

Becoming entangled: Producing marine protected areas through Dolphin-Fisher relations in Southern India

EPE: Nature and Space

1–18

© The Author(s) 2026

Article reuse guidelines:

sagepub.com/journals-permissions

DOI: 10.1177/25148486261478098

journals.sagepub.com/home/ene

**Rahul Muralidharan**^{1,2} 

Abstract

Marine protected areas (MPAs) are widely used for biodiversity conservation through spatially defined zones that regulate human activity. While contemporary practices increasingly emphasise flexible, participatory, and adaptive governance, they continue to rely on area-based approaches that seek to regulate ecological processes through territorial management. Drawing on ethnographic research in the Gulf of Mannar Marine National Park in southern India, the paper examines how conservation is experienced and operationalised in marine environments where species move, fishing practices shift, and conservation authority extends beyond formally demarcated boundaries. Focusing on interactions between humpback dolphins, artisanal fishers, and state actors, the paper shows how dolphin depredation reorganises fishing locations, gear use and temporal rhythms, redistributing fishing effort across the seascape. Situating these interactions within broader transformations in fishing technology and ecological decline, it further demonstrates how state actors selectively prioritise species protection through surveillance and negotiated enforcement. The paper argues that marine conservation territories are produced not solely through fixed spatial exclusion, but through the interaction of dolphin mobility, fisher adaptations and governance practices, including territorial restrictions, species-based legal protections, surveillance practices, and negotiated enforcement. Conservation effects, therefore, emerge beyond the protected area boundaries through the interaction of ecological processes and governance practices rather than territorial regulation alone. In doing so, the paper reconceptualises MPAs as dynamic conservation spaces continually produced through multispecies interactions and everyday governance.

¹Ashoka Trust for Research in Ecology and the Environment, Bengaluru, KA, India*

²School of Sustainability, IIT Madras, Chennai, India

*This article is based on my doctoral work, which was conceptualised during my stint at the Ashoka Trust for Research in Ecology and the Environment (ATREE), Bangalore, India. This article was written during my time at School of Sustainability at the Indian Institute of Technology Madras (IIT Madras), Chennai, India.

Corresponding author:

Rahul Muralidharan, The Energy Consortium and School of Sustainability, Indian Institute of Technology Madras, IIT P.O., Chennai 600 036, Tamil Nadu, India.

Email: rahul.muralidharan1988@gmail.com

Keywords

Marine protected areas (MPAs), multispecies relations, political ecology, marine governance, more-than-human geography, India

Introduction

Marine protected areas (MPAs) are central to contemporary ocean governance and biodiversity conservation. They encompass a wide range of strategies, from strict no-take reserves to multiuse and co-managed areas, and are increasingly framed as flexible, participatory and adaptive instruments. (Adams et al., 2023; Artelle et al., 2019; Gill et al., 2024; Grorud-Colvert et al., 2021; Jupiter et al., 2014). A growing body of scholarship has highlighted this diversity, showing MPAs are unevenly enforced, socially embedded, and shaped by ongoing negotiations among actors (Bennett and Dearden, 2014; Jones, 2014; Mascia and Claus, 2009). Recent debates have increasingly shifted attention from expanding MPA coverage to enhancing the quality and effectiveness (Pike et al., 2024). Conservation effectiveness is commonly evaluated through ecological recovery, biodiversity outcomes, governance performance and compliance indicators. This paper complements these approaches by examining how conservation effects are enacted and experienced through everyday interactions among mobile species, resource users and state actors in dynamic marine environments.

Despite advances, MPAs continue to rely on spatial strategies and area-based approaches that aim to stabilise marine environments by fixing boundaries, zoning, and regulating access (Gray, 2018; Peters, 2020). Even in their more flexible and participatory forms, they assume that conservation can be organised within territorially defined spaces, where human activities are managed, and ecological processes are contained. This assumption sits uneasily with a growing body of work in human geography and multispecies studies that emphasises the fluidity, mobility, and relational character of marine environments, challenging fixed spatial thinking (Anderson and Peters, 2014; Steinberg and Peters, 2015). Oceans are not stable surfaces but are shaped by currents, species movements, and human practices, raising questions about how conservation space is actually constituted.

Political ecology has questioned the assumption that MPAs are neutral conservation instruments, drawing attention to the political and spatial process through which conservation territories are produced and contested (Benjaminsen and Bryceson, 2012; Chmara-Huff, 2014; Satizábal and Batterbury, 2018). Multispecies and more-than-human approaches have shown that non-human lives actively shape human practices and spatial arrangement, challenging assumptions of human control over the environment (Bear, 2013; Ogden et al., 2013; Whatmore, 2006). Co-production has further demonstrated that environmental governance is enacted through everyday practices in which rules, knowledge, and authority are continually negotiated (Jasanoff, 2004; Turnhout et al., 2016). Yet these perspectives have been rarely brought together to explain how conservation space itself is materially constituted in dynamic marine environments.

This paper addresses this gap by examining how everyday interactions among dolphins, fishers, and state actors produce the effective spatiality of MPAs themselves. Focusing on encounters between artisanal fishers and Indo-Pacific humpback dolphins, I show that dolphin foraging behaviour reorganises fishing activity by creating temporary zones of avoidance where nets are damaged, and catches are lost. Fishers respond by altering fishing locations, gear types, and temporal rhythms, redistributing effort across the seascape. State actors, operating under legal mandates to protect dolphins and practical constraints on enforcement, selectively stabilise

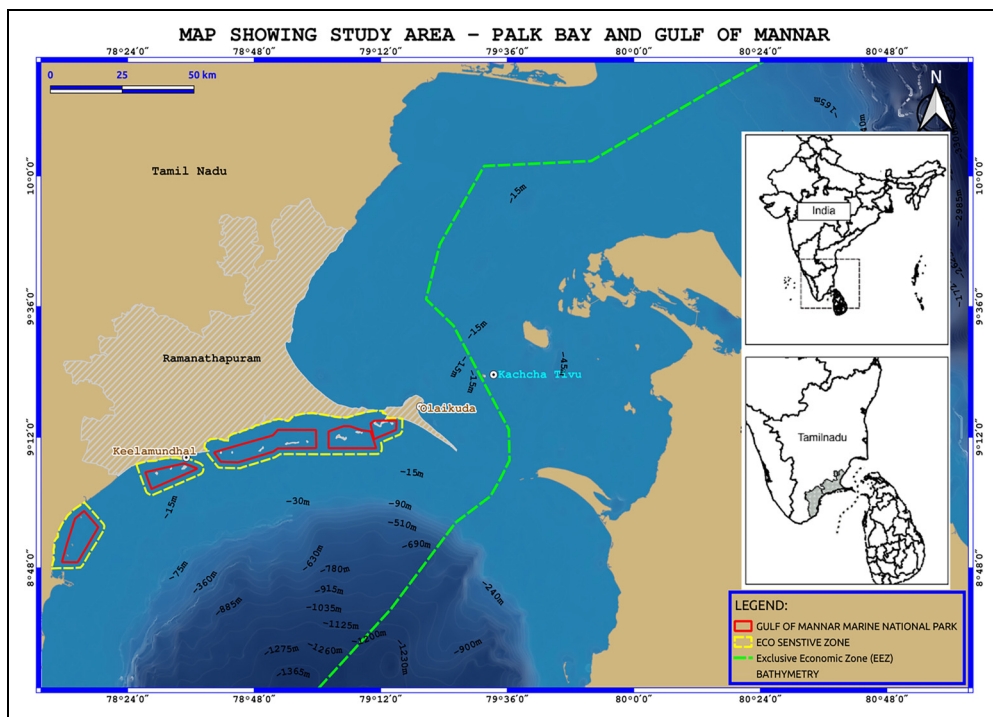


Figure 1. Map showing the study area and the Gulf of Mannar Marine National Park located in Southern India.

these dynamics through negotiated enforcement and surveillance. To conceptualise this process, I develop the concept of “becoming entangled”. Becoming entangled describes a recursive process in which dolphin mobility reorganises fishing practices, fisher responses redistribute effort, and governance selectively stabilises these new spatial arrangements, continually reconstituting conservation space.

The Gulf of Mannar Marine National Park (Gulf of Mannar MPA), located in Tamil Nadu, India, provides a particularly revealing case for this analysis (See Figure 1). The Gulf of Mannar MPA comprises a chain of fringing coral reef islands surrounded by legally demarcated restricted-access zones, embedded within a region of intensive artisanal fishing and the presence of mobile marine species. Interactions between dolphins and fishers predate the establishment of the MPA. Although dolphin protection extends beyond the MPA through broader wildlife legislation, the protected area reshapes how these interactions are governed by restricting the range of responses available to fishers. Dolphins, therefore, occupy a distinctive position within the Gulf of Mannar MPA because their everyday interactions with fishing practices make species protection materially consequential in ways that many other protected species do not.

Territorialisation and the political ecology of MPAs

The governance of global oceans and the conservation agenda is mainly driven through the state’s establishment of conservation territories, such as MPAs (Campbell et al., 2016; Gray, 2018; Hung and Lien, 2022; Mansfield, 2004). Contemporary ocean governance frameworks, from exclusive economic zones to area-based management tools such as MPAs, rely on territorial logics that



Figure 2. A humpback dolphin with a mullet in its mouth at Mandapam (south) fishing harbour, Gulf of Mannar.

aim to stabilise marine environments through fixed spatial designations and regulatory control. (Acton et al., 2019; Campling and Colás, 2018; Mansfield, 2004; Melvin et al., 2023; Peters, 2020). Such approaches implicitly assume that conservation can be achieved by demarcating protected areas and organising human use around them, despite the mobility, fluidity, and ecological interconnectedness of marine ecosystems.

Political ecology scholarship has critically examined how MPAs are shaped by power, exclusion and authority that is contested, in which conservation territorialisation reshapes access and governance (Benjaminsen and Bryceson, 2012; Bennett and Dearden, 2014; Chmara-Huff, 2014; Gray et al., 2014; Kamat, 2018; Satizábal and Batterbury, 2018; Walley, 2004). Studies have also shown how MPAs redistribute access to resources, impose uneven costs on coastal communities, and generate forms of resistance and negotiations among resource users (Baker et al., 2021; Baker-Medard, 2019; Lynch and Turner, 2022; Peterson and Stead, 2011; Raycraft, 2019b). MPAs emerge as socially embedded governance arrangements in which legitimacy, compliance, and enforcement are continuously negotiated rather than as simple enclosures.

However, despite these critical insights, political ecology analysis often treats MPAs' spatial form as a given. They focus on how actors contest, resist, or negotiate within and against bounded territories, rather than examining how those spatial boundaries are materially constituted and reworked in practice. As a result, conservation space often appears as a pre-defined container for governance and conflict, even in contexts where ecological and social dynamics exceed mapped boundaries.



Figure 3. Fishers mending holes made by dolphins on shore seine nets.

Multispecies relations and relational space at sea

A parallel body of work in multispecies studies and more-than-human geography challenges such assumptions that space can be treated as a stable container. These approaches emphasise that marine environments are inherently fluid, shaped by the movement of currents, species, and human practices, and therefore cannot be fully stabilised through fixed spatial designation. (Anderson and Peters, 2014; Peters, 2014; Steinberg and Peters, 2015). Nonhuman organisms are not passive occupants of space but active agents that shape human activities, redistribute effort, and reorganise spatial relations (Bear, 2013; Bear and Eden, 2008, 2011; Ogden et al., 2013; Van Dooren et al., 2016).

This perspective is particularly significant in marine contexts, where species mobility and environmental variability constantly reconfigure the conditions under which livelihoods and governance operate. For instance, fishing practices are not simply organised within predefined zones but are constantly adjusted in response to ecological conditions, uncertainties and interactions with other species. Therefore, marine spaces appear not as territorially bounded units but as relational spaces emerging through multispecies encounters.

However, while multispecies approaches effectively destabilise fixed notions of space, they often pay limited attention to how governance structures such as MPAs are materially enacted within these dynamic conditions. As a result, conservation territories remain analytically backgrounded, even as relational ontologies demonstrate that the spatial foundations of governance are inherently fluid. This leaves open the question of how conservation space in MPAs is constituted through the interactions among mobile species, human practices, and regulatory arrangements.



Figure 4. Humpback dolphins approaching the cod end of the shore seine net, while two fishers are there to prevent gear damage.

Governance, co-production, and everyday practice

Conservation governance cannot be understood merely as the application of rules to bounded areas if marine space is relational and mobile, other than being territorially fixed. Work on co-production and environmental governance further complicates the idea of conservation as a top-down imposition on bounded space. Governance is enacted through everyday practices in which rules, authority, and knowledge are continually interpreted, negotiated, and adapted (Jasanoff, 2004; Turnhout et al., 2016). Studies of MPAs have shown that enforcement is often selective and uneven, shaped by practical constraints, ecological conditions, and the need to maintain legitimacy among resource users (Baker et al., 2021; Baker-Medard, 2019; Bennett and Dearden, 2014; Cañada, 2024; Peterson and Stead, 2011; Raycraft, 2019a). From this perspective, conservation outcomes emerge not only from policy design but also from how governance is carried out in practice.

Co-production approaches tend to assume a pre-existing spatial frame within which these interactions unfold. While they show how governance is socially enacted, they pay less attention to how the spatial form of conservation itself is constituted through the everyday interactions of mobile species, human practice, and governance.



Figure 5. Remains of a barracuda head in a monofilament gill net that dolphins depredated.

Becoming entangled: Producing conservation space in practice

Taken together, political ecology, multispecies approaches and co-production perspectives highlight that marine conservation is shaped by power, practice and multispecies interactions. However, each approach leaves a gap. Political ecology foregrounds territorial governance and uneven consequences but treats spatial form as given. Multispecies approaches destabilise spatial fixity but do not fully engage with governance structures. The co-production perspective highlights practice but assumes a stable spatial frame.

To address this gap, I develop the concept of “becoming entangled” as a framework for analysing how conservation space in MPAs is materially constituted in marine environments. Becoming entangled is not simply coexistence or interactions. It describes a recursive process in which



Figure 6. Knots being tied on a mackerel net due to holes made by dolphins.

dolphin mobility reorganises fishing practices, fisher responses redistribute effort, and governance selectively stabilises these new spatial arrangements, continually reconstituting conservation space. Instead of treating space, governance, and agency as separate analytical domains, this perspective foregrounds their mutual constitution. Mobile species reshape human practices by redistributing risk and opportunity across the seascape. Resource users adapt by shifting timing, location, and technology, altering their patterns of effort and access. State actors, operating within operational and institutional constraints, selectively stabilise or tolerate these dynamics. Through their interaction, the effective spatiality of the MPA is continually reworked in practice.

This approach shifts attention from viewing MPAs as bounded territories governed through spatial control to understanding them as unstable spatial formations that emerge through ongoing multispecies interactions. It highlights the limits of governance in stabilising marine environments and draws attention to how conservation outcomes can arise through indirect ecological interactions as well as formal regulation. This framework guides the empirical analysis that follows by examining how dolphin mobility, fisher adaptations, and governance practice interact to produce the effective spatial configuration of the Gulf of Mannar MPA.

Methods

This study draws on ethnographic fieldwork between 2016 and 2018, with a follow-up visit in 2019, in fishing villages surrounding the Gulf of Mannar Marine National Park in Tamil Nadu, India (See Figure 1). Ethnography was chosen to capture the everyday practices and interactions through which marine conservation is experienced and negotiated. The Gulf of Mannar Marine National Park comprises a chain of 21 fringing coral reef islands, and the 500-meter-wide area surrounding these islands forms the core of the MPA, with a 10 km buffer zone covering the sea and the coastal

zones. The Gulf of Mannar Marine National Park was established in 1986 and, in 1989, expanded into a Biosphere Reserve covering 10,500 sq km. Since the establishment of the MPA, fishing from the islands and access to core protected zones have been restricted under MPA regulations. In addition, the taking or harming of protected marine species, including dolphins, is prohibited under broader national legislation, the Wildlife (Protection) Act, 1972, that extends beyond the MPA itself.

Conservation restrictions were further enforced in 2002, when a United Nations Development Program (UNDP) and Global Environment Facility (GEF) initiative was launched to promote the sustainable use of marine resources. The islands are considered a lifeline for artisanal fishers in the region, as they buffer winds and waves and provide calm fishing areas with abundant traditionally harvested resources. Fishing villages adjacent to the MPA rely heavily on island and near-shore resources through artisanal, small-scale fishing, with activities occurring both within and outside the MPA, including in restricted zones where enforcement is uneven and compliance is negotiated in practice. The Forest Department and the Gulf of Mannar Biosphere Reserve Trust (GoMBRT), both government bodies in Tamil Nadu, are tasked with enforcing the rules and managing the MPA.

Data was collected through qualitative topic-guided in-depth interviews, participant observation, and field notes recorded during daily fishing activities. A total of 60 interviews were conducted with artisanal fishers across different gear and boat types, community leaders, local organisations, and state actors, including Forest and Fisheries Department officials and security agencies. The sample was male-dominated as women fishers were not accessible due to prevailing cultural norms in the field sites. Interview participants were recruited through purposive and snowball sampling (Maxwell, 2013). Each interview lasted 45–60 min and covered fishing practices, dolphin encounters, conservation regulations, and the challenges of managing the MPA. Repeated participation in and observation of fishing trips, landing-site interactions, and patrolling activities on the islands enabled triangulation among interviews, observed practice, and informal conversations among fishers and state actors, including staff from the Fisheries and Forest Department. Interviews and field notes were coded thematically using qualitative analysis techniques. Codes were developed inductively from the data and focused on themes such as dolphin encounters, fishing practices, and interactions with governance. They were then analysed to examine how multispecies interactions shape the spatial organisation of fishing practice within and beyond the MPA.

This research is informed by more-than-human scholarship that seeks to account for the agency of non-human actors in social research (Dowling et al., 2017). It does not directly study dolphins using ecological methods. Instead, it examines how dolphin behaviour is encountered and interpreted through fishing practice, allowing analysis of multispecies interactions as they are experienced in everyday life and their role in shaping the MPA.

Encountering dolphins: Mobility, knowledge and material consequences

It was a windy July morning. The sea was rough with lapping waves accumulating dead seagrass on the shore. I was walking on the beach during my first visit to a fishing village adjoining the Gulf of Mannar MPA. The boats that went out for fishing had returned already and were stowed away from the sea. On the beach, Muniasamy (68) was cleaning his net, removing seagrass and fish after returning from a fishing trip. I went up to him and asked if dolphins were a problem for fishing. He looked up and said sternly, *“The dolphin is a thief, which steals the fish from us. Same as a human being who steals things from people”*. He said he experiences a sheer sense of helplessness as dolphins cause a loss to livelihoods by eating away fish from the nets and damaging them beyond

repair. Dolphin encounters were not isolated events but a routine feature of everyday fishing in this village, as in several others along the coast. Conversations about such encounters served as an entry point into understanding how fishers interpreted dolphins' movements and behaviour.

Fishers in the region describe dolphins as highly perceptive and adaptive animals, as they "come from wherever they are" as soon as nets are soaked, guided by sound, smell, sight and water movement (See Figure 2). Fishers say that the dolphins can sense the engine sound and direction of the motorised boats they use, as they start from the shore and reach the fishing grounds to depredate on nets. Fishers used oar-propelled boats that were largely silent, before technological change and rarely experienced such depredation events.

The dolphins also use light as a cue to spot fishing boats during early morning and night hours. An old fisherman said that, in the past, while fishing before sunrise, he would be afraid to light a matchstick to smoke on the boat, as dolphins would see the light and come straight to the boat to depredate the nets. At present, fishers operating drifting gill nets use flashing lights installed on poles and tethered to the gear. They do this to identify where the fishing gear has drifted through the darkness and to indicate to other fishers at sea to prevent damage. When I talked to a fisher engaged in drift net fishing, he said, "*The dolphins come up to see where the light is, and then they go to the light to find fish nets*" (interview, 19 November 2016).

I spoke to a group of fishers sitting beside their boat at the landing site shortly after sunrise. Torn sections of gill net were spread across the sand as they were sorting the day's catch. One fisher held the damaged section of the net and said that the dolphins "*had only left us two fish today*". Another interrupted before he finished, laughing bitterly that "*the dolphins only eat the expensive fish*." I was perplexed upon hearing this. Only later, upon further explanation, did it make sense: bright-coloured fish, including white and silver ones that fetch higher prices in the market, are preferred by dolphins over dark-coloured fish, as some of the latter are venomous. Fishers explained that during clear-water months, dolphins could easily see fish entangled in the nets, making encounters more frequent and harder to avoid.

Every fishing day begins with uncertainty and anticipation. I observed how the fishers constantly scan the horizon, looking for dorsal fins as dolphins surface to breathe, on board fishing trips. At times, fishers head out to the sea right after midnight, fishing in pitch darkness and complete silence, in order to avoid dolphin encounters. They only use brief flashes of torchlight to indicate to other fishers at sea to beware of deployed nets. While speaking to a fisher on a night trip, he said, "*When the dolphins come, we can hear their breathing sounds. Alternatively, it will slap its tail on the water, which sounds like a blast. When we hear that sound, we know there will be no catch today.*"

Dolphin encounters meant fishers had to remain constantly attentive to changing conditions at sea and work more intensively to prevent gear damage and economic loss. One morning, at around 6:45 am, the boat I was on board turned east and made way to a sandy bottom fishing ground called 'seven-palm berm' (due to the presence of seven palm trees on the adjacent shore), known for abundant fish and dolphin presence. The crew sighted a school of fish and immediately laid the nets to encircle it. A crew member said, 'The dolphins are here.' Once dolphins appeared, the atmosphere on the boat quickly changed, and so was the rhythm of work. The net would have barely remained in the water for 15 minutes. Amidst intense commotion, the skipper said, "*We need to retrieve the nets as soon as possible, otherwise dolphins would make holes*". The crew began shouting '*ongi.. ongi..*' (a local word for dolphin) as the skipper chanted '*alli, alli, alli*', and the crew heaved and synchronously pulled the long net with much effort as quickly as possible. Dolphin encounters, as I realised, were not simple episodes of gear damage; they altered the way fishing itself happens, since the consequences were felt on the shore.

On a searing afternoon during the shore seine fishing season, I noticed an elderly fisherman and his grandson repairing the net spread across the beach. I could see many circular holes punched through the yellow cod end of the net where dolphins had bitten through the mesh

(See Figures 3 and 4). While mending, the old man went on: *“In the past, dolphins would eat four or five fish and leave. Now, not only do they eat a lot of fish, but they also tear the net. When the shore seine net comes close to the shore, they come exactly at that time”* (Interview, 5 July 2017). The next morning, I saw Umayarasu (48) sitting beside his boat and making small knots in an otherwise empty gill net (See Figures 5 and 6). Besides him, his wife was pulling apart the mesh holes punctured by the dolphins carefully before they could be repaired. Holding up the damaged gear, the fisher remarked that after dolphin depredation, the day’s catch would barely fetch ₹200 (\$2). His wife added: *“We cannot use fish nets because of dolphin trouble. We do not know what to do. Last year at this time, we landed many mackerel, but now dolphin trouble is extremely high”*.

Dolphin encounters, therefore, extended well beyond the moment of depredation as it continued on the shore through the labour of repairing torn nets, conversations about declining catches, and calculations about whether the next day’s fishing would be worthwhile. Experiencing immediate loss of fish was significant, as was the material work, household negotiations, and uncertainty that followed once the boats returned to shore.

Living with dolphins: The reorganisation of fishing practices

Fishers have gradually reorganised their everyday fishing practice to accommodate repeated encounters with dolphins rather than responding through confrontation. As my fieldwork progressed, I realised that stories about dolphin encounters rarely ended with the encounter itself. Conversations routinely shifted to questions about what should be done differently tomorrow: whether another fishing ground might be more productive, whether different nets would reduce losses, or whether dolphins had once again changed their behaviour. Adaptation, therefore, emerged less as a single decision than as an ongoing process of collective reflection, experimentation, and adjustment.

To counter dolphin depredation events, the fishers have adjusted their fishing schedules. One of the most immediate responses to dolphin depredation is early retrieval of nets. Once dolphins are around the boats, the fishers often pull their gear before the intended soaking time, even when the catch remains incomplete. During an interview, Umayarasu (65) said, *“As soon as we spot a dolphin, we pull the net as fast as we can. If we are slow, we lose the catch. Once one dolphin slaps its tail, the whole pod arrives. They leave large holes in the nets, and then our family spends many days repairing them.”* (7 July 2017). As he was inspecting holes in his fishing net, James (70) remarked one day: *“Sometimes, if we spot dolphins on the way to the fishing ground, we return to shore - once the net is cast, and dolphins arrive, nothing can be done. It is the dolphins that make the rules.”* (Interview, 3 July 2017). The decision to haul the nets early illustrates how dolphin encounters had become embedded within the temporal rhythms of fishing. Rather than following a fixed routine, fishers constantly adjusted their actions in response to anticipated dolphin movements.

Another form of adaptation is where fishers leave the shore shortly after midnight to deploy and retrieve the nets before dolphins become active at dawn. A fisher described, *“because these dolphins come very early, we go right after midnight. Despite that, dolphins come to bite one or two nets. They come exactly at sunrise, and it comes because it is hungry”* (Interview, 3 July 2017). These changes seldom offer lasting solutions, as dolphins were widely perceived to have learned and adapted to the altered routines of fishing boats. Such decisions transform what would otherwise be productive fishing grounds into temporarily abandoned areas.

During interviews and conversations, fishers frequently reflected on how changes in fishing technology have transformed both their fishing practices and their encounters with dolphins. In the past, dolphins damaged some gears used to target valuable fish species so badly that fishers abandoned those fisheries. John (70) who was speaking to me said: *“Back in the days, we used to use white nets (vella valai) made out of cotton, and it was the dolphins that stopped us from using those nets”*

(Interview, 24 June 2017). Older nets made of cotton were described as visible to fish and less efficient. In contrast, monofilament nets made of plastic were understood to dramatically increase catchability because “fish cannot see them in water”. They explained why catch increases because *“If ten fish come... in cotton nets, only two remain. Today, if ten fish come, then all ten get caught.”* Dolphin encounters have also led fishers to modify the fishing techniques of traditionally harvested species such as sardines. As one fisher explained: *“Before we used to leave the net in a straight line. Now we encircle the fish. If it is straight, the dolphins come easily and eat from the net.”* (Field notes, 21 December 2017). Encircling nets allow fishers to protect their gear better and reduce opportunities for dolphin depredation. When dolphin presence is perceived as high, even though high-value species are present seasonally, some fishers shift to crab nets or squid jigging because dolphins interfere less with these gears.

Another reason is that the older fishers rarely discussed dolphin encounters without simultaneously reflecting on how fishing itself has changed. Conversations on fishing repeatedly moved backward and forwards in time, as fishers compared cotton with monofilament nets, remembered periods before mechanised trawling became widespread, and described the rapid decline of catches across the region. Irudhayam (40) said, *“Trawlers are one way responsible for dolphins depredating artisanal nets because the trawlers pull the net on the seabed and kick up all the mud. The dolphins have nowhere to go other than come to our nets for feeding.”* (Interview, 4 July 2017). Likewise, James, for example, explained that dolphins *“often remained offshore feeding on discards from trawlers but turned to artisanal nets when trawlers were absent”*. Rather than attributing dolphin depredation to a single ecological process, fishers interpreted it through cumulative histories of technological change, environmental degradation, and shifting relations with the sea. Dolphin encounters thus became another way of narrating broader transformations of the Gulf of Mannar seascape.

Through dolphin encounters and depredation, the impact might appear to be felt by individual boat-owning fishers, but it often spills over into the household’s social and economic conditions. I have observed fishers spending many hours repairing their nets, sometimes from the morning after they returned from fishing until sunset. When dolphins depredate and tear up the nets, it increases labour hours not only for individual fishers but also for their families, including children and spouses. One November afternoon, I was waiting outside Caspar’s (58) house when his wife asked me about my research. She said, *“What are you studying dolphins for? You should be killing them for us.”* When I jokingly replied that I would end up in jail if I killed a dolphin, she responded that perhaps I could at least tell government officials about their situation so that they might receive support to replace damaged nets. She continued, *“The men come home dejected and sad. After putting in so much effort into fishing, they return with nothing. Diesel money and damaged nets go to waste because of the dolphins.”* This, in turn, leads to fewer fishing days due to postponement and income decisions, and at times to perpetual debt cycles from investments in new fishing gear.

At the same time, while it appears that fishers are responding to dolphin encounters individually, decisions about where to fish, when to go and whether to continue fishing emerged through conversations with other fishers before, during and after fishing. Fishers who mainly used oar-propelled boats gathered on the beach beside their boats during early hours before departure to observe the wind, waves and tides before deciding if weather conditions were favourable for fishing. Similarly, such discussions continued on water, with sightings of dolphins communicated to neighbouring boats. I was talking to a fisher after he returned to the shore, as he described warning two boats when a pod approached his nets. He watched the dolphins move from one boat to the next, prompting all three to abandon fishing and return to shore without any catch. Back on shore, fishers compared locations where dolphins had been seen, debated whether the same animals repeatedly visited particular fishing areas and exchanged ideas about changing fishing times, gears and target species. Tea shops and landing centres became important spaces where observations accumulated

across individual fishing trips were transformed into shared practical knowledge that informed subsequent decisions at sea.

Despite facing a range of challenges created by dolphins, the fishers are unable to fish freely, chase away or kill the dolphins because they are legally protected. While fishers are aware that dolphins are a protected species and harming them could result in fines, confiscation of gear or boats, or even arrest, the range of possible responses to dolphin depredation is constrained. Decisions about where and when to fish and which technologies to use redistribute effort across the seascape, extending the spatial effects of dolphin mobility beyond formal boundaries. Conservation space is not imposed solely through regulation. Still, it emerges from the interaction of animal behaviour and human practice, setting the stage for governance responses that further stabilise these dynamics.

Governance and the everyday enactment of the MPA

One morning, during my usual beach visits to observe the fish being landed on the shore, I was talking to a group of fishers who operate small, oar-propelled boats locally called ‘*Vathai*’ (in Tamil). Once they were aware of my presence, one of the fishers asked me, “*What to do about the ongi (dolphin), they create a lot of trouble*”. An old man sitting and cleaning the net opined: “*The only way to stop dolphins is to put dynamite*”. Upon hearing this, the other two fishers hushed up and responded by saying, “*Do not say that, the Forest Department will not allow it to happen*”. Similarly, I was talking on the beach with a boat owner when a young fisherman arrived and began to help clean the nets. He then said that “*he wanted to kill sharks because they bite off the fish from their gill nets*”. Once, he said that, he was visibly afraid and turned to the boat owner to ask if it was okay to talk about sharks in front of me, and he swore he would not do anything to the dolphins since he knew that I was researching dolphins in the village. With a history of bans and the taking of endangered species around the MPA, there was constant fear of enforcement authorities, which showed how surveillance was internalised.

I had official permission from the Forest Department to visit the islands for research purposes, and their staff were tasked with accommodating me during their patrols. However, the island visits often involved informal negotiations with the department’s anti-poaching watchers, who simultaneously conducted surveillance, mediated access, and managed their own precarious working conditions. During one visit, despite holding an official letter from the department, the watcher repeatedly contacted his supervisors to seek permission to take me on patrol while also requesting fuel money and mobile recharge cards to operate the patrol boat. While anti-poaching watchers are expected to remain stationed on the islands, this was rarely possible in practice. The watcher explained that his monthly salary was ₹9000, of which only ₹2000 was provided as a fuel allowance for the patrol boat. To cover additional fuel costs, he supplemented his income through fishing. As he remarked, “*I am actually supposed to stay on the island, but I rarely do. I come back home by about six in the evening*” (Fieldnotes, 27 June 2016). Limited financial resources, inadequate facilities, and safety concerns meant that surveillance depended on daily commuting rather than a continuous presence on the islands.

I have often observed anti-poaching watchers standing on the shore, scanning the adjacent island for anchored boats. In fact, Raycraft (2019a: 137) has made a similar observation in the Mnazi Bay-Ruvuma Estuary Marine Park in Tanzania, where only 50% of surveys were conducted over three years due to practical challenges. During the island visits, the watcher’s phone rang repeatedly. Each time he stepped away briefly, he responded, “*Ama, sir*” (Yes, sir) before reporting when we departed, where we were, what we were doing and when we returned. Surveillance, therefore, extended beyond the physical presence of patrol boats through continual communication with supervisors. Surprise inspections formed another layer of surveillance within the MPA. While walking towards the patrol boat, the watcher pointed out a broken bridge on the shore and explained

that the Wildlife Warden would occasionally appear at that spot without warning, then ask to be taken to the islands. These visits created a sense of urgency among the watchers, who “ran helter-skelter” to demonstrate that patrols were being undertaken.

The 500-metre zone around the islands forms the core of the MPA, which has legally demarcated boundaries and where entry is restricted without official permission. There have been attempts by the state, through the UNDP and GEF-funded project, to mark boundaries using floating buoys. However, the buoys were removed by protesting fishers because they impeded navigation and access to the island, and a few drifted away due to challenging environmental conditions. While on a patrol duty with an anti-poaching watcher, he abruptly stopped the boat at sea while approaching close to the island and said, “*This is the boundary line for the national park; no one should come inside without permission.*” (Fieldnotes, 14 July 2016). Fishers routinely crossed the boundary to reach fishing grounds or sought shelter on the island during rough weather. The anti-poaching watchers themselves acknowledged that such movements could not be monitored continuously, and rarely intervened unless protected species were perceived to be at risk. The boundary, therefore, functions less as a rigid territorial limit than a flexible point of reference through which state authority could be asserted when required.

Rather than strictly enforcing zoning rules, officers often prioritise dolphin protection while tolerating certain fishing practices that technically violate MPA regulations. The islands around which the MPA is demarcated occupy a complex position in local practices. Shore seine fishing has been a central activity of the region’s fishing community, which relied on island-based fishing, which was banned with the formation and later enforcement of the MPA. During rough seas and cyclones, the island offers small boats a place to anchor for protection from waves and strong winds, which the fishers consider a boon for their labour-intensive livelihoods. Fishers described requesting permission to anchor close to the islands, which required approval from Forest Department personnel, creating uncertainty about whether access would be allowed. The island serves as a conservation territory, a security frontier and a critical space for fishing livelihoods (Muralidharan and Rai, 2020). Governance does not fix spatial boundaries but produces conditional, negotiated access that varies with ecological and social circumstances.

Fishers experience economic losses from dolphin depredation, including reduced catch, gear damage, and lost fishing days, revealing the uneven distribution of conservation burdens. However, the officers in the Fisheries and the Forest Department I interacted with often framed fisher losses as an unfortunate but inevitable consequence of protecting a legally safeguarded species, effectively accepting uneven burdens as part of conservation. It also showed that fishers are expected to absorb the economic consequences of depredation while conservation priorities remain centred on species protection. Interviews with fishers indicate that officers emphasised that dolphins could not be harmed because they are protected under national wildlife legislation. During an interview, Murugan (62), who operates oar-propelled boats and is severely impacted due to dolphin depredation, said, “*If we make some efforts to chase the dolphins, the anti-poaching watchers do not let us. They say not to do anything because the presence of dolphins attracts abundant fish. They do not know the damage the dolphins cause to fishing livelihoods. What can we do against the government? Nothing*” (Interview, 15 March 2019). Fishers recognise the legitimacy of conservation regulations while questioning their distributive consequences.

Conservation space thus emerged not only from mapped territorial boundaries but also from the continual interaction of dolphin mobility, fisher adaptation, selective enforcement, negotiated access, and everyday surveillance. Rather than functioning as a fixed territorial container, the MPA was repeatedly enacted through these multispecies encounters and the everyday practices of state actors who selectively governed a dynamic marine environment.

Discussion

Conservation effectiveness is generally evaluated through biodiversity, compliance, governance quality, or ecological indicators. My findings suggest that conservation effects may also emerge through indirect ecological processes that redistribute human activity beyond formal protected area boundaries. While not replacing the existing measures of effectiveness, these findings broaden the range of mechanisms through which conservation operates.

Political ecology has largely examined how conservation territories are produced through institutions, state power and contestation. The findings suggest that territorial outcomes are also materially shaped by nonhuman agency. Dolphins do not merely inhabit conservation territories; through their mobility, they redistribute fishing effort, thereby producing the effective spatiality of the MPA.

Governance operated through selective intervention rather than continuous territorial control within a dynamic marine environment. Governance and adaptation alike depended upon continual observation, producing overlapping networks of attentiveness that linked dolphins, fishers and state actors. This suggests that governance capacity should not simply be evaluated by the ability to enforce fixed boundaries, but by how state actors continually negotiate ecological mobility and human practice.

The concept of becoming entangled offers ways to understand MPAs not as fixed conservation territories but as emergent spatial formations produced through recursive interactions among mobile species, resource users and state actors. Unlike approaches that privilege either governance or ecological relations, it foregrounds how conservation space is continually constituted through their interaction.

Recognising MPAs as spatial formations produced through ongoing, recursive interactions shifts attention away from static zoning toward the processes through which conservation is enacted in practice. This perspective is particularly relevant as marine environments are increasingly subject to overlapping uses, including fisheries, conservation, and offshore development (Fairbanks et al., 2018; Flannery et al., 2018; Jouffray et al., 2020; Tafon, 2018). Understanding how conservation space emerges through multispecies interactions provides a basis for rethinking how governance operates in fluid seascapes (Bear, 2017), where spatial boundaries alone are insufficient to capture the realities of ocean use and ecological change.

Conclusion

This paper has shown that MPAs cannot be understood solely as territorially bounded instruments of conservation governance. Drawing on ethnographic research in the Gulf of Mannar Marine National Park in southern India, it demonstrates that conservation space is produced through interactions between dolphin mobility, fisher adaptations, and governance practice, which together reorganise patterns of use and avoidance across the seascape. By developing the concept of *becoming entangled*, the paper shows how conservation authority is enacted through ongoing multispecies interactions rather than through territorial regulation alone. This perspective views MPAs as dynamic spatial formations continually reworked by ecological processes, everyday practices, and selective governance.

As ocean governance increasingly relies on spatial planning to manage overlapping conservation, fisheries, and offshore development, recognising conservation as an emergent multispecies process rather than a fixed territorial achievement becomes increasingly important. Doing so does not require abandoning protected areas, but rethinking how conservation authority operates within dynamic seascapes where ecological mobility, human practice, and governance continually reshape one another. Recognising MPAs in this way shifts attention from where conservation is bounded to how it is continually produced.

Highlights

- Conservation space is produced through multispecies interactions and governance
- Dolphin mobility and fisher adaptation reorganise patterns of resource use
- Conservation effects emerge beyond protected-area boundaries
- MPAs are dynamic spatial formations rather than fixed conservation territories

Acknowledgements

I want to thank all the research participants who helped me conduct this study. This paper is based on my doctoral work. I want to acknowledge the guidance provided by Nitin D Rai and the Ramanathapuram Fishworkers Trade Union (RFTU) for enabling the fieldwork in the Gulf of Mannar. A Rufford Small Grant supported fieldwork for this study. I am grateful to the anonymous reviewers, colleagues and peers who provided constructive feedback in various stages during the preparation of this manuscript.

ORCID iD

Rahul Muralidharan  <https://orcid.org/0009-0003-7066-9121>

Funding

The author disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This study was made possible with funding support from the Rufford Small Grants (grant number 18975-1).

Declaration of conflicting interests

The author declared no potential conflict of interest with respect to the research, authorship, and/or publication of this article.

References

- Acton L, Campbell LM, Cleary J, et al. (2019) What is the Sargasso sea? The problem of fixing space in a fluid ocean. *Political Geography* 68: 86–100.
- Adams VM, Chauvenet ALM, Stoudmann N, et al. (2023) Multiple-use protected areas are critical to equitable and effective conservation. *One Earth* 6(9): 1173–1189.
- Anderson J and Peters K (eds.) (2014) *Water Worlds: Human Geographies of the Ocean*. Routledge, Taylor & Francis Group. <https://doi.org/10.4324/9781315547619>
- Artelle KA, Zurba M, Bhattacharyya J, et al. (2019) Supporting resurgent indigenous-led governance: A nascent mechanism for just and effective conservation. *Biological Conservation* 240: 108284.
- Baker D, Murray G, Kaijage J, et al. (2021) Relationships matter: Assessing the impacts of a marine protected area on human wellbeing and relational values in Southern Tanzania. *Frontiers in Marine Science* 8: 673045.
- Baker-Medard M (2019) Conservation in a crisis: Marine resource management authority and legitimacy during political instability in Madagascar. *Conservation and Society* 17(4): 331.
- Bear C (2013) Assembling the sea: Materiality, movement and regulatory practices in the Cardigan Bay scallop fishery. *Cultural Geographies* 20(1): 21–41.
- Bear C (2017) Assembling ocean life: More-than-human entanglements in the Blue Economy. *Dialogues in Human Geography* 7(1): 27–31.
- Bear C and Eden S (2008) Making space for fish: The regional, network and fluid spaces of fisheries certification. *Social & Cultural Geography* 9(5): 487–504.

- Bear C and Eden S (2011) Thinking like a fish? Engaging with nonhuman difference through recreational angling. *Environment and Planning D: Society and Space* 29(2): 336–352.
- Benjaminsen TA and Bryceson I (2012) Conservation, green/blue grabbing and accumulation by dispossession in Tanzania. *Journal of Peasant Studies* 39(2): 335–355.
- Bennett NJ and Dearden P (2014) Why local people do not support conservation: Community perceptions of marine protected area livelihood impacts, governance and management in Thailand. *Marine Policy* 44: 107–116.
- Campbell LM, Gray NJ, Fairbanks L, et al. (2016) Global oceans governance: New and emerging issues. *Annual Review of Environment and Resources* 41(1): 517–543.
- Campling L and Colás A (2018) Capitalism and the sea: Sovereignty, territory and appropriation in the global ocean. *Environment and Planning D: Society and Space* 36(4): 776–794.
- Cañada JA (2024) Blocks and overflows of care: Territorialization and marine conservation in the Balearic sea. *Science, Technology, & Human Values* 51(5): 934–962.
- Chmara-Huff F (2014) Marine protected areas: Territorializing objects and subjectivities. *EchoGéo* 29: 1–19. DOI: 10.4000/echogeo.14040.
- Dowling R, Lloyd K and Suchet-Pearson S (2017) Qualitative methods II: ‘more-than-human’ methodologies and/in praxis. *Progress in Human Geography* 41(6): 823–831.
- Fairbanks L, Campbell LM, Boucquey N, et al. (2018) Assembling enclosure: Reading marine spatial planning for alternatives. *Annals of the American Association of Geographers* 108(1): 144–161.
- Flannery W, Healy N and Luna M (2018) Exclusion and non-participation in marine spatial planning. *Marine Policy* 88: 32–40.
- Gill DA, Lester SE, Free CM, et al. (2024) A diverse portfolio of marine protected areas can better advance global conservation and equity. *Proceedings of the National Academy of Sciences* 121(10): e2313205121.
- Gray NJ (2018) Charted waters? Tracking the production of conservation territories on the high seas. *International Social Science Journal* 68(229–230): 257–272.
- Gray NJ, Gruby RL and Campbell LM (2014) Boundary objects and global consensus: Scalar narratives of marine conservation in the convention on biological diversity. *Global Environmental Politics* 14(3): 64–83.
- Grorud-Colvert K, Sullivan-Stack J, Roberts C, et al. (2021) The MPA guide: A framework to achieve global goals for the ocean. *Science* 373(6560): eabf0861.
- Hung P-Y and Lien Y-H (2022) Maritime borders: A reconsideration of state power and territorialities over the ocean. *Progress in Human Geography* 46(3): 870–889.
- Jasanoff S (ed.) (2004) *States of Knowledge: The Co-production of Science and Social Order*. Routledge.
- Jones P (2014) *Governing Marine Protected Areas*. 0 ed. Routledge. <https://doi.org/10.4324/9780203126295>
- Jouffray J-B, Blasiak R, Norström AV, et al. (2020) The blue acceleration: The trajectory of human expansion into the ocean. *One Earth* 2(1): 43–54.
- Jupiter SD, Cohen PJ, Weeks R, et al. (2014) Locally-managed marine areas: Multiple objectives and diverse strategies. *Pacific Conservation Biology* 20(2): 165–179.
- Kamat VR (2018) Dispossession and disenchantment: The micropolitics of marine conservation in south-eastern Tanzania. *Marine Policy* 88: 261–268.
- Lynch M and Turner S (2022) Rocking the boat: Intersectional resistance to marine conservation policies in Wakatobi National Park, Indonesia. *Gender, Place & Culture* 29(10): 1376–1398.
- Mansfield B (2004) Neoliberalism in the oceans: “rationalization,” property rights, and the commons question. *Geoforum; Journal of Physical, Human, and Regional Geosciences* 35(3): 313–326.
- Mascia MB and Claus CA (2009) A property rights approach to understanding human displacement from protected areas: The case of marine protected areas. *Conservation Biology* 23(1): 16–23.
- Maxwell JA (2013) *Qualitative Research Design: An Interactive Approach*. 3rd ed. Sage.
- Melvin EC, Acton L and Campbell LM (2023) (Un)claiming rights, resources, and ocean spaces: Marine genetic resources and area-based management tools in high seas governance negotiations. *Environment and Planning E: Nature and Space* 6(3): 1661–1681.

- Muralidharan R and Rai ND (2020) Violent maritime spaces: Conservation and security in gulf of mannar marine national park, India. *Political Geography* 80: 102160.
- Ogden LA, Hall B and Tanita K (2013) Animals, plants, people, and things: A review of multispecies ethnography. *Environment and Society* 4(1): 5–24.
- Peters K (2014) Tracking (im)mobilities at sea: Ships, boats and surveillance strategies. *Mobilities* 9(3): 414–431.
- Peters K (2020) The territories of governance: Unpacking the ontologies and geophilosophies of fixed to flexible ocean management, and beyond. *Philosophical Transactions of the Royal Society B: Biological Sciences* 375(1814): 20190458.
- Peterson AM and Stead SM (2011) Rule breaking and livelihood options in marine protected areas. *Environmental Conservation* 38(3): 342–352.
- Pike EP, MacCarthy JMC, Hameed SO, et al. (2024) Ocean protection quality is lagging behind quantity: Applying a scientific framework to assess real marine protected area progress against the 30 by 30 target. *Conservation Letters* 17(3): e13020.
- Raycraft J (2019a) Circumscribing communities: Marine conservation and territorialization in southeastern Tanzania. *Geoforum; Journal of Physical, Human, and Regional Geosciences* 100: 128–143.
- Raycraft J (2019b) Conserving poverty: Destructive fishing gear use in a Tanzanian marine protected area. *Conservation and Society* 17(3): 297.
- Satizábal P and Batterbury SPJ (2018) Fluid geographies: Marine territorialisation and the scaling up of local aquatic epistemologies on the Pacific coast of Colombia. *Transactions of the Institute of British Geographers* 43(1): 61–78.
- Steinberg P and Peters K (2015) Wet ontologies, fluid spaces: Giving depth to volume through oceanic thinking. *Environment and Planning D: Society and Space* 33(2): 247–264.
- Tafon RV (2018) Taking power to sea: Towards a post-structuralist discourse theoretical critique of marine spatial planning. *Environment and Planning C: Politics and Space* 36(2): 258–273.
- Turnhout E, Dewulf A and Hulme M (2016) What does policy-relevant global environmental knowledge do? The cases of climate and biodiversity. *Current Opinion in Environmental Sustainability* 18: 65–72.
- Van Dooren T, Kirksey E and Münster U (2016) Multispecies studies: Cultivating arts of attentiveness. *Environmental Humanities* 8(1): 1–23.
- Walley CJ (ed.) (2004) *Rough Waters: Nature and Development in an East African Marine Park*. Princeton University Press.
- Whatmore S (2006) Materialist returns: Practising cultural geography in and for a more-than-human world. *Cultural Geographies* 13(4): 600–609.