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RESEARCH

Coral reefs and small pelagic fisheries: livelihood and governance interactions in Southern Luzon, Philippines

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Abstract

Coral reef fisheries and small pelagic fisheries make different contributions to livelihoods, food and nutrition security, which have informed academic and policy debate about their respective needs for governance. However, few studies have explicitly examined how governance of these different fisheries interacts at a local level, or how they interact with wider social-economic contexts and processes. This study examines a small pelagic fishery in the Philippines, focusing on the varied interactions between this fishery and coral reefs. Drawing on household surveys, focus group discussions and interviews, we demonstrate the significant economic and social contributions made by the small pelagic fishery and describe a series of governance interventions aimed at protecting coral reefs and regulating small pelagics. We highlight some of the emerging governance risks that undermine legitimacy and social acceptance for the management of both small pelagic and coral reef resources. We argue that planning for successful management of fisheries needs to be highly cognizant of the complexity of livelihoods, to equity issues in sharing the benefits and burdens of conservation, and to tourism-fishery interactions.

Keywords Small pelagic fisheries · Coral reef governance · Tourism-fishery interactions · Fisheries livelihoods

Introduction

Fisheries make highly significant contributions to food and nutrition security and to livelihoods, across coastal regions of the tropics and elsewhere (FAO, Duke University and WorldFish 2023). However, continued high levels of poverty and food and nutrition insecurity in many fisheries-dependent coastal regions (Jentoft and Eide 2011), combined with widespread stock declines and environmental degradation (Andriesse et al. 2022; Muallil et al. 2014a), have led to significant and sustained efforts to regulate marine ecosystems to improve fisheries productivity and sustainability (Jentoft et al. 2022). Within this broad context, much policy debate centres on which specific components of marine ecosystems have the greater potential to generate improved social outcomes, and which should therefore be a priority for investment in governance. In tropical regions in particular, much attention has been paid to the contributions made by coral reefs and associated fisheries on the one hand, and pelagic fisheries on the other (Clifton and Foale 2017; Cruz-Trinidad et al. 2014; Kittinger et al. 2024). In this paper, we examine a case of a small pelagic fishery in the coastal Philippines to investigate the varied interactions between this fishery and coral reefs, and to identify the subsequent implications for governance.

Coral reefs face unprecedented and expanding challenges—from increasing incidences of coral bleaching caused by anthropogenic global warming (Hughes et al. 2018), to destructive fishing practices (Hampton-Smith et al. 2021), to agricultural runoff and other forms of pollution (Nalley et al. 2021). In recent years, international donors,

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civil society and governments have significantly scaled up efforts to improve the status of coral reefs across the tropics. These efforts are reflected in the growth of marine protected areas, political mobilisation through multilateral partnerships such as the Coral Triangle Initiative (Christie et al. 2016), and investment into more active forms of conservation, such as coral restoration (Boström-Einarsson et al. 2020; Razak et al. 2022). Driving these investments is recognition of the multiple benefits (or 'services') that coral reefs provide to societies, including habitat for important fisheries that generate livelihoods and contribute to food and nutrition security (Hoegh-Guldberg et al. 2019).

Increasingly, the conservation of coral reefs is associated with tourism, woven under the paradigm of the "blue economy" (Voyer et al. 2018) where nature can be both preserved and sold at the same time. Under this approach, coastal tourism offers attractive sustainable opportunities for rural development by expanding infrastructure and services (Miller 2022). It is often linked to conservation by promoting recreational activities, such as scuba diving, snorkeling on coral reefs and boat tours (Spalding et al. 2017), where good business means preserving the aesthetic values and ecosystem integrity of these spaces. Under the same principle of economic potential, tourism opens alternative pathways for livelihood and income generation by creating a multitude of new jobs and services. In fishing communities, these opportunities may have the potential to shift pressure away from extractive fishing (Cruz-Trinidad et al. 2009; Gier et al. 2017; Lowe et al. 2019).

However, the drivers and outcomes associated with interventions to protect coral reefs have also come under sustained criticism (Christie 2004). Numerous studies, for example, have documented the negative social impacts of marine protected areas that have reduced access to fishing grounds (e.g. Segi 2014). Conflicts between the fisheries and tourism sectors have been observed, including unequal distribution of benefits from tourism and the loss of access to and control over local resources, including land (Fabinyi et al. 2022). Others have critiqued the assumed linkages between coral reef protection and food security, highlighting instead the range of factors that mediate between the improved productivity of coral reef fisheries and actual food security (Foale et al. 2013). More fundamentally, Foale (2023) and Clifton and Foale (2017) have suggested that investments to protect coral reefs are driven largely by Western scientific preservationist values that emphasise the intrinsic value of biodiversity: 'the 'weight' of this cumulative intrinsic value underpins a moral mandate for transnational conservation intervention, typically in the form of marine protected areas, most of which impose a short- to medium-term economic cost on people who are already very poor' (Foale 2023: 1).

In contrast, pelagic fishery resources boast several features relating to social outcomes that have led to calls for greater attention and investment by the academic and policy communities. For example, Roeger et al. (2016) suggest that in response to decreasing fish catch from coral reef areas, 'fishing down the food chain' has resulted in higher catch per unit effort and provided the community with a major source of food and livelihood. In particular, fish aggregating devices (FADs) as a potential tool to generate increased catch and contribute towards food security have a mix of challenges, opportunities and trade-offs (Albert et al. 2014; Bell et al. 2015; Tilley et al. 2022).

At the level of production, small pelagics are one of the major fisheries caught in the Coral Triangle region (Cruz-Trinidad et al. 2014), and the largest capture fishery in terms of volume in the Philippines (BFAR 2022). Subsequently, these small pelagic fish are highly important for food consumption. These contributions lie not only through their well-known provision of protein, but also through their vital contributions of micronutrients including calcium, iron, selenium, zinc, omega-3 fatty acids, vitamin A, and vitamin B12 (Farmery et al. 2020; Robinson et al. 2022). As relatively fast-growing, highly fecund schooling species with short life spans, small pelagics also tend to be more resilient to fishing pressure (Dalzell et al. 1991; Ruddle 2005; Freon et al. 2005; Otero and Hidalgo 2023).

Other literature has emphasised the interactions between multiple components of marine ecosystems. From a livelihoods perspective, scholars have suggested that diversification and occupational multiplicity should be encouraged, and are typically key components of stable, resilient and sustainable livelihoods (Allison and Ellis 2001; Bailey and Pomeroy 1996; Cinner and Bodin 2010; Eder 2011). From this perspective, the emphasis is on accessing multiple parts of the marine ecosystem in order to generate flexible, diversified livelihoods. Similarly, Cabral and Geronimo (2018) argue that in addition to consuming pelagic resources, local communities also rely on healthy coral reefs for their food, and that this diversified source of food helps build resilience of coastal communities.

From an ecological lens, coral reefs are intertwined with other types of fisheries through trophic overlaps in relatively shallow systems (Bacalso et al. 2023a, b; Bachiller et al. 2020). Artisanal nearshore fisheries have traditionally targeted small pelagic fishes adjacent to coral reefs in the Philippines (Bagarinao-Regalado et al. 2023; Dalzell and Lewis 1989), and small pelagics are "forage fishes" that serve as essential prey food for pelagic and demersal predators, providing a pathway for energy to flow from low to higher trophic levels (Pikitch et al. 2012). In terms of ensuring fisheries sustainability, scholars also argue that it is desirable to maintain and encourage a diversified fishery, preventing overexploitation by spreading the load and

distributing fishing intensity across multiple ecosystems and in proportion to their production (Roscher et al. 2022; Zhou et al. 2019). In contrast to many of the temperate industrial fisheries such as herring and cod, many small-scale fisheries in the Global South are already characterised by the use of multiple gears that target multiple species. Especially in nearshore areas frequented most heavily by small-scale fisheries, pelagic and coral reef fisheries typically overlap. At the same time, the health of one fishery influences fishers' behaviour and decisions that may have impacts on another fishery. For example, Cabral and Geronimo (2018) point out that degraded reefs push fishers to fish farther offshore, while degrading pelagic resources may conversely affect reef fisheries as fishing pressure shifts nearshore. Given this, they argue an integrated and interconnected outlook in the management of both pelagic and reef-associated fisheries is critical.

While much research has focused on these biological interactions between coral reefs and small pelagics, and subsequent recommendations for managing fishing activities, few studies have focused empirically on how livelihoods associated with these contrasting components of marine ecosystems interact, and how these livelihood interactions can inform governance for improved social and ecological outcomes. In this paper, we investigate a fishery that targets juvenile small pelagic species occurring in nearshore areas in order to enrich the literature on how pelagic and other fisheries livelihoods, especially in the coral reefs, interact. We aim to build on what is mostly a relatively macro-scale, high-level debate about these interactions to empirically examine in depth the implications of a better understanding of the interactions and trade-offs between coral reef-associated and small pelagic fisheries for livelihoods and, subsequently, for governance at the local level. In doing so we make a case for addressing different coastal fisheries not as independent of each other but as linked both biologically and socially. A particular focus is on how the relationships between coral reef and pelagic fisheries link into broader policy debates about the roles of conservation, tourism and small-scale fisheries.

Conceptual approach

Following Ellis, livelihoods refer to 'the assets (natural, physical, human, financial and social capital), the activities, and the access to these (mediated by institutions and social relations) that together determine the living gained by the individual or household' (Ellis 2000: 10). While acknowledging the multi-faceted nature of livelihoods and the various approaches to them (Nunan 2022), in this paper we focus on a core element highlighted by many researchers, diversification. From this perspective – and in contrast to some of the literature from marine resource management, or the natural sciences – this means emphasizing that fishing is one activity among many potential options to support a livelihood, and that within the category of fishing activities, there are many different forms (Allison and Ellis 2001; Eder 2003, 2006; Fabinyi et al. 2022).

Governance is another concept with a wide spectrum of research approaches, from those that emphasise governability (Chuenpagdee and Jentoft 2013), to formal and informal institutions (Pellowe and Leslie 2020). Our approach in this paper focuses on 1) formal legislation, policies at national and local government levels in the Philippines; 2) how these formal instruments have been operationalised in practice, recognising that there are often significant gaps between policy and practice, including in the Philippines (Basurto and Nenadovic 2012; Fortnam 2019; Pomeroy et al. 2019,); 3) subsequently focusing on perceptions about governance among the small-scale fishers who are largely the target of these instruments. Perceptions about governance are a key component of legitimacy and the wider institutional context of governance (Chuenpagdee and Jentoft 2013; Coulthard et al. 2011; Fabinyi et al. 2015).

Background and methods

Study site and fishery under study

In 2023, the Philippines' total fisheries production was estimated at 4.26 million metric tons (PSA 2024). The multigear, multispecies nature of Philippine small scale fisheries (Bailey and Pomeroy 1996) allows fishers to benefit from different resources, diversify their incomes, and opportunistically take advantage of seasonal abundance of particular species. The Philippines, therefore, is particularly significant as a location to study the interactions between pelagic fisheries and coral reefs. The country is part of the Coral Triangle, the region of the highest global marine biodiversity (Carpenter and Springer 2005). These diverse ecosystems support a range of highly economically significant reef fisheries, including export fisheries for live reef food fish, and local markets for a range of other species. Coral reefs are also important for a range of coastal tourism activities, including scuba diving and snorkelling, as well as their role in storm protection.

Pelagic fisheries likewise are highly important, especially as a source of cheap animal protein for lower income households. Species such as *galunggong* (*Decapterus spp.*/roundscad) are commonly referred to as "the poor man's fish". Small pelagics amounted to around 40% of the marine fishery landing in the 1980s (Dalzell et al. 1990) and in 2022, small pelagics made up 44% of the country's total production from capture fisheries, composed predominantly of sardines, roundscads, mackerel and anchovies

(BFAR 2022). While fisheries production in the country has declined (Malayang III et al. 2020) due to a host of natural and anthropogenic causes (Anticamara and Go 2016; Muallil et al. 2014b), small pelagics are still some of the most abundant fish resources. In view of the Philippines' high reliance on fisheries, a host of different management interventions and strategies for recovery and sustainable harvest of stocks are implemented and enforced in the country, including fish catch restrictions and MPAs (Mecha et al. 2022; Ungkakay-Bagsit et al. 2023).

The target fishery in this study is *dulong*, a traditional fishery that targets post-larvae and early juveniles of Clupeids (sardines) and Engraulids (anchovies) congregating in the shallow waters of the Verde Island Passage (Campos et al. 2013; Thomas et al. 2013) and caught using fine-mesh nets. The fishing of *dulong* has been documented in many locations across the country (Bagarinao-Regalado et al. 2023; Hermes 2004), where they may be referred to by other names. Although seasonal in nature, the primary factors that underpin this productivity are influenced by monsoon winds, rainfall, plankton biomass and the presence of upwelling systems. Small pelagic species like sardines and anchovies are common upwelling species, which often dominate the intermediate trophic level in productive upwelling systems (Ruddle 2005; Villanoy et al. 2011).

The research was conducted in Lobo, Batangas, a coastal municipality in the Philippines with an estimated population of 40,736 (PSA 2022). Located in the Southern Luzon region (Fig. 1), Lobo is roughly 39 km from the highly urbanized Batangas City. There are 26 *barangays* (smallest political unit in the Philippines) in Lobo, 10 of which are coastal, covering around 175 square kilometers (PhilAtlas n.d.). To the south of Lobo lies the Verde Island Passage (VIP), a strait considered as the world's epicenter of marine biodiversity (Carpenter and Springer 2005). Along the VIP are extensive coral reef habitats (Azcuña et al. 2022; Horigue and Licuanan 2013) that are well-known spots for diving and tourism. During the northeast monsoon, elevated chlorophyll concentrations are recorded in the VIP, suggesting that nutrient-rich water is being transported into the surface by upwelling systems, thus explaining the increased biological productivity during this period (May et al. 2011).

Lobo's economy is primarily based on fisheries and agriculture, yet is now rapidly changing, with new highways and roads being built to make coastal and mountainous areas more accessible. Promoting agriculture and coastal tourism

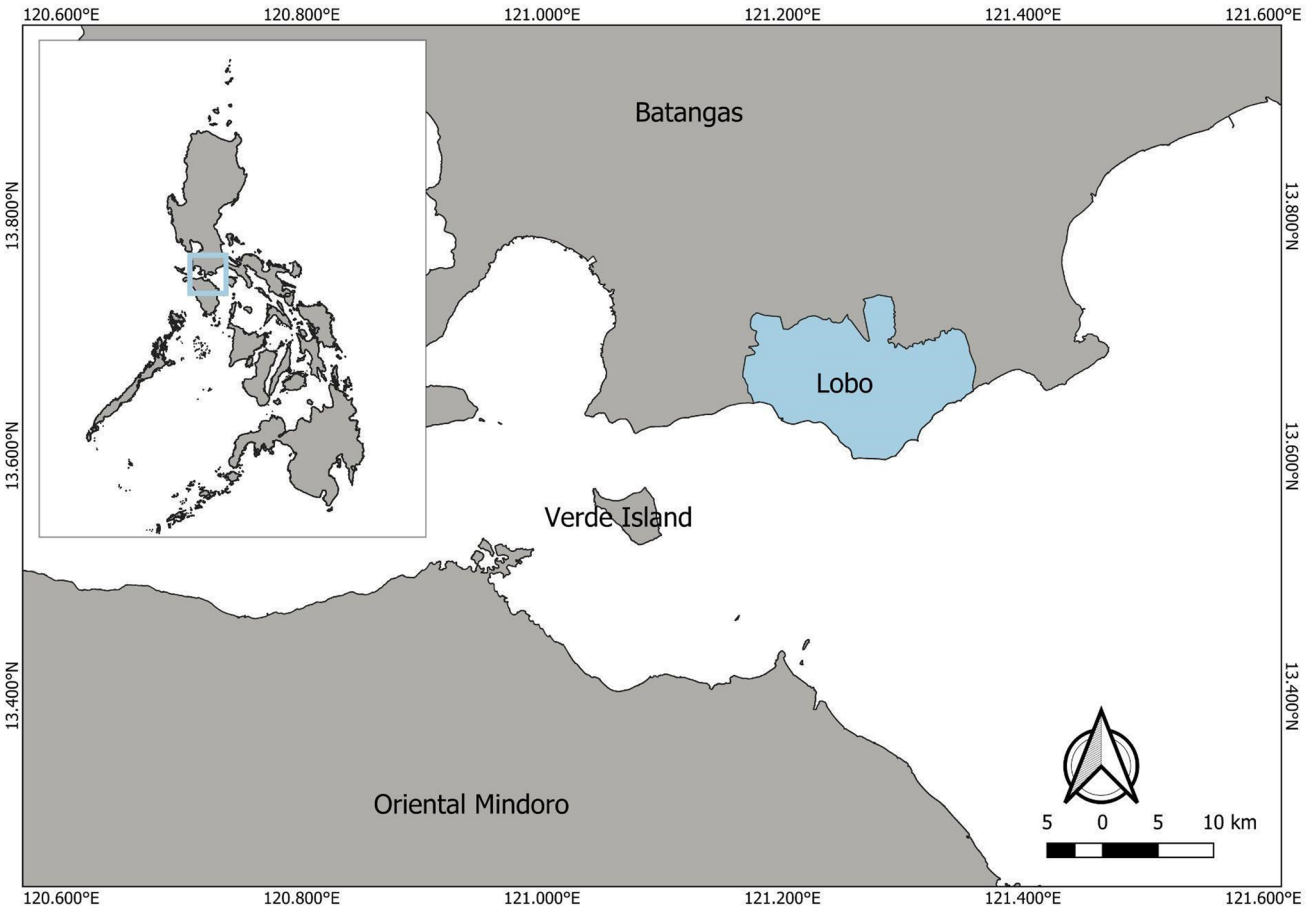

Fig. 1 Map of Lobo and the Verde Island Passage

has been one of the local government unit's (LGU) focal programs to bring infrastructure and economic development in the area. Recent years have seen the influx of tourists coming to Lobo, with investments and capital going into the building of new resorts and hotels to cater to the growing tourism industry, paving way for the entry of new businesses too such as restaurants, cafes, and souvenir shops. The local government tourism information platform (https://ilovelobo.ph/) takes visitors through a virtual menu of places to visit, products to buy and accommodations to stay. Different livelihood opportunities for local production of wine, candies and pastry have opened and are actively promoted by the local government to drive job creation and income for residents.

Although the tourism industry is much smaller compared to its neighbors, the coral reefs and marine sanctuaries attract holidaymakers and reef enthusiasts to come there. Lobo is also growing in popularity as a beach and freediving destination in southern Luzon. There are 119 registered resorts and 66 registered huts, tents and cottages overall as of 2024 (Lobo, Batangas Tourism 2024), capable of accommodating thousands of tourists, especially during peak season in the months of March to May. In 2022, the LGU registered 263,000 tourist arrivals (Lobo Tourism Office 2023).

There are two established LGU-managed Marine Protected Areas (MPAs) in Lobo, with more being proposed for establishment. Coral reef habitats and rocky substrates are present in most of the coastal areas, except near the Lobo River where the water shifts to brackish and the ecosystem is dominated by seagrass and mangroves. The municipality has also put considerable resources into establishing artificial reefs in various locations for purposes of substrate enhancement, fish stock enhancement and tourism. In 2024, there are more than 10,000 of these concrete units already installed underwater according to the local government.

Data collection

Fieldwork was conducted in September 2022 to June 2023, where the first author conducted key informant interviews, participant observation, focus group discussions and a household survey ($n=162$) to collect information and gather knowledge, attitudes and practices on the fishery. A trip to Lobo by the second author in October 2022 included informal discussions with key fisheries and marine stakeholders, which also assisted in the interpretation of findings. The data collection was conducted under a human research ethics protocol approved by the University of Technology Sydney (ETH21–6531). In addition to field-based activities, academic and grey literature were also reviewed and consulted for information and background.

Twenty three (23) semi-structured interviews were conducted, with key informants comprising of fisherfolks (7), traders (3), processors (2), market vendors (2), fisheries enforcers (2), barangay and municipal local government officials (5) and regional government agency representatives (2). These interviews were conducted in-person, with only two conducted online through Zoom. Participants were selected based on their personal knowledge and involvement in the capture, trading, and regulation of *dulong* fishery. Interview questions were adapted based on the sector key informants were supposed to represent. Five (5) focus group discussions were conducted to supplement the interviews. Four (4) of these FGDs had 4–10 *dulong* fisherfolks participants and were conducted in three coastal barangays. One (1) FGD was attended by at least 10 participants representing the federated organization of fisherfolks in the municipality. Participants in the FGD were asked about their knowledge and experiences with *dulong* fishing, fishing areas, the significance of *dulong* and other types of fishing to their daily life, the impact of policies and regulations to their livelihoods and their perceptions on coastal development and programs to promote sustainability of resources. Recorded interviews were subsequently transcribed, while field notes were taken from observations and informal discussions that occurred. These sources of data were subsequently analyzed by identifying emergent and recurring themes that were consistent throughout the dataset.

The survey was conducted in 6 coastal barangays, in Banalo, Lagadlarin, Soloc, Malabrigo, Balibago and Biga, to gather quantitative data on the socio-economic profile of *dulong* fisherfolks, fishery characteristics, livelihood activities and perceptions and knowledge on the fishery and its governance (Supplementary Materials). While an initial list of 73 registered *dulong* fisherfolks for year 2022 was obtained from the Municipal Agriculture Office to identify respondents through a targeted approach, some were no longer active fishers and some fishers were not present during the survey. Purposive sampling was hence complemented with a snowball approach to reach additional respondents. Of the 162 survey respondents, 78% were male and 22% were female. Most female respondents were *dulong* vendors and processors, while a number of women respondents were solely providing responses in lieu of their fisher husbands who were away at work during the time of the survey.

The Results section firstly presents a profile of the *dulong* fishery and the contributions it makes to livelihoods. Sections "Governance of dulong and other fisheries" and "Fisherfolk perceptions on sustainability and governance" then examine various aspects related to governance.

The Discussion section then elaborates on the wider implications of these interactions for coastal development and fisheries management in coastal tropical communities.

Results

Characterizing the fishery

Dulong is a collective term for fish caught using fine mesh net in Lobo and much of the Luzon region. Studies and knowledge on *dulong* fisheries are scant and limited. It is characterized by its white or gray, short and slender body but due to its morphological resemblance to the anchovy family (Thomas et al. 2013), there is a common belief that *dulong* is the juvenile form of a single taxa, the "*dulis*" or anchovy. However, taxonomic research has shown that *dulong* are primarily comprised of post-larval to early juvenile forms of two major families: Engraulidae (anchovies) and Clupeidae (sardines and herrings) (Thomas et al. 2013; Campos et al. 2013; Bagarinao-Regalado et al. 2023). Campos et al. (2013) found that the bulk of catches were between 15–25 mm SL, a total of 97.5% of the catch being immature. Aside from these two families, some larvae of demersal, reef-associated, epipelagic and deepwater fishes make up a small component of *dulong* caught in Batangas, although in miniscule amounts (Campos et al. 2013).

Using a V-shaped scoop net to take the fish out, fishing for *dulong* occurs quite close to shore and not more than a hundred meters from the shoreline. *Dulong* fishing is mobile and has no defined fishing ground as they aggregate in different locations of the shoreline, most often in areas where the substrate is sandy. However, fishing has been observed in locations where the bottom substrate turns rocky and where corals are present, suggesting that fishing may occur in coral reef areas. Except inside marine sanctuaries, all coastline and nearshore waters of Lobo are open for fishing of *dulong*. Fishers would often go back and forth from both ends of the municipal boundaries in search of the aggregation. Fishers observe and exchange information with each other to track the presence of aggregations, where to fish and when to take their boats out. Both sides of the *dulong* boat are equipped with halogen lamps, whose lights are used to attract the *dulong*.

While *dulong* is observed by fishers to be present year-round, the season for fishing *dulong* peaks in November – January. During peak season, it is common for fishers to catch between 50 to 150 kg of fish per fishing trip. About 10% percent of the catch is retained for local consumption while the rest is sold to local traders who then transport the fish from Lobo to subsequent traders and buyers in major nearby urban markets. During lean season, fishers often come home empty handed so that most of them seek other livelihood opportunities or engage in other types of fisheries for the remainder of the year. During peak season, fishing occurs almost everyday. Fishers prepare their gear and boat late in the afternoon, and wait until the sun sets, usually at 6:00PM, to start their fishing (Fig. 2). This usually lasts until 8:00 or 9:00PM, averaging two to three hours a day. However, many tend to fish longer during these peak months, some beyond the locally imposed limit of 10:00PM, in order to maximize their profit for the day.

There is an average of 5 people in a *dulong* boat. Smaller boats are usually manned by 3 to 5 people. The driver and captain are often the most experienced and direct where to fish, while the crewmembers help maneuver the scoop net and the light. Upon landing, the owner receives twice the catch share of fishers to cover the costs of financing and maintaining the boat.

Dulong fishers surveyed have been fishing for an average of 23 years, with an average age of 41 and with 35% of them having completed high school. Only 37% of the fishers interviewed possess their own boat for fishing *dulong*. However, some crew members also possess other types of boats and gears that they use to access other fisheries. Seven percent (7%) of surveyed fishers were minors or below the legal age of 18. It is typical of young adults to participate in *dulong* fishing to augment family income or to support one's schooling. They take a supporting role as boat crews to help the main fishers, especially during the high season when the catch is high. Three-quarters of the fishers are men and about a quarter are women. Men primarily participate in the fishing and catch while women would wait by the shore at night until the boats come back to process, distribute or sell the *dulong*.

Many women, specifically in Brgy. Lagadlarin, process the fresh *dulong* into steamed "*pinais*" to sell within Lobo and in neighboring municipalities. It is also common to process the *dulong* into "*bagoong*" or fermented fish paste, especially when there is a surplus. *Dulong* is therefore an important food source for the people of Lobo. As one

Fig. 2 *Dulong* fishers at night

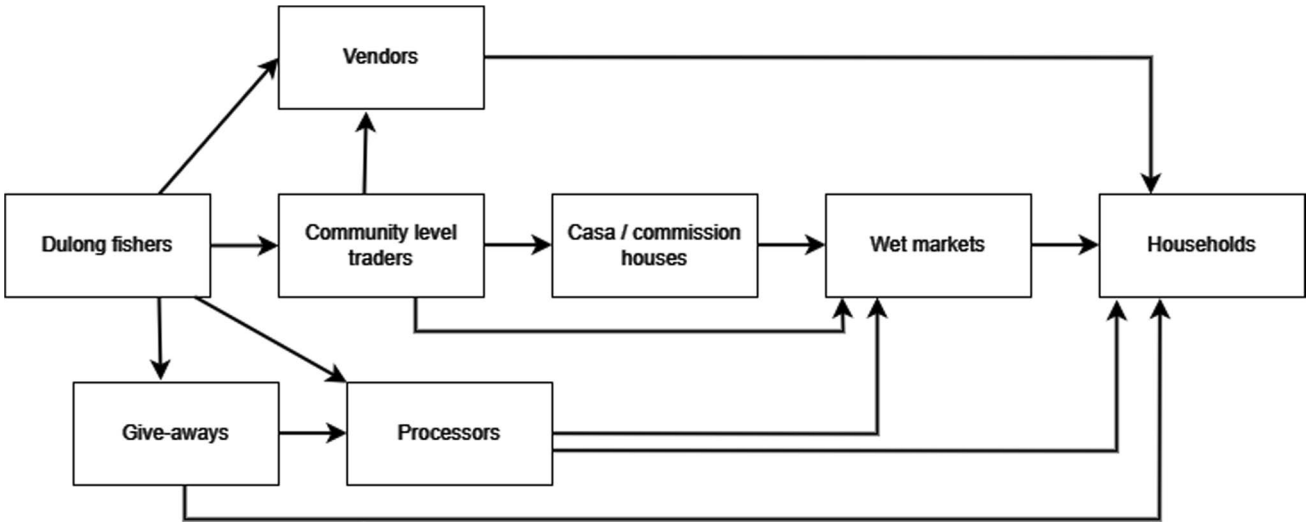

Fig. 3 The social and trade network of *dulong*

respondent exclaimed, "We have tried all the different ways one can cook *dulong!"* Consumption is frequent when other types of fish are not available or when there is no income coming in, respondents said. *Dulong* not only supplements the daily diet of locals but is also salted and stored for weeks and months at a time, and subsequently utilized by many fishers to bait bigger and commercially important species such as mackerels and scads.

Dulong fisheries as a livelihood and its wider social contributions

Dulong is a fishery that has been exploited by generations of fishing families in Lobo. In Brgy. Lagadlarin, a lack of space and available land for farming has led the community to specialize in this particular catch. Before the *dulong* is sold to the trader and enters the market, there are forms of redistribution and sharing within the fishery that can be described as informal institutions and arrangements between fishers and community members (Russell and Alexander 2000) and as instruments in community sharing and reciprocal exchange (Mangahas and Rodriguez-Roldan 2019). Upon reaching the shore at night with their haul, it is the norm for fishers to share or give away a handful of *dulong* to more marginal members of their community, women, children and elderly, awaiting by the shore. A boat's catch is also not sold to one person alone, but often is arranged for partition, from one to several kilos, to many people in the community, processors, small traders, market vendors, to ensure that everyone is able to get something to earn from.

Lagadlarin is the economic center of *dulong* fishing. Fishers across Lobo would bring their catch to sell them to the few traders/consolidators, who then are able to transport the bulk of catch overnight to bigger trading houses or "*casa*" located in Batangas City and Lipa City, or to traders in the neighboring community of Laiya, San Juan (Fig. 3). But while *dulong* is still widely practiced, the number of fishers has been declining in many of the barangays. This became obvious to us when during the survey, it became a challenge to locate some of the fishers because many have opted to exit the fishery.

On average, a *dulong* fisher earns PhP5,000-PhP10,000 [89.3 USD—178.6 USD][1] in monthly income but during the season of *dulong,* their income increases two-fold. Despite the fact that fishing occurs only for several months, we found in the survey that half of the annual income of *dulong* fishers come from *dulong*. They sustain themselves the rest of the year by fishing for other fisheries resources or by engaging in small businesses or working in construction. However, income from these other jobs does not pay off the way *dulong* does, they claim. Due to the abundance and volume of catches, they are able to earn enough such that they are able to save money, pay for the education of their children, settle debts, accumulate assets or invest in other businesses. Without *dulong*, people say they are likely to experience hunger.

Dulong is sold at the average price of PhP 80.00 [1.4 USD] per kilogram. The price increases depending on the quality of the *dulong*. Glassy and transparent looking *dulong* commands a higher price, between PhP120

[1] At the time of the survey in June 2023, the exchange rate was roughly 1.00 USD = 56.00 Philippine pesos, which was used to calculate the equivalent income figures presented in this study.

– PhP140.00 [2.1 USD—2.5 USD] per kilo, up to as much as PhP180.00—PhP200.00 [3.2 USD—3.6 USD]. Supply likewise influences the price of *dulong*. The price at the consolidator/trader level depends on the price agreed between the fisher and the consolidator/trader. The price the trader will offer will be based on the prevailing price of *dulong* in the *casa*, in the markets in Batangas City and Lipa City. The consolidator/trader, on principle, earns through the profit made between the price agreed with the fisherman and the price agreed with the *casa*. It is not necessary for the trader to shell out capital in the business. Typical of traders in the Philippines where "*laway lang ang kapital*" (your only investment is your saliva) (Turgo 2016), once the price between the fisher and trader is agreed, the *dulong* will be "on loan" to the trader until it is sold in the casa. The fisher is paid the next day. Transactions are based on a high degree of trust among and between fishers and consolidators/traders, facilitated by long-standing community and family ties. The risk in fluctuations of price at the source and in the *casa* is absorbed by the consolidator/trader as there is a possibility that the price of *dulong* will change upon reaching the *casa*. This happens when there are unexpected large supplies of *dulong* coming in, caught from other parts of the province and brought into the trading house, which then drives the price down.

Aside from fishers and traders, the processors are also deeply reliant on *dulong's* availability for their income. Processors are only found in Lagadlarin, numbering to more than 30 women in the community. Fresh *dulong* is immediately processed into *pinais*, steamed and wrapped in banana leaf and sold the next day for PhP 16.00 [0.3 USD] per wrap, both in the local market and outside. Fermented *dulong* is salted and preserved in small glass bottles, and sold for around PhP80.00 – PhP100.00 [1.4 USD—1.8 USD] a bottle. Vendors, who directly retrieve supply from fishers, on the other hand either sell itinerantly in the villages or display them in the markets.

Other fishery livelihoods

We found that 56% percent of the *dulong* fishers in Lobo have a secondary fishing alternative to *dulong*. Other major fishery livelihoods include "*kawil*" (handline) and "*hayhay*" (bottom-set longline) to catch coral reef and associated fish such as *bisugo* (*Nemipterus spp.*/threadfin bream) and *maya maya* (*Lutjanus spp.*/snapper), and schooling epipelagics such as *buraw* (*Rastrilleger kanagurta*/Indian mackerel) that come nearshore. Locals likewise use "o*hayan*" (troll line) and "*lagarete*" (drift gillnet) to catch mainly *tulingan* (*Auxis thazard*/frigate tuna), *galunggong* and *buraw* found in deeper waters. *Gulyasan* (*Katsuwonus pelamis*/skipjack tuna), *donpilas* (*Sardinella gibbosa*/goldstrip sardinella) and *pagulpol* (*Cypselurus spp.*/flying fish) are often also caught using nets. Squid jigging during night time, on the other hand, is common in barangays Biga and Balibago. *Ohayan* is the most common secondary fishing livelihood, with an estimated 39% of *dulong* fishers likewise using the gear as an alternative to *dulong* during off-season. During the months of November and December, and during March to May, fishing for mackerels and scads is widespread. Many *dulong* fishers shift to *ohayan* and *lagarete* during this period. They also take advantage of mobile and pelagic species coming close to shore to feed on anchovies and other small fish species during this time. Many fishers have traditionally used gillnet to catch fish closer to the shoreline but this practice has since been limited by the LGU to specific areas away from coral reefs.

Dulong fishers who opt for other forms of land-based work take advantage of other livelihood and sources of income in the community such as working in local transportation, selling of goods, setting up of various small businesses and working different jobs in construction. Because of the seasonal nature of *dulong*, fishers believe that it is essential that there are other alternative income sources and other fishery livelihoods available.

Governance of *dulong* and other fisheries

The decentralized governance of municipal waters and fishery resources within these boundaries are the mandated responsibility of the local government units through Republic Act 7160 (Local Government Code of 1991). This is complemented by Republic Act 8550 (Philippine Fisheries Code of 1998) and Republic Act 10654 (the amended Philippine Fisheries Code) that enshrines the laws and policies governing the management of fishery resources in the Philippines. The Fisheries Code clearly prohibits the catching of juvenile fish by banning the use of fine mesh nets in fishing. However, the law has made exceptions on the use of fine mesh nets for fish species that occur naturally small, like anchovies, or where they are to be harvested as fry, such as milkfish. Against this language that lacks specifics on *dulong* in particular, along with the common belief that they are anchovies, the national policy on *dulong* is ambiguous. A much more active approach to the regulation of *dulong* is contained in the Fishery Management Area (FMA) Plan of FMA 12, where Lobo municipal waters are situated. FMA 12 is one of the 12 areas that was established in 2019 to delineate Philippine waters into smaller fishery management zones for the management and conservation of fisheries using principles of Ecosystem Approach to Fisheries Management (EAFM) (BFAR 2019). Under the FMA 12 framework, harvest control and reduction of *dulong* fisheries will be implemented through regulation of fine mesh nets and adoption

of policies reducing juvenile fish catch, according to a government official.

Consistent with this, the provincial government of Batangas is working on regulating their fishing by banning the use of fine mesh net during the months of December to March. Initially started and piloted in Balayan Bay in 2014 (Bacalso et al. 2023a, b), the closed season has expanded throughout Batangas and is informally adopted by municipalities already, ahead of a formal policy. This is based on studies determining the peak spawning period of sardines to be during the Northeast monsoon, in the months of November to February (Pata et al. 2021), and also somewhat coincides with pioneer models of closed season for small pelagics implemented in major fishing grounds in the country, in Zamboanga Peninsula and the Visayan Sea, to support the spawning of stock (Napata et al. 2020; Rola et al. 2018).

At the site level, the Municipal Fisheries Ordinance (MFO) No. 2006–06 localized the provisions of the Fisheries Code on the use of fine mesh net, explicitly banning its use except for species that are naturally small such as *bangus* fry (*Chanos chanos*/milkfish), glass eels and elvers (*Anguilla spp.*), *tabios* (*Mistichthys luzonensis*/goby), *alamang* (*Euphausiacea spp.*/krill), and *dulong*. The ordinance likewise prohibits the catching of *dulong* during the months of March, April, May and June, in order to allow this period to gather bangus fry. However, there is little to no implementation of this latter provision, being merely an outdated policy that has no significant impact to both fisheries due to differing peak spawning periods. *Dulong* fishers continue to fish, as permitted by availability, during these months. These policies are supplemented by Municipal Ordinance No. 2017–21,which aims to regulate *dulong* fishing by limiting it until 10:00 PM. The original purpose of this policy, however, was intended to regulate noise and disturbance coming from the boats that may otherwise bother tourists.

There is no locally binding policy to establish closed seasons and limits to catch in Lobo yet. The MFO, however, provides that fishing during the spawning of pelagic and demersal fish species shall be unlawful, categorically prohibiting the catching of "*tamak*" at all times of the year. The ordinance defines *tamak* as the "combination of pelagic and demersal species of fish which are immature". In contrast, it defines *dulong* as "such species of fish which by their nature are small but are already mature, e.g. anchovy". The local policy in this instance therefore acknowledges the protection of spawning and breeding pelagic and demersal groups that come nearshore during larval stage but may further grow into adulthood. However, since *dulong* is viewed to be outside this classification, locals believe it should be open for fishing. Informally, the municipality of Lobo regulates *dulong* by prohibiting export of the fish outside Lobo during the months of December to March. Arguably, there is no ban and seasonal closure for fishing *dulong*, fishers are just not allowed to sell it outside town. Checkpoints are installed in the entry and exit points of the municipality, manned by the Bantay Dagat and local police.

While both formal and informal arrangements typify the regulation of *dulong*, policies appropriating nearshore waters for protection, such as for the establishment of MPAs, are more formally codified in municipal legislation. The municipality has initiated the establishment of MPAs in barangays in Sawang-Olo-olo and Malabrigo in 2001 and 2002, respectively, in order to protect what are considered the most important coral reef habitats of the town. There are also other sanctuaries that, although not yet ratified at the municipal level, have already been approved for implementation by the community and barangay. Along with the MPAs, the fisheries ordinance additionally has a blanket prohibition for fishing in the coral reefs. As a ramification of this, the municipality implemented a ban on the use of gillnets in nearshore areas with rocky and live coral substrate to further support their ongoing coral reef management measures. This, however, has affected fisherfolks, many of them *dulong* fishers who rely on the use of gillnets to catch reef-associated fishes, as well as small pelagic fishes such as mackerels and scads that come to shore occasionally to feed, as a secondary source of income. To further discourage the use of gillnets, the local government installed artificial reefs in specific locations to provide deterrence.

While the impacts of these policies are more substantially felt by fishers, actors down the value chain, such as traders and vendors, are also affected but in varying scales. *Dulong* trader and processor households are influenced by *dulong* and coral reef policies as much as fishers since income is directly dependent on the same catch. Their secondary and alternative sources of income are also highly similar and related. Market vendors (largely women) on the other hand are more able to flexibly weather seasonal and catch fluctuations or specific gear bans given that they are able to sell a wider variety of fish types. "We do not feel the impact as much as the fishers" said one vendor. When there is no fish available in Lobo, they simply outsource or import from outside.

Fisherfolk perceptions on sustainability and governance

Nature of fishery and health of stocks

Dulong has been traditionally understood by locals, based on their long-term observation, as the juvenile of a single fish group, the anchovy, which they say is distinct to

tamak. *Tamak* become sardines and mackerels when they mature, they claim. Both *dulong* and *tamak* are physically similar but when looked closely, there are variations in appearance that separate both groups, according to fishers. *Tamak* also behaves distinctly in the water, allowing them to tell the difference. *Tamak*, fishers say, are jittery and restless under the light, while *dulong* move placidly in the water column even when lighted upon. There is no defined period when *tamak* appears, but they are often sighted in December and may be present for weeks at a time, only to dissipate again. A fishing ban on *dulong* is implemented once the *tamak* appears substantial in volume. The relative proximity of *dulong* fishing to the shoreline allows law enforcement officers to monitor the presence of *tamak* in the catch from the near distance. They said they are able to identify from the shore when the catch is mostly *tamak* or whether it is mostly *dulong* based on how the fish behaves while being scooped out. However, locals admit that there are instances where both *dulong* and *tamak* blend in the water, which in turn makes selective fishing impossible. Despite this, locals believe that it is right and proper to restrict the catching of *tamak*, whereas on the other hand, they believe *dulong* need not be because "they no longer grow big". The perception that *dulong* remains small as it matures was consistent throughout, from fishers to traders and vendors, regardless of gender and age. Responses however also show that respondents hold strong opinions against *dulong* regulation, as well as negative perceptions against artificial reefs, in Lagadlarin where *dulong* fishing and processing is principally practiced compared to the other coastal barangays.

Their views on regulation are also influenced by their perception on where the fish comes from and how they come about. In the absence of information on the drivers of productivity and abundance, some fisherfolk believe that *dulong*'s presence is driven by luck and a gift from the sea. They believe they are merely receiving what the ocean has provided but do not take more nor take less because *dulong* comes and goes on its own. Furthermore, resting the fisheries is not necessary because "the sea takes natural periodic breaks on its own volition", they say. Given these, there is meager support in the coastal communities of Lobo, especially in Lagadlarin, to regulate the fishing of *dulong*. When asked regarding the impact of the fishery, respondents are largely divided on the effect of extraction to the sustainability of stocks. However, only 31% agreed to control the fishery for the purpose of conservation, recognizing *dulong's* sizable contribution to daily food and income. Here, there is no marked pattern differentiating the views of men and women. Many believe their fishing method has no impact on coral reefs because gear operation is limited to the surface, high above in the water column and the majority are also against the imposition of a closed season or any total ban on *dulong* fishing.

Fishers' perceptions on regulation are also shaped by their views on who benefits from protection. Fishers believe that if they don't catch the fish, the fish will just go away anyway for somebody else to catch and enjoy the fruits of their protection. Letting the stocks rest and recover will not benefit them, they say. Moreover, *dulong* fishers believe that without the simultaneous and harmonized implementation of closed season and other limitations, they will unequally shoulder the burdens of conservation, while other *dulong*-catching municipalities continue to exploit the fishery. They likewise believe that conserving the stocks and allowing them to mature benefits the commercial fishers more than the small-scale folks. Large-scale fisheries such as "*pangulong*" (purse seine), with their bigger boats and more sophisticated technologies, have a bigger impact on overfishing and decline of the fishery. In group and individual discussions, male and female fishers have generally expressed how policing small scale fisheries to ensure sustainable production unfairly puts the sole responsibility for conservation to *dulong* fishers while allowing large-scale fisheries to evade accountability for their impact.

Reef management and tourism

Given the seasonal nature of *dulong*, many of the fishers alternate one or two other types of fisheries-based livelihoods to get by. 89% of the respondents think access to other forms of income from fishing is important, such that the majority is largely against regulating them. However, while there are policies that aim to limit access to certain types of fishing nearshore, the addition of formal and informal policies that aim to restrict *dulong* fishing has further exacerbated what locals felt were highly regulating and exclusionary rules affecting their livelihoods. This growing dissatisfaction is further exacerbated by other management tools and strategies that although are believed by the LGU to help in fish stock recovery, are regarded by fishers as interventions that benefit tourists more than fishers.

In addition to the marine sanctuaries where no fishing is permitted, the municipality of Lobo prohibits the use of gillnets to fish in rocky and coral reef substrates, providing exception to certain areas where sand or silt is dominant, for the purpose of preserving coral habitats. However, gillnet fishing was one of the key alternate livelihoods and banning this gear has had a big impact on the income of *dulong* fishers, as one noted: "People had a much harder time when they banned the use of net". Small pelagic fish caught using these gillnets also regularly contribute to the local diet, compared to coral reef-associated fish types that are at the same time usually out of the budget range of locals, therefore have a greater role in daily food consumption. "It is usually the

tourists who eat the coral reef fish because they prefer the pretty fish", one market vendor said.

Moreover, the gradual installment of over 10,000 artificial concrete block units in the nearshore waters of Lobo has increased the areas where fishing may be possibly limited. However, contrary to the expectation that the artificial reefs would help improve fish stocks, many fishers argue the ARs are useless because they are "empty" and therefore, not productive. This has driven the perception among *dulong* fishers that the policies set up to protect and conserve coral reefs (establishment of sanctuaries and artificial reefs) are only intended to increase Lobo's tourism appeal. One respondent even said, "They banned the net because they wanted the tourists to see more fish". Only 37% percent of the *dulong* fishers in the survey believe that an increase in coral cover or more coral reefs will benefit them. They say, "We can divide the sea so don't take everything", believing that more corals mean more protected areas and less grounds for fishing. Both men and women interviewed largely shared these views.

Fishers believe they are bearing the brunt of the consequences of these policies. Linking tourism opportunities as alternatives to fishing in order to decrease fishing effort is not lost on the local government, however. To facilitate a well-intentioned shift from fishing livelihoods to tourism-related jobs, the LGU has started a program to train fishers to become tour guides. In fact, around 3–5 *dulong* boats in Lagadlarin have started converting their boats into tourist boats during off-season already. Nonetheless, many fishers remain cynical as to the potential of tourism to supplement lost income. They argue that not all *dulong* fishers can become tour guides, and because tourism in Lobo is not fully developed, there are only a few jobs available and customers are scarce.

The rise in tourism has also driven land values to increase, driving some locals to sell land in favor of outsiders seeking to cash in on the tourism boom. Many of the resorts and AirBNBs, including private vacation homes, are owned by new entrants and outsiders based in Metro Manila and elsewhere. In 2010, the official zonal value of a commercial property along the seashore in Brgy. Malabrigo was PhP800.00 [USD 14.3.00] per square meter (BIR 2010). In 2022, the same zonal area is valued at Php3,500.00 [USD 62.5.00] (BIR 2022), growing the land value by 337% in 12 years. To that effect, they also do not see themselves as the main beneficiaries of tourism growth because many of the land titles and businesses are already owned by the wealthy few. In the survey, half of the respondents agreed to the statement when asked, "Is coastal development and tourism in Lobo beneficial to you?". Half of the respondents, on the other hand, think these activities are negatively affecting their livelihoods. Some fishers interviewed believe that the entry of more resorts are squeezing them and their boats out of the foreshore areas. Hence, they perceive coastal development to be designed to appropriate coastal areas for tourism at their expense.

Discussion

Our research has shown the significant contribution of the *dulong* fishery to people's livelihoods, and has shown how *dulong* is an important component of a multi-species fishery where pressure is distributed between multiple ecosystems and trophic levels across different periods of the year. Targeting small pelagic species in general diversifies the fishery and helps alleviate stress in coral reef ecosystems which are less resilient to constant fishing activities. This targeting of a wider set of species and the flexibility in utilizing a range of available habitats are deemed to be key attributes contributing to fisheries resilience (Eurich et al. 2023; Mason et al. 2022). However, our findings suggest that increasing governance of coral reef zones impact fishers livelihoods by diminishing access to nearshore resources, while governance of *dulong* fisheries impact support and legitimacy for coral reef management. Furthermore, the paper presents how maritime zone developments such as tourism interact with small pelagic fishing as a livelihood. Considering these overlaps and interactions between small pelagic fisheries and coral reefs, we highlight key areas that need to be considered in managing these resources.

Regulating effort for sustainability

Philippine small pelagic fisheries have been biologically and economically overfished since the mid-1970s (Dalzell et al. 1990). Moreover, the unregulated harvesting of fries poses a threat to the sustainability of stocks and contributes to overfishing overall (Muallil et al. 2014b). It has been long viewed that the reduction of fishing effort by both municipal and commercial fisheries is necessary in order to mitigate the depletion of stocks, hence, seasonal closures and fishing bans have been traditionally employed by fishery managers as input control fixes, especially during spawning periods. It has been demonstrated that letting the immature fish reach maturity size to reproduce improves fishery productivity (Froese et al. 2008; Ishida et al. 2009). In fact, reducing juvenile sardine catch is one of the priority goals of the Bureau of Fisheries and Aquatic Resources (BFAR) to manage the sardine resources of the country (BFAR 2020). However, unlike other fisheries, the sustainable management of small pelagics is complex because the fish stock is unpredictable and fish productivity is influenced by the fishes' life history traits, climate regimes, environmental conditions, nutrient input and primary productivity, leading to catch variability (Fernández-Corredor et al. 2021; Otero and Hidalgo 2023; Peck et al. 2021). In the Visayan Sea for example, the

impacts of the seasonal closure on the production of sardines and mackerels is uncertain, and uneven enforcement across interconnected areas undermine the effectiveness of its implementation (Bagsit et al. 2021; Napata et al. 2020). Additionally, traditional perceptions versus new scientific information continue to sow debate amongst local managers, enforcers and fishers whether *dulong* should or should not be exempted from regulation by virtue of being a naturally small fish, potentially impeding the widespread acceptance of any regulating measure on *dulong*.

The case of Lobo in this case offers an interesting perspective on the implementation and enforcement of other effort control measures such as defined hours for fishing and market-focused restrictions. Evidence suggests that regulation on this scale can be carried out with compliance without necessarily enforcing a blanket ban on fishing. Taking in mind the huge socio-economic contributions of *dulong* fishing to communities, steps can be taken to reduce fishing effort, aided by the right input controls and data such as limit reference points, to levels where they can be harvested sustainably. Extraction in small amounts may not have a huge impact on the overall survival of juveniles (Bagarinao-Regalado et al. 2023), therefore, *dulong* could potentially be harvested due to its high mortality during their larval stages. Controlled harvest and extraction then can also be monitored by improving registration and licensing of *dulong* boats and fishers, and by setting socially agreed and defined targets (Barclay et al. 2023).

Market and trade limitations on *dulong* also suggest modification in fishing behavior as a response to policy. Some fishers reported that they adapted to the new regulations through self-imposed quotas, limiting their catch to what they can only sell within the municipality. This allows *dulong* to remain accessible as a source of food and contribute to local food security. It likewise retains the diversified character of their fishery. It is known that in conditions where fishing effort is displaced, there is a possibility that fishers will divert their fishing effort elsewhere, to exploit other resources that may be in deleterious conditions themselves or intensify their operations once fishing opens (Armada et al. 2018; Cohen et al. 2013; Vaughan 2017). For instance, it may exacerbate growing fishery-coral reef tourism conflicts such as is already happening in Lobo, and possibly, create new conflicts as well. Targeting a diversity in species and trophic levels within optimal levels of exploitation enables a more balanced allocation of fishing effort (Bundy 2011; Garcia et al. 2016; Zhou et al. 2019).

Legitimacy of governance

As with all fisheries in the crowded coastal spaces of the Philippines, ensuring legitimacy for any governance mechanism is key to ensuring actual effective fishery governance, as well as for social equity. In this study, spatial and catch regulations were intended to limit nearshore fisheries for conservation but are perceived to favour the commercial fishery sector, fishers from other municipalities, and lastly, tourism—in effect, impeding community-wide acceptance for the policies. Regulation of small scale fishing without effectively containing large scale commercial fishing, whom they compete with for catch, challenges the legitimacy of the governance interventions. The study shows that *dulong* fishers are reluctant to participate in conservation efforts because it is perceived to be beneficial to the bottomline of sardine canning fishing fleets more than their own. We show here that fishers could be more concerned about the fairness of management, and it follows that where there are greater concerns about inequality of the rules than the greater goal of sustainability itself, the efficacy of governance will be highly constrained (Fabinyi et al. 2015). Addressing these disparities and uneven enforcement between neighboring and adjacent municipalities is an essential prerequisite in the policy to ensure compliance. Failure to consider fairness, especially between competing actors, in these scenarios will only undermine the credibility of fisheries management interventions (Loomis and Ditton 1993; Fortnam 2019).

Tourism

The ways in which livelihood and governance interactions between small pelagics and coral reefs have unfolded in Lobo are indicative of a wider, ambiguous relationship between fisheries and tourism that are present in much of the Philippines, Southeast Asia (Fabinyi et al. 2022), and elsewhere (e.g. Chernela 2005; Suripeddi et al. 2025). As with the concerns of fishers in Lobo over the governance of fisheries, exclusion and inequality are themes that are also pronounced in the interactions of *dulong* fishing with tourism. The development of tourism in Lobo and its emerging impacts—rising land values, "coastal squeeze" (Gupta and Bavinck 2017), an influx of outsiders and a proliferation of protected zones—is emblematic of a wider trend where ocean spaces are commodified and transformed into hotspots for investment and capital, opening economic opportunities, sometimes linked to sustainability (ecotourism), but in doing so, enclosing and territorialising these coastal spaces by restructuring resource access and property rights (Satizábal et al. 2020; Steinberg 2018; Vandergeest and Peluso 1995). While some fishers in Lobo have begun to offer boat rental, short-term rental stays, and rental of snorkeling gear and equipment to try diversifying their income sources, fishers report that income from these is still minimal, indicating that the ability of fishers to negotiate the tourism boom and access the full benefits of tourism is currently limited. While tourism is still in relatively early stages in Lobo compared to neighbouring municipalities, the extent to which the benefits of tourism will be widely distributed, including gendered dynamics (Eder 2006; Rowbottom 2023), will be key for future livelihood security among coastal residents.

Communities like Lobo that are already challenged by a multitude of regulations that limit essential fishing livelihoods are poised to respond negatively to further governance if they are to continue with fishing. Fisheries management strategies often associated with tourism—artificial reefs, coral reef rehabilitation, and additional marine protected areas—are tepidly received by some fishers because they are viewed to result in more enclosures. These management interventions, therefore, are not likely to win broad support if scaling governance for tourism and conservation means further straining the diverse types of fisheries livelihoods that people are dependent upon, unless livelihood solutions that are adequate for the communities' needs are made available. Long-term sustainability is also likely to be undermined if different objectives of fishery management, conservation and tourism are entangled (Oracion et al. 2005).

Conclusion

Building on related work focusing on the relatively neglected sector of small pelagic fisheries (Clifton and Foale 2017), this study has highlighted the contributions of the fishery to the economic and cultural reproduction of coastal communities, and examined the interactions between these livelihoods and the governance of marine resources more broadly. Fishers adapt to catch fluctuations in small pelagic fishing and limited land-based options for livelihood by diversifying within the fishery to use and target different gears, species and habitats. It can be argued that this flexibility and mobility contributes to the ecological and livelihood resilience of these communities that are likewise already facing various vulnerabilities (Allison and Ellis 2001; Eurich et al. 2023; Mason et al. 2022). We find that governance to improve the conditions of coral reef areas reconfigures use and access, affecting the livelihood adaptation strategies employed by small scale fishers. In parallel, new regulations on *dulong* fishing magnify existing constraints to livelihoods, and undermine the legitimacy of local fishery management strategies. These dynamics between flexible livelihoods and rigid governance ultimately have implications to the management of both small pelagic fisheries and coral reefs and their intended governance outcomes.

The interactions of livelihood and governance within the wider fishery context reflects broader tensions between small scale fisheries and tourism that is increasingly prevalent in coastal zones, as part of widespread shifts towards the logic of 'blue growth' (Bennett et al. 2021). Management interventions for coral reefs are organized embodying the conviction and logic of environmental conservation simultaneously coupled with economic development. But while policymakers and managers see the synergy of these two values in marine tourism, initial impacts and fisher perceptions of tourism development diverge from this "win–win" notion. Our study highlights that these synergies are not automatic, and that the equitable and sustainable management of both coral reefs and small pelagic fisheries will require not only regulations to manage fishery stocks and coral reef habitats, but also attention to the diversity of fisheries livelihoods, and efforts to mitigate the potentially harmful externalities of coastal tourism.

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Declarations

Conflict of interest On behalf of all authors, the corresponding author states that there is no conflict of interest.

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