SEAA concept foregrounds affective experience as a crucial source of information for understanding complex environmental problems, showing how affects and emotions co-constitute the worlds we live in and narrate (Nightingale et al., 2022; Slaby & Von Scheve, 2019; Slaby, Von Scheve, et al., 2025). Our analysis of Farmer P. SEAA in section 4.1 reveals how human subjects grow and change embedded in changing environments, *affecting-while-being-affected* by them (Cunsolo Willox et al., 2013; Jankowski et al., 2025; Strzelecka et al., 2025). This is shown in how Farmer P. describes his every day contacts with the lagoon since childhood, but also in how he is affected by a multiplicity of socialecological relations in the watershed. Farmers irrigation practices shape groundwater levels: A change in groundwater levels might induce a change in the mood of Farmer P. Thereby, SEAAs helps visualize distributed forms of agency, contributing to non-solipsistic conceptions of more-than-human subjectivities (Braidotti, 2019; Neimanis, 2017; Roelvink & Zolkos, 2015).

Furthermore, Farmer P. SEAA visualizes the contradictory ways in which we inhabit our environments, caring for them while having a role in their deterioration (Nightingale, 2013). His story is illustrative of the ambivalent roles of emotions in ecological crises beyond the,

too often assumed, capacity to mobilize for action (Neckel & Hasenfratz, 2021; Schütze et al., 2022). One can grieve the lagoon's eutrophication while feeling anger against the policies in place to prevent nutrient leakage, denying your quote of responsibility as means to cope with inner emotional conflicts or preserve collective identities (Norgaard, 2006).

When assembling the sea of SEAAs, the lagoon's entanglements become multiple and interdependent. Each person and community in this territory has a different experience and relational composition with the Mar Menor (tourists, environmentalists, farmers, fishermen…). However, those arrangements are not isolated narratives of what the Mar Menor is. They are affectively and spatially connected, and their encounters reveal the part of the world that interviewees share, even when their affective experiences of that world may differ significantly. Our analysis sheds light on how different SEAAs overlap and rub each other when, for instance, sailing in the same sea, or highlighting the consequences of the largest hydrological infrastructure in Spain (Juan Manuel Zaragoza, 2026). Sometimes they scratch harder, projecting the shared frustration generated by the long-term structural abandonment of the problem (Cabello Villarejo & Serrano, 2024; Sobczak-Szelc & Chułek, 2025) on blaming those others they hold responsible.

Crucially, affective arrangements are always in the making and connect different temporalities (Cunsolo Willox et al., 2013; Slaby et al., 2019a). Whereas our networked SEAA (Figure 2) presents an image from interviews held in March 2022, it displays different stories for how the lagoon has changed over the years together with its relational entanglements – from idyllic family recreation site in the past, to muddy-greeny-eutrophicated waters spitting dead fishes out in 2016-2019-2021, to legal subject emblem of global ecological justice in 2021-2022–.

The different crises of the Mar Menor have not only become polarizing forces but also relational blenders with transformative effects over the many Mar Menors. This ambivalent becoming is shown in our clustering analysis in section 4.3, rendering farmers and other participants as different groups. This speaks to sociopolitical approaches on how emotions both drive and result from group dynamic and confrontational politics (González-Hidalgo & Zografos, 2020; Durnová & Karell, 2023). The cleavage between farmers and environmentalists narratives (Cabello & Brugnach, 2023; Levain et al., 2020) can be interpreted in terms of the different ways in which they, individually, collectively and dynamically experience the consequences of eutrophication – emotional impacts of fish dieoffs, socioeconomic depression of touristic and fishing sectors, new constraints to farming practices, engagement or not in social activism.

5.3 Implications for an affective knowing agenda

We would like to conclude by revisiting the problem statement of environmental knowledge being reduced to purportedly objective facts disregarding the affective dimensions of socialecological crises (Hertz et al., 2020; Nightingale et al., 2022; Slaby, Von Scheve, et al.,

2025; Sorman & Galende-Sánchez, 2025). We have argued that one side of this problem is the lack of interdisciplinary tools capable of connecting socialecological models with qualitative information on human and more-than-human affective worlds.

By analysing emotions enmeshed within wider socialecological affective networks in the Mar Menor, we have demonstrated how causal framings of the eutrophication problem align with the diverse attachments to the lagoon and its deterioration. Thereby, SEAAs help foreground knowing-feeling narratives (Fals-Borda, 2012), assuming all facts emerge from affective relations. This affective knowing stance (Nightingale et al., 2022) proved particularly useful for deep-diving in polarizing topics with participants in the later knowledge co-production experience (Cabello 2024). It also helped demystify false facts circulating in disinformation campaigns and reframe controversies to discuss how their local knowledge could be mobilized to address existing uncertainties and take actions.

Overall, we argue that a SEAA approach supports an agonistic sustainability governance (Mouffe, 2016) in the Mar Menor. The new legal personhood has devised spaces for democratic participation including a scientific committee. We dare to ask: what if this committee goes beyond traditional monitoring of ecological indicators to pay attention to the multiplicity of affective entanglements with the lagoon and their conflict-cooperation dynamics? Any answer at this stage is pure speculation, but whatever action they take it will still be enmeshed in a sea of many SEAAs.

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