From communal access to private ownership: Negotiating rights to the sea

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5 From communal access to private ownership

Negotiating rights to the sea

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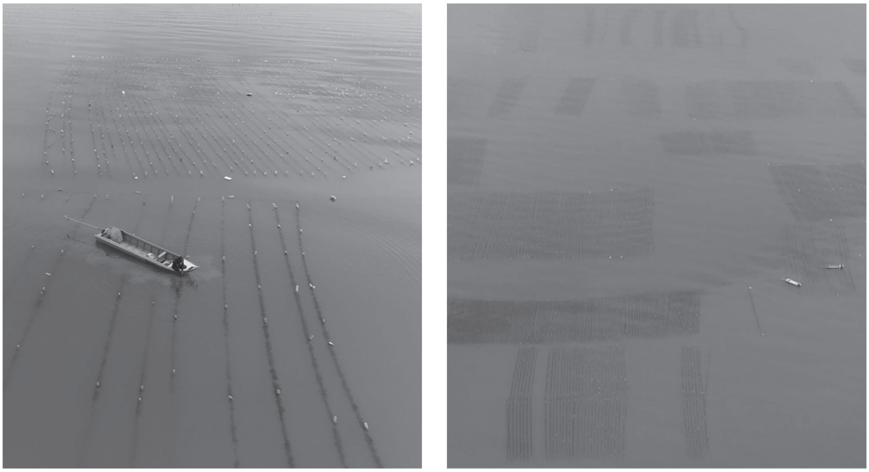
Enclosure

Looking out across the waters of Pitu Sunggu, the ocean is visibly full of seaweed farms, tightly packed together with only small gaps between them for boats to pass through. Just twenty years ago, seaweed farming was virtually unknown in this area, and fishermen moved around the space freely, catching fish, netting crabs, and trading with offshore islands. The sea was a communal resource which could be used by anybody, and nobody could be prevented from using it. However, today it is divided into individually owned plots of sea space (Figure 5.1) which can be bought, sold, rented, and inherited.

Seaweed farming has caused a dramatic change in the way that the sea is used and managed. Unlike fishers and crab netters, who typically move around across large



(a) (b)

Figure 5.1 a) A seaweed farmer working on his farm; b) Pitu Sunggu seaweed farms from above

Image from drone footage by Nur Ihsan recorded May 2022 offshore of Pitu Sunggu village.

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areas in search of their catch, seaweed farming requires that farmers be able to claim use of an area of sea space for the full farming cycle – around six weeks (Figure 5.1). During the time that the seaweed is growing, they must be able to exclude other ocean users – such as crab netters and passing boats – from their area of the sea, as boats passing through a seaweed plot can damage the seaweed or become tangled in the ropes supporting the farm. In addition, in order to set up their farming apparatus, farmers must install anchors to attach their farm to the sea floor, known as seaweed farm 'foundations'.[1] These foundations delineate the area of the farm and are expensive to set up. To justify the investment, farmers need to be able to guarantee that they will be able to continue to use them for longer than just one cycle – normally for several years. This requires a different type of right to use the sea: one that is both exclusive and permanent. This is a significant change from the customary use of sea space, in which people have traditionally enjoyed the non-exclusive right to temporarily access the sea: they were free to use it, but so was everybody else.

The success of the seaweed farming transition has therefore depended on the conversion of the ocean from a public access area to space divided into discrete, individually owned farming plots, where farmers can work the same area of sea space over many months or years. It relies on excluding other ocean users from seaweed farming areas, and, in Pitu Sunggu, the excluded users are primarily crab netters, who with the seaweed farming transition have been pushed out of shoreline areas, and now must set their crab nets further offshore or in the gaps between seaweed farms. The concept of land 'enclosure' has been widely used to interpret the drivers and effects of 'the division or consolidation of communal … lands' into 'carefully delineated and individually owned and managed farm plots' (*Britannica* 2013, n.p.). Early writing on enclosure in Europe explored the multiple interacting forces that led to enclosure of common land from the 12th to the 19th century, driven not only by landholding elite, but also by farmers themselves:

> Contrary to the popular idea that enclosure was wholly a landlord's movement … there was a distinct effort on the part of the peasantry … to abandon the open-field system and escape compulsory co-operation with the lazy and shiftless … there was no compulsion on the customary tenants … to make them enclose; theirs was a purely spontaneous movement prompted by a desire to escape obsolete restrictions. There was also another motive – the need of self-protection. The growth of large grazing farms, and the consequent over-stocking of the commons, led the small men to enclose as the only way to keep some of the pasture for their own use.
>
> (Curtler 1920, pp. 65–66)

As Curtler notes, enclosure resulted from multiple divergent efforts on the part of different groups of people operating under interacting pressures over a long period of time, resulting in uneven geographies of enclosure. He emphasises the agency of farmers within these processes, as actors in the process driven by both entrepreneurialism (desiring to 'escape compulsory co-operation' with others), and the increasing pressures they faced as a result of broader structural changes.

More recent work on enclosure has similarly emphasised both 'top-down' and 'bottom-up' processes of enclosure. In Indonesia, enclosure has often been driven by large-scale land acquisitions for agriculture (such as palm oil plantations), mining or conservation (for example, Goldstein 2016; Hall et al. 2015; Ito et al. 2014; McCarthy et al. 2012; Pichler 2015; Schoenberger et al. 2017; Semedi and Bakker 2014). However, enclosure is also a process undertaken 'from below', by smallholder farmers themselves (see, for example, Alkhalili 2015; Castellanos-Navarrete and Jansen 2015; Curry and Koczberski 2009). Investor- and farmer-driven processes often interact as smallholders both respond to external pressures (for example, Giorgio et al. 2022) and entrepreneurially pursue new agricultural opportunities, such as those offered by export commodities (for example, Olofsson 2021).

To date, the Indonesian seaweed industry has been resistant to large-scale agribusiness as a result of the practicalities of farming seaweed, which is seasonally variable, requires high labour inputs, and is subject to high levels of risk due to environmental changes (as will be described in detail in Chapters 6 and 7). Consequently, processes of enclosure have occurred within villages largely in the absence of claims on sea space from outside the village. In this context, enclosure has been driven by coastal residents themselves. Hall et al. (2011, p. 145) describe smallholder driven processes of 'intimate exclusion', in which 'neighbours and kin who share common histories and social interaction … exclude one another from access to land as part of a strategy to accumulate capital'. They note that 'these are "everyday" processes, mundane and piecemeal, that do not grab headlines. But cumulatively, they have the effect of producing agrarian classes with differential access to means of production' (Hall et al. 2011, p. 145). The role of export commodities in triggering the reconfiguration of land access systems has been studied in several contexts. Rights to use land are often gained through the application of labour. In subsistence agricultural systems, constant labour application on land is typically required to maintain its productivity, which reinforces the ownership claim of the user. There are differences in labour use between different types of land-based agricultural activities – annual crops and perennial crops – that impact on the establishment of property rights. Li (2014) describes how the production of cocoa by Sulawesi highlanders generated enclosure of previously communal land. She emphasises the materiality of cocoa as central to this process, since

> [t]ree crops like cacao do something by their permanence. When highlanders planted cacao in their fields, the presence of the trees disrupted the cycle in which they cleared a patch of forest, used it for a few seasons, then left it to fallow. The trees also changed the ownership status of the land, transforming it into individual property, since no one else could use the land thereafter. Excluding other users, and other uses, wasn't new: planting a field of corn also required exclusion, at least until after the harvest. The new element was permanence.
> (pp. 84–85)

Similar processes occur in Vanuatu where production of kava in large quantities for export, which requires lower labour inputs than traditionally produced food crops, enables the use of much larger areas of customary land than was possible under traditional cultivation systems (Langford 2019, p. 26; 2022). In such cases, changing agricultural livelihoods shifted the way that communal land was used and claimed, in some cases laying the groundwork for the creation of what is now recognisable as more formal land markets, in which it is possible to buy, sell, rent, inherit, and lend against plots of previously communal land. This chapter explores how Pitu Sunggu village transitioned from a system of shared communal rights to access the sea to a system comprised primarily of private ownership rights – in less than two decades. It outlines how this system was negotiated by seaweed farmers and other ocean users, how it is (tentatively) maintained and stabilised today, and the potentially conflicting agendas of provincial and national government marine zoning programmes and local marine space governance. We begin with the first seaweed farmer.

The first seaweed farmer

At the turn of the century, seaweed farming was not yet established as a livelihood option in Pitu Sunggu. On the land, coastal residents cultivated shrimp and fish in brackishwater ponds, and in the sea they caught fish and crabs which they sold, traded, or consumed. As discussed in Chapter 4, marine fish were an important dietary supplement. The sea was viewed as a communal resource: anyone could use the sea to find sustenance, and no one had the right to exclude others. As one village resident put it, '[I]n the sea, no one may forbid you from searching … just like when we came to the village, there was no rule to forbid us from searching in the sea to find sustenance'. Crab fishing was a major livelihood strategy in this region. Crabs are caught by installing temporary gill nets in the ocean which are left for hours or overnight (depending on the net size and other factors) and are checked regularly for crabs caught in the net. They are more permanent than net fishing because they occupy an area of the sea for up to a few days, but are still relatively transitory, since crab fishermen move around to optimise their harvests of crabs with different tidal and seasonal fluctuations in ocean conditions.

From our interviews and oral histories, it appears that seaweed farming was first successfully introduced to the village sometime around 2007,[2] most likely by a man we will call Dodi. Dodi recalled that a family member from Bone Regency had come to see him to tell him about seaweed cultivation, reporting that the results were very good. He decided to try it, and travelled to Makassar to buy ropes, which were not available in the village, and then rented a car and drove to the regency of Bone, some 170km away, to buy seeds to start the cultivation. Dodi describes the community resistance to the new activity:

> When I first started farming seaweed, there were many challenges … the crab fishermen did not agree with my seaweed farming, because my farm displaced their crab nets … They went to the house of the village head and protested against my farming … [they said] 'why put a rope in the sea?' Many people were angry, because the seaweed ropes prevented them from looking for crabs … but I persisted. Even at night, I went out to sea to guard it. I brought a light and a flashlight to guard the seaweed and tell the crab

> fishermen who were looking for crabs at night not to cross my seaweed longlines. I did it with the help of my neighbor. I went out to sea after dinner, and guarded it until 9pm, when the crab fishermen were no longer active … Often [people would damage my seaweed farm]. They broke my rope, longline and anchor. Some used boat propellors, some used machetes … For a year, every day there was an argument.

Early adopters of seaweed cultivation report that their activities were not welcomed by other village residents. As one early farmer described,

> In the beginning, many people hated this seaweed. They said, "what kind of job is that? After being lowered into the sea, [the seaweed] is raised again?" They really hated it. But I did it anyway, [although] I felt embarrassed … people laughed at us at that time.

As others began to experiment with seaweed farming, conflict over the use of sea space intensified, beginning a period of conflict that lasted for several years and involved direct confrontation between those who sought to claim areas of the sea for seaweed farming and those who wished to maintain the system of communal access. The conflict was concentrated around crab netters and seaweed farmers, as one farmer described:

> People here argued because there were those who want to catch crabs and those who wanted to plant seaweed. How can you put a crab net if there is a seaweed plot there? The seaweed [ropes] will get stuck in the net. That's the reason they fought.

Prior to seaweed farming, crab fishers were responsive to changing ocean conditions and would move their nets around and change the type of net they used depending on prevailing conditions. They would test locations in several areas by installing a net there, and if the catch in that location was good, would install additional nets. They resisted the construction of seaweed farms as it prevented them from moving around in this way and reduced the area available to them. The imposition of seaweed farms excluded them from areas of the sea, and deprived them of the access rights they had previously enjoyed. In particular, residents of the coastal hamlet of Pungkalawaki (who had traditionally specialised in marine capture livelihoods) opposed the construction of new plots. As one farmer described:

> In the past, none of the Pungkalawaki residents wanted to plant seaweed … if anyone wanted to build a new foundation, it was prohibited by the Pungkalawaki people, because they only liked to net crabs and the area for crab netting was large when it was not planted with seaweed … [The situation lasted for] almost five years. People would stand guard at the wharf and if someone wanted to build a foundation, the Pungkalawaki people would take away the ropes they were using … It used to be difficult, almost every day people wanted to fight.

Fierce resistance to seaweed farming persisted for a number of years. Residents recalled conflict between the new seaweed farmers and the crab netters, who were angry about the decreasing area available for them to catch their crabs. As one early seaweed farmer described, '[when they] passed our houses, they always provoked fights … they were annoyed and asked "why did you make the foundation where we usually hang our crab nets?"'. The residents of Pungkalawaki, including the hamlet Head, unilaterally forbade seaweed farming along the coast of Pungkalawaki (the borders of which were marked by the mouths of the Bawapitu and Langoting Rivers). At that time, every Friday at the mosque it was announced that seaweed farmers should not make plots along the coastline of the village. Despite this, seaweed farming gradually began to encroach on the village coastline, often established by residents of neighbouring villages. Residents of the coastal hamlet grew increasingly frustrated with their inability to exclude people from the area. One of the residents expressed regret that even though these seaweed farmers had violated the rules, they could not be punished for their actions. One influential village member, Pak Vino, who had vehemently opposed the construction of seaweed farms in the region, described to us how over time he became increasingly anxious about the situation. Seeing the expansion of seaweed farms along the coastline of the hamlet, he realised that soon there would be no space left. Accepting this, he relented and began to install his own farms along the coastline in order to avoid missing out on claiming an area of sea space for himself. His actions were observed by other village residents and were followed by a rush for sea space and a rapid dissipation of resistance to the practice. Seaweed farmers quickly became a majority within the village.

Claiming the sea: first come, first served

From 2007 to 2011 there was a rapid increase in the number of seaweed farmers, from 16 to 50, and these were mostly from Pungkalawaki, the coastal hamlet that had initially resisted the construction of farms (Figure 5.2). This was followed by another period of uptake and consolidation from 2011 to 2019, when the total number of seaweed farmers in the village rose from 50 to 93 (largely due to residents of Kampung Baru hamlet taking up the practice), while existing farmers continued to accumulate plots of sea space.

Crab fishermen who established their own seaweed farms were no longer in a position to protest against the farms of others, and as more and more people took up this activity, resistance dissipated. Specialised crab fishers no longer actively protested against seaweed farming, as they found themselves surrounded by family and friends who had plots. As one crab fishermen said,

> I was bothered by the seaweed farms because when I went to the island [to net crabs] there would be people there installing seaweed [in the crab netting locations] … [but I] didn't say anything, I just felt it in my heart because [seaweed farming] cannot be forbidden. Because here we are all family, so you can't say anything.

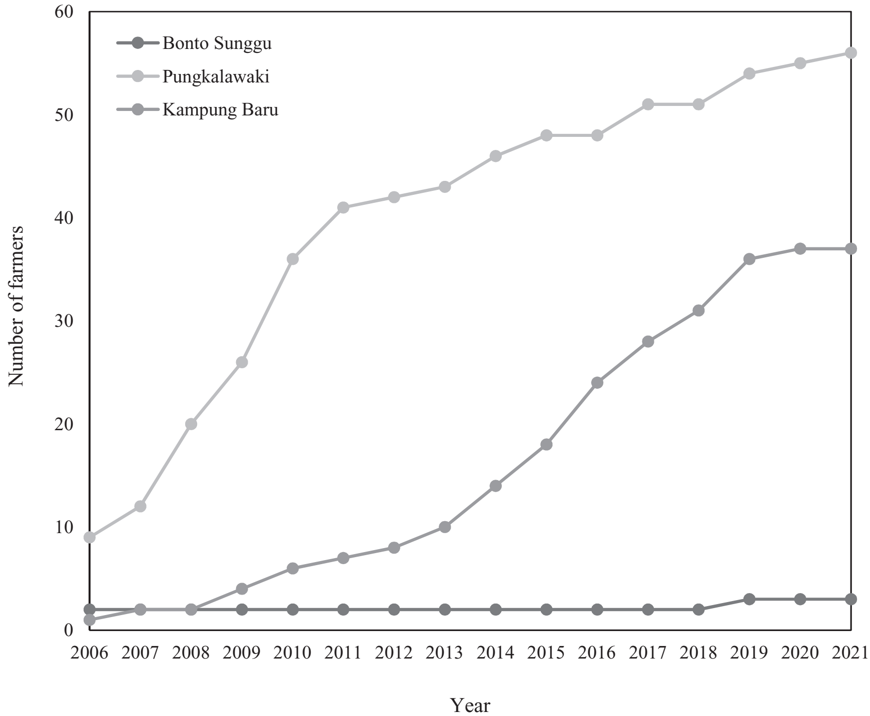

Figure 5.2 Increase in number of seaweed farmers over time by hamlet

Source: Data from authors' survey.

During fieldwork we spoke with several crab netters who complained about the challenges of crab fishing in the seaweed dominated area. However, the situation has become less clear over time as many coastal residents undertake a combination of activities. Sometimes crab netters have felt unfairly marginalised by the encroachment of seaweed farming, and at other times they have been the beneficiaries of it. As one farm extension officer put it, '[T]here is no conflict between seaweed farmers and crab fishermen because the two professions are carried out by the same person'.

As seaweed farmers rushed to claim areas of the sea for their farm locations, their selection of sea areas was complicated by the variable suitability of the coastal space for seaweed farming. Oceanic conditions can change rapidly and often vary across small areas. Farmers could only assess if seaweed would grow well in a particular location by trial and error, such that they would 'test' an area by constructing a foundation, planting seaweed in it, and observing its growth. As one farmer said,

> In the beginning, there were still not many people working on seaweed. So we spread the cultivation area. We checked the condition of the waters – "Oh, so it's like this". Then we moved to another location and then checked again the condition there. And so on until we got to the waters that were quite far away.

When farmers found an area in which the seaweed grew well, they would install additional foundations in that location. Cognisant of the rapidly decreasing area available for cultivation, they rushed to claim productive areas of sea space – one farmer described the attitude at the time, '[W]hen you see that your seaweed [growth] is good, immediately expand your cultivation area. Because later there will be no space left.'

Although the spatial variability in productivity contributed to the rapid claiming of space, it also led to abandonment. Many farmers would install foundations in plots and then abandon them if they were unproductive, susceptible to disease, too muddy, too vulnerable to fish grazing, or too far away to be easily used. Unlike some horticultural and forestry crops that entail substantial initial and ongoing investments, it is relatively easy to establish and maintain ownership for seaweed plots, simply by leaving foundations in the water. Thus, even if unproductive, many households retained claims to the plots. Furthermore, many of these previously abandoned plots have been brought back into operation as seaweed farming methods have changed – through, for example, the introduction of the double-line method which made farms more resilient to waves, the introduction of the sacol seaweed species which was suitable for cultivation during the dry season, and higher prices which make it economic to farm areas of lower productivity.

In addition, as seaweed is highly vulnerable to disease caused by a sudden change in ocean conditions (brought about by factors such as high rainfall), some farmers have pursued strategies of geographic diversification, in which they build plots in a range of different areas to minimise the risk of losing all their seaweed after a significant weather event (as will be discussed further in Chapters 6 and 7). As a result, many farmers have claimed large areas of sea space, and sea space ownership is unequally distributed in the village: the top 25 per cent of seaweed farmers produce 51 per cent of the village's seaweed, while the bottom 25 per cent produce just 6 per cent. In addition, there are a number of households that want to farm seaweed but are excluded from the industry due to a lack of sea space. The largest producers of seaweed in the village are those who laid claim to plots early in the development of the industry (Figure 5.3).

Some of these seaweed farmers have rights to very large areas of sea space. One farmer described how he had worked proactively to establish his foundations. Every time he heard someone say they had found a good growing area, he would go to the location and build a foundation. In the end, he had so many foundations that he was unable to work all of them. As he boasted to us, '[M]y foundations have never been full. I have planted more than thirty thousand seeds but the site is not full yet … [my location is very] wide.' Another farmer told us that during the rush for sea space he had built so many plots that he was unable to find them all again later, because he had left them idle for a while and the foundation anchors had been buried in sand.

Other farmers – typically those who commenced later – only have access to small areas, sometimes sharing a single plot between multiple family members, or entering into sharecropping arrangements with other residents. One couple described how, after returning to the village from working on another island for

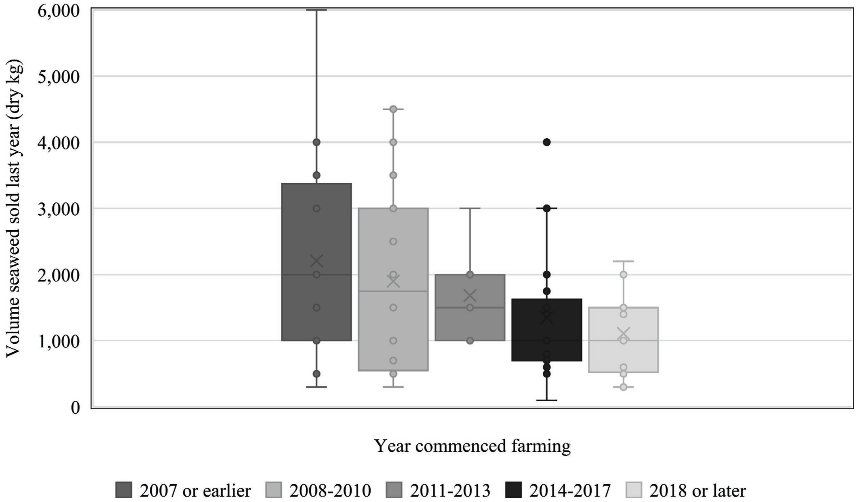

Figure 5.3 Scale of production of farmers commencing seaweed farming at different times

Source: Data from authors' survey.

several years, they had found that most of the sea had already been claimed and had had to work hard to establish their livelihood in the village. They had first slowly accumulated money by catching crabs, and eventually saved enough to build a small seaweed foundation in a 'boat lane' – an area of the sea proximate to the river kept empty to allow boats moored upstream to travel out to sea. They reported that they kept the foundation as small as possible to try to avoid conflict and allow boats to still pass by. They gradually accumulated money by farming this small plot, hoping to eventually rent or buy a larger plot. As they explained, their inability to access sea space meant that for them, '[I]t's been a long process. Not like people who have a lot of money [to rent a good space].' Despite the unequal division of sea space amongst village residents, owners of seaweed farming areas feel justified in their ownership, which they see as grounded in their own labour and entrepreneurialism. As one seaweed farmer noted when discussing the distribution of sea space in the village, '[E]veryone already has a location, except for those who showed up late'. However, this system of ownership is maintained not only by seaweed farmer labour, but by the ability of seaweed farmers to access the labour of others.

The development of markets for land, labour, and capital

Labour and capital markets

The rush for sea space was driven by the pressure villagers felt to secure areas for themselves and was compounded by the uncertain production conditions for seaweed, since the yield from different locations varied considerably and in ways that varied seasonally, such that farmers could not be sure that the plots they had secured would be productive. This led to the claiming of large areas of space by some farmers. However, seaweed farming is highly labour intensive. Seaweed is grown from propagules (cuttings), and these propagules rapidly deteriorate when they are removed from the sea. This means that when seaweed is harvested, cuttings from the mature seaweed must immediately be taken to seed the next cycle, and these must be reattached to ropes and returned to the sea within about 24 hours. This work is very labour intensive and there are limits to the speed at which ropes can be tied. An average, middle-aged binder can tie around one rope an hour. Farmers wishing to produce higher volumes of seaweed (for example, wanting to re-plant 100 ropes in a day) need to enlist the assistance of paid labourers, who typically work in groups of five or more so that they can quickly bind large amounts of seaweed.

Without the labour of seaweed binders, farmers would not be able to profit from operating seaweed farms across large areas and there would be fewer incentives to maintain ownership of areas that they are not using. The supply of labour from other village residents therefore supports the ownership of large farmers. More recently, as farming has increased with high prices, farmers have begun sourcing labour from nearby inland villages because wages are lower and there is higher availability.

In addition to labour, farmers need access to capital to benefit from ownership of sea space, to pay for ropes and the purchase new seeds when changing seasonally between seaweed species or when their crop is affected by disease (as happens regularly). Sea space ownership is therefore founded not only on claims to the sea, but also the ability to access the labour and capital necessary to benefit from those claims. Labour is typically provided by groups of mostly female seaweed binders, who work together to attach seaweed to longlines (as will be discussed further in Chapter 8). Capital is provided by the farmer themselves, by banks through the People's Business Credit (*Kredit Usaha Rakyat* (KUR)) scheme, by pawnshops, and by seaweed traders, who provide financial services to farmers in addition to buying their seaweed (as will be discussed further in Chapter 9). We found that it is common for farmers to borrow from multiple sources concurrently, and to repay old debt using new debt from other sources. The system of sea ownership has therefore been enabled and sustained by the development of labour and financial markets within the village. These features have supported the ownership of large areas of sea space by some farmers, leading to a situation in which the space which is productive for seaweed farming has been fully claimed – creating a condition of scarcity required for the assetisation of land (Visser 2017; Langford, Lawrence, and Smith, 2021).

Sea space markets

The filling of the sea space in Pitu Sunggu has meant that newcomers to the industry are unable to claim areas of the sea in productive growing areas, and instead need to rent, borrow, or buy space from other seaweed farmers. Seaweed farming is viewed as a highly profitable activity, and seaweed farmers see their farms as important assets and sources of wealth. However, some farmers have areas larger than they can manage themselves or have claimed areas which they don't farm. Some who claimed space in the sea have since moved away or grown too old to work their plots. Meanwhile, as prices paid for dried seaweed more than doubled between July 2021 and October 2022, seaweed farming came to be viewed as a much more lucrative activity. Some people from the village who moved away in order to find work began to return to try their hand at seaweed farming. As one farmer described, '[T]his year … the nomads, city people, everyone – they came home [to work on seaweed]'. As a result, there was demand for space in the sea from those without claims to it, and some people who had claimed areas of the sea but did not wish to use it, leading to the development of a market for sea space.

Renting

The most common type of sea space transaction is the leasing of a foundation to another farmer. Renting practices are highly seasonal, as the seaweed farming year is divided into two seasons. The 'dry' season runs roughly from May to October, in which the species cultivated is mostly 'sacol', and the region of cultivation is mostly in areas close to the coast (100–500m from the shoreline). This gives way to the 'wet' season, roughly from November to April, in which the 'cottonii' species of seaweed is grown in areas further from the coast (>500m from the coast). These locations can be a long way from the coast (up to 5km) as in this area there are several offshore islands and a large expanse of shallow waters that farmers make use of. The seasonality of seaweed farming is clearly visible on satellite imagery (Figure 5.4). Farmers report that the areas suitable for cultivation in the dry season are full, and this area is closely packed with seaweed farms during these months.

In the wet season, farmers can achieve good seaweed growth in outer areas but also experience a high level of risk associated with crop losses due to sudden changes in ocean conditions (as will be discussed further in Chapter 6). Consequently, the dry season is widely considered to be the most profitable season for seaweed farming in Pitu Sunggu, but many farmers do not have foundations in locations suitable for cultivation during this season. In addition, variable spatial productivity means that some plots are not productive, while others yield good seaweed harvests. As one farmer explained,

> In that sea, all fertility is not the same. There are indeed points in the sea that are considered rather fertile, there are also those that seem to be barren land. If only all locations in the sea were fertile, no one would fight over space, no one would need to rent space. That's why people rent the sea space, because in the right position, which is good, which is fertile, they don't have a place.

Due to the shortage of space suitable for dry season cultivation, the leasing of space during this season is common. One respondent, who owns around 900 stretch ropes, mentioned that although he owns several foundations in suitable dry season locations, this area is still not big enough to fit all of his 900 ropes, so he rents three

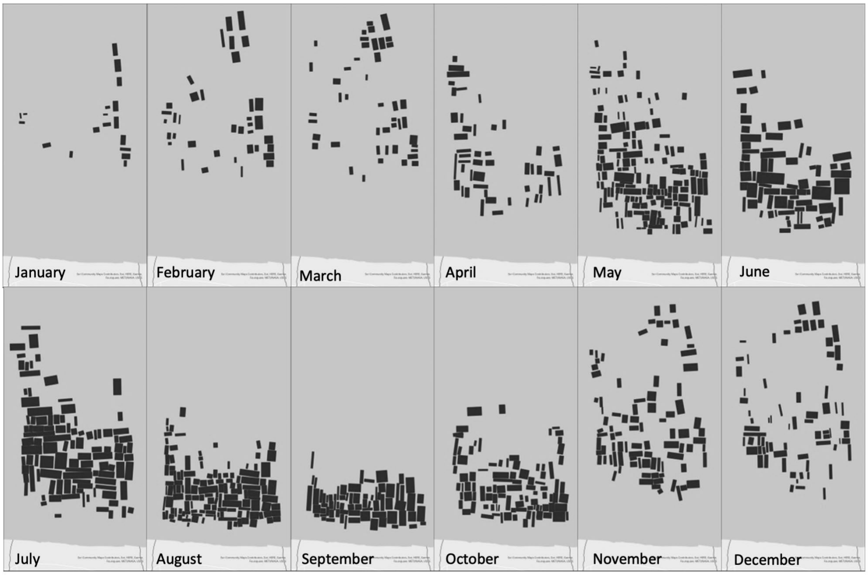

Figure 5.4 Seasonal change in sea space use for seaweed farming in Pitu Sunggu in 2022

Source: Image created by Zannie Langford using data from Planet Labs for 2022.

additional foundations during the dry season. However, during the rainy season leasing happens infrequently because many farmers own foundations in waters that are quite a long way from the coast. In fact, according to one of the farmers, there is still enough area in the outer waters for new foundations to be laid. Indeed, there seems to be a class of 'senior farmers' who own plots close to the shore, while many newer entrants to the industry only have space further out to sea. Typically, farmers from Pungalawaki hamlet who started earlier (Figure 5.2 above) dominate this class of senior farmers, while farmers who started later (many of whom are residents of Kampung Baru) are less likely to own foundations close to the coast.

As a result, foundations are commonly leased during the dry season, where a fee is paid to the foundation owner for its use. There is no set price for plot rental, rather the price depends on the growth rate of the seaweed in that area (referred to as the 'fertility' of the plot), the size, location, and duration of lease (often a year or 'season', but flexible arrangements are also common). With the doubling of seaweed prices that occurred during the 2022 financial year (as described in Chapter 2), demand for sea space also grew, putting upward pressure on rental prices. As one renter described:

> The owner will set the price. Many people want to plant seaweed, but because we don't have any space, those who do have space will raise the price for us to rent … Previously it was Rp. 500,000 (~$50) [for the season], then it increased to Rp. 1 million (~$100). My cousin increased the price like that too, he told me that 'seaweed is already valuable. If you don't want to rent the

> space [at that price], someone else will take it' … Many people are looking now, even though the rent is already now up to Rp. 3 million ($300).

Lease prices in the village vary widely between Rp. 500,000 and Rp. 5,000,000 per foundation ($50–$500), with a duration that typically spans a planting season but in some cases lasts until it is reclaimed by the owner. Farmers differentiate between the 'quality' of different plots in assessing a foundation rental price. For example, one farmer referred to a location close to the mouth of the river as a 'first class' location. The renting of plots provides an avenue for young people and new farmers to commence farming, but the high price of leases make this a somewhat risky venture and excludes people who do not have the capital required. Many new farmers took up seaweed farming by using plots belonging to a family member, or by establishing small plots in unfavourable locations. Barriers to entry of seaweed farming have therefore increased significantly since the industry was initiated about two decades ago.

Buying

Foundations can also be sold if a farmer is willing to permanently part with their right to their foundation. We found only a few reports of sales of foundations, and these had occurred several years earlier at varying prices. One sale occurred a few years ago for around Rp. 1 million (~$100) for a 500 stretch plot (capable of holding 500 'double' ropes), and another in 2021 for Rp. 5 million ($500) for a 1,000 stretch plot. These prices are currently considered very low relative to rental prices and seaweed farm profits after the recent price increase. As a result, sales of seaweed farming foundations are uncommon, and farmers report that it is currently very difficult to find a foundation for sale, as they only become available when farmers are quitting the business permanently. When asked whether he would ever consider selling his foundation, one farmer responded, 'Never. I will bequest this foundation to my children … nothing can interfere [with that].' Most sales that occur tend to be between relatives and are therefore at prices below that which would be expected on an open market. Foundation owners not using their plots prefer to rent them out rather than sell them, as this provides a regular source of income and retains their right to use the plot in the future if production conditions change or prices remain high.

Borrowing

Although the market for sea space appears to be maturing, there are still some farmers who prefer to lend their land without charging a fee. These farmers feel that since anyone may find themselves in need of help at any time, it is important to cultivate a supportive relationship between farmers. As one such farmer said,

> I have never bought [a foundation], nor have I rented [one]. At most, if people want to borrow [my foundation], I just lend it to them, no charge ...

> I have a foundation … that can fit around 1,000 ropes, it hasn't been filled in 7 years … [It is] not [for rent], people there just use it … [if I want to use it] I just come, I say that I want to fill it. People here [are like that] …we just exchange information with friends, that such and such [belongs to] such and such, [but you can] just use it for now.

Some farmers appear to have close working relationships with each other to the extent that they do not even need to ask each other's permission before using a plot. Farmers who benefit from this sharing system report that they have been greatly assisted by it when they were just starting in the industry. The practice is common among family members and friends and requires a level of trust between lender and borrower because of the potential for conflicts to arise.

Conflict over sea space

Conflicts occur between different users of the ocean as a result of the sea space ownership system that emerged through the development of the seaweed industry. Rising prices of seaweed through 2021–2022 intensified conflicts between sea users, including old conflicts that had faded away and new conflicts that have arisen. These conflicts have mostly been resolved quickly and informally, although some parties appeared to continue to harbour negative sentiments. As one farmer involved in a conflict put it, conflicts may seem to be 'quickly resolved … but are like a "thorn in the flesh" … They must arise again. Not all of them [can be considered finished]. The people's mindsets are different. There is social jealousy.' We observed three main types of conflicts: between seaweed farmers and crab netters, between seaweed farmers and boat users, and between seaweed farmers and other farmers.

With fishers

The first common type of conflict over sea space occurs between seaweed farmers and fishers, including crab netters. As a result of the shrinking space available to crab fishers to hang their nets, they often work in close proximity to seaweed farms. Gill nets for catching crabs are installed on the bottom of the ocean in 'sets' of 12 stretches of 100m, and 2–3 stretches are often lined up sequentially such that they may reach several kilometres in length. The location and direction of the nets on the sea floor are difficult to spot from the surface such that crab nets often overlap each other on the seabed, and may become tangled. One crab netter complained that during the crabbing season, there were so many crab netters that 'the nets on the seabed are like cobwebs'. Conflicts can occur because crab netters working in close proximity to seaweed farm plots may inadvertently damage the plots if their boat collides with the seaweed farm. In addition, crab nets often become tangled in the seaweed farm ropes. A tacit agreement has been reached that when this occurs, the crab fisher must cut their own net. Crab nets are easier to repair than seaweed ropes, and crab fishers do not want to be liable for the potentially high costs of damaging a seaweed farm. Similarly, crab fishermen and fishers are both liable for any damage they may cause to seaweed farms whilst moving between them. Most fishermen reluctantly accepted this rule. As one fisher complained,

> Why is it that we fishermen are just catching fish, but seaweed farmers are angry if we cut the ropes or [damage] the foundation, when we only do that because there are no more roads [for boats] that we can use … [there are] unlimited [seaweed] foundations.

Another fisherman complained about the negative impact that they perceived that seaweed farming had had on their livelihood:

> Since I was small, I have been catching fish … [but] since seaweed has been here, I rarely catch big fish … there have been many changes … in the past it was easy … [but] now [the fishing location] is far away … [because] there are [seaweed] foundations. If the current is fast, [the boat] can float [with the waves] into people's foundations …

Some seaweed farmers expressed anger that crab fishers damage their foundations. However, the overlap in livelihood activities between crab fishers and seaweed farmers curbed these conflicts. As one seaweed farmer explained,

> Crab netters are not completely to blame, because the distance between seaweed foundations is indeed narrow. What can he do but install the crab net right on the sideline of the foundation? So when the boat is hit by strong waves, they cannot control the rudder. It automatically goes up into the seaweed. This is bad for the crab netter, but he really can't control the rudder too much…. [he has to] keep throwing [the net into the sea and] keep one hand on the wheel [for steering].

Seaweed plots are often left empty for days (between cycles) or months (between seasons) and crab fishers can use an empty foundation for laying crab nets. They report that they vacate the plots when the farmer who owns it indicates that he will imminently be planting it with seaweed. As one crab fisher said,

> we understand each other … if … the next day he wants to fit the plot with seaweed, he makes a sign, and from the sign we know that tomorrow the foundation will be fitted with seaweed so we can no longer put nets there … [we give in] because we who are crab netters are not bound to one location, it is different from seaweed farmers because they have to make a foundation beforehand.

Crab netters therefore appear to have workable, but lesser rights to use the sea than seaweed farmers. They can net crabs in the gaps between seaweed foundations, but must cut their own net if they become entangled with a seaweed farm. They can use empty spaces marked by seaweed foundations, but must vacate them when the owner moves to use them. They can still find empty spaces not marked by foundations, but often have to travel further out to sea, using valuable petrol to do so. Crab fishers therefore feel that on the whole, their rights have diminished as a result of the introduction of seaweed farming. They also report that while crab prices are higher today than they were fifteen years ago, this is offset by smaller catches in both the size and number of crabs.

The introduction of seaweed farming has not, however, had a uniformly negative impact on crab fishers. Seaweed often breaks off seaweed longlines as a result of wind, waves, and changes to seaweed health. This phenomenon is particularly common in March, when Pitu Sunggu experiences high winds and waves. Broken seaweed becomes entangled in crab nets, and when this occurs in large quantities, crab netters can obtain significant quantities of seaweed (Figure 5.5). During 2022, when the majority of this research was undertaken, the crab season ran roughly from April to June with crab prices ranging from Rp. 20,000 to 75,000/kg. Although the prices are highly variable, they were much higher than a few years ago when farmers reported prices of only around Rp. 15,000/kg. During the same period (April–June 2022), seaweed prices increased from Rp. 33,000 to 37,000 Rp/kg dry – the equivalent of around Rp. 4,400 to 5,000/kg wet. As seaweed collected in the crab nets in much greater quantities than crabs did, crab fishermen found this to be a significant extra income stream. The crabbing season runs roughly from April to June, during which time crab fishermen typically catch 7–10 kg.

Outside of this season, catches of crabs are limited, but many crab fishers still install crab nets in order to catch the broken seaweed – going 'fishing' for seaweed, using old, damaged crab nets to catch falling seaweed. As one crab netter commented, 'It is good if there is (strong) wind because we can catch the (broken) seaweed'. This is especially common in March, when high winds mean that there is significant seaweed breakage. Some seaweed farmers expressed annoyance at the crab netters benefitting from the broken seaweed since they were simultaneously experiencing losses of their own seaweed, but as the seaweed could no longer be assigned to any individual owner, they were not able to prevent this and did not seek to collect broken seaweed themselves, leaving this to other village residents. Indeed, some residents with no other livelihood made a habit of searching for broken seaweed along the shore amongst the mangroves, which they then dried and sold for a little income. In these ways, income from seaweed spreads beyond the farmers themselves. Fishermen also appear to benefit indirectly from seaweed farming in some ways: one of the most common fish species we observed in fishermen's baskets were rabbitfish (*Siganus sp.*), a species commonly observed around seaweed farms because it grazes on the seaweed.

Today, fishers and seaweed farmers seem to have reached an uneasy truce, although conflicts occasionally break out between them. Many residents of Pitu Sunggu even insisted that such conflicts no longer exist, because crab netters and seaweed farming are overlapping livelihoods often undertaken by kin or neighbours, as well as frequently 'by the same person'.

Figure 5.5 Seaweed caught in gill nets used by crab fishers

Source: Image by Zannie Langford, Pitu Sunggu, May 2022.

With other seaweed farmers

Conflicts also occurred between seaweed farmers, particularly as prices rose through the financial year 2022. In general, people expressed a sense of resentment over the unequal division of sea space in the village. As one large farmer put it, '[P]eople fight over the sea, because people who didn't get space for cultivation end up feeling angry, whereas before [in the early days of the industry], they themselves didn't want to!'. Small and beginning farmers were indeed dissatisfied with the system, but simultaneously felt that they were not really able to contest the situation since they themselves participated in the process. As one small farmer commented, 'We think it's unfair (that some have lots of space), but what can we do? We want to make the location full too.' Some of this resentment centred on the rights of farmers to maintain ownership of plots they were not using, as happened when farmers had too many plots to operate at full capacity or when they retired from farming seaweed but still refused to sell their plots, preferring to lease them for an ongoing source of income. Complaining about a retired seaweed farmer who continued to benefit from his 'landlord' status, one resident said, '[I]in our opinion it is unfair … he has lots of locations, but he just rents out the places … so our feelings must hurt, but what can we do because he feels that he completely owns that place'.

In addition to these generalised tensions, conflicts occur between seaweed farmers over specific farming foundations. This occurs in two main ways. Firstly, conflict arises between lessors and lessees when lessees damage the foundation - that is, the anchor ropes which demarcate the location of the farm. Several cases were cited where ropes were damaged and the lessee did not repair them before vacating the foundation. Some farmers reported that they chose not to lease out empty plots because they were worried about such damage. Conversely, one farmer, who commonly rents space from others, said that he sought to avoid potential conflicts with lessors by always taking action to improve the foundation that he had rented.

The second type of conflict that arises is due to a lack of clarity around who owns different foundations. In recent years there have been several instances where people have dishonestly claimed ownership of a foundation and have rented out or sold the plot. This often occurs when farmers have left plots empty for an extended period of time, particularly if the plots are located offshore from other villages. In one such instance, a farmer who had established several plots in a nearby village returned to check on these plots only to find them in use by someone else, who had paid a sale price to a third party claiming to be the owner. In the end, the original farmer assented to the loss of his space, as he foresaw an extended dispute if he took the matter further. However, the farmer learnt from that experience that sea space which is left unoccupied, not leased, and not regularly checked, may be claimed by others. In this 'use it or lose it' situation, leasing a foundation to others may be a way of retaining an ownership claim on it. These conflicts are not always resolved in favour of the occupant however, and there have been a number of cases where people have been forced to pay rent or purchase prices twice when the original owner returns to claim the foundation. In her work amongst Sulawesi highlanders, Li similarly noted issues raised in land markets by uncertain ownership status, finding that 'Land purchasers … preferred to buy land that had already been sold at least once, so they could be sure it was an unencumbered *lokasi*, fully detached from its origins in someone else's work' (Li 2014, p. 93). This reflects the ambiguity in ownership rights established through informal mechanisms.

With other boat users

Finally, seaweed farmers can come into conflict with other boat users when they try to establish plots in new areas encroaching on boat lanes. In Pitu Sunggu, boats are moored overnight either in an upstream bend of the river or at the pier on the coast. In the morning, boat users travel from the mooring location out to sea using boat lanes. These are unoccupied stretches of sea which are allocated by the community to be used for transport and should therefore not be filled with seaweed farms or obtrusive fishing gear. Satellite imagery along the South Sulawesi coastline reveals that at most river mouths, there is an area of space from the mouth of the river to beyond the seaweed farming area which is clear of farms (see Langford, Waldron et al. 2021). These passageways are presumably boat paths (Figure 5.6).

These gaps left for boat transit are appealing to new farmers who face the prospects of high rental prices to access space for farming. In one case, a crab netter named Adil sought to establish his own seaweed farm and established a foundation in part of an area used as a boat lane. Other seaweed farmers using the boat lane became annoyed and complained to the head of the hamlet, who reprimanded Adil. Adil felt this reprimand was unfair, since he himself was disturbed by the presence of seaweed farms, which meant that he had to slowly manoeuvre around

Figure 5.6 Distribution of seaweed farms observed at any time from 2018–2020

Source: Image created by Zannie Langford using data from Planet Labs for 2018–2020.

them when catching crabs. He felt that given the inconvenience he suffered, he was also entitled to inconvenience others by establishing a foundation. Consequently he complained, '[A]ren't these *all* [boat] lanes? We [crab netters] also want to go out [to sea], but [seaweed farms] block the road.' Despite the warning, Adil maintained his plot in the boat lane. When farmers threatened that his longlines would be broken by seaweed propellers, he reportedly responded that '[I]f the problem is that the rope will break, it can be reconnected' and continued to farm the area regardless.

Some farmers also reported that they established new plots in controversial areas through subterfuge, believing that once installed, their right to farm in the foundation location would be respected. As one farmer admitted,

> I asked about the location [I wanted to claim] first, but there was no owner for it yet. I asked all the neighbors about the location but they all said no one had that

> place yet. So I secretly made the foundation. I thought, if someone asks about it tomorrow, only then I will tell them that it was *I* who made the foundation.

Although it is understandable that ocean users inconvenienced and disadvantaged by the presence of seaweed farmers feel that they too have the right to establish plots, the blocking of boat lanes and the filling of gaps between farms has made transport difficult during the dry season, when plots are heavily used and crab netting is at its peak. As one ocean user lamented,

> There are no [rules], and meanwhile the [boat] paths are all closed … it used to be good here, [the boat path] was straight, [and the area in front of] the river was wide … now they have let the boat path at the mouth of the river be completely closed off [by the seaweed farms].

Similarly, farmers complained that the gaps between farms had in many cases been filled. As one retired farmer recalled, '[B]ack when I was still active [as a farmer], all the cultivation plots were in order. There was a dividing line between the tiles. But now, it is all out of order.' These conflicts raise the issue of sea space governance in an increasingly contested environment.

Governance of sea space

As has been described, informal community rules and norms have formed property rights in seaweed farming in Pitu Sunggu. When asked about whether they had sought formal recognition of legal ownership from the regency or provincial government, most respondents replied that this was unnecessary, since the current system of ownership recognition within the village was operational and mostly uncontested. The main area in which they saw a role for regulation from higher levels of government (i.e. beyond the hamlet and village government) as desirable was in preventing the construction of new plots in boat lanes. Regulation of ownership of individual plots was not viewed by farmers as the role of the provincial government, but a matter for the community themselves. Village residents felt secure in their ownership of individual plots, since ownership was widely recognised within the village. As one farmer said, 'if you want [a land ownership certificate], we don't have it… [but] we all already know [who owns it] … as long as there is a rope there, it means that the others can't [build a new foundation]'. The system of ownership was enforced by the community itself via the village government structure, which occasionally plays a role resolving conflicts. Residents have confidence in the authority of the village government and community members in protecting ownership rights, even if the owner is no longer living in the village. As one farmer said,

> [I]f someone tries to occupy a location left empty by a community member, they will ban it because the community believes it is still the location of the person who occupied it first … even though the person is not there. Because here kinship bonds are still strong.

The method for testing if an apparently empty area of sea is used is simple, as one farmer told us: '[I]f someone doesn't believe that someone owns a location, we order him to drop the anchor. When the anchor is pulled and there is a rope going up, it means someone already owns that location.'

The rules for claiming sea space and access to it – namely that the establishment of a foundation gives the maker the exclusive right to use that area for seaweed farming, and to exclude other ocean users from the area while the plot is in use – were defended by community members as their own. As one resident put it, 'Only we, the people of this area, have made such rules'. This was true even when residents noted the unequal distribution of space in the village – as one farmer said, 'I think it is fair, because those who came first own the location. Those who were slow to claim a place made an error – but such are the rules we have made for the sea.' The right to build foundations in boat lanes was contested, but still ultimately respected, as occurred in the case above. Residents sought to avoid doing so if at all possible due to the negative reactions this was likely to provoke from other boat users, but as one farmer put it, it remains the case that '[Y]ou can't [forbid other people from building foundations in boat lanes]. Who knows, we may get scolded too. Unless the government regulates it … [But] if we manage it ourselves, it will be difficult.' In this way, patterns of acceptable behaviour that emerged informally over time through extended conflict have become accepted as community formed rules.

These rules have not been formally recognised by village or provincial government however, and the relationship between possession and recognition is complex (see Lund 2021). One attempt at such formalisation was made a number of years ago when the Pitu Sunggu village government participated in an initiative with several neighbouring villages to develop regulations relating to the use of coastal space in the region. As one person involved with the initiative told us, they sought to determine a minimum distance from the shore at which seaweed could be planted, a task which was challenging due to the many small islands in the region and the mobility of seaweed farmers and fishermen from the islands and coastal villages, who often worked in the sea several kilometres from their place of residence and in sea areas closer to other villages than their own. As one person involved with the initiative said, '[W]e wanted to make an agreement between Village A and Village B and also with the island … [but] that's difficult because we also don't understand things like that'. In the end, such regulations did not eventuate and further efforts have not been pursued, in the opinion of one fisheries official, '[B]ecause [it seemed that] the conflict had subsided … [the community] already found a solution so we didn't follow up on it … we saw it to be safe'.

It appears that as demand for sea space intensified with rising prices, previously observed customs are no longer followed. As one farmer said,

> There used to be limits … not a rule from the government but the result of community agreement … it was not permissible to build foundations at the top of the estuary… [and where] a foundation had been erected, no one may place another foundation within [that area] or closer to the coast. Community

> members could build foundations on the outer coast. The same goes for road [boat lane] rules. There were rules regarding the distance between one foundation to another … Because it's not just seaweed farmers who want to use the location. In addition to them there are the crab netters, and those who look for rebon shrimp (*acetes*) in the interior of the coast close to the mangroves … in the past the arrangement of foundations in the sea was neat … Very neat. Roads, boundaries, foundations were very visible … [But] when the price of seaweed soared … society got greedy and kept building the foundations until the rules were broken … So now it is hard. Only certain locations can be accessed because there are already many obstructing foundations, boat lanes are also closed.

Despite this, there was understandable hesitation about a role for formal government intervention, since farmers cannot be sure whether they would benefit from additional protection, or lose access to their own plots. This is by far the most common stance of farmers interviewed in our study. In a recent village forum with government officials, no farmers dared to raise issues related to seaweed farm space. The village government feels that they are capable of regulating the situation themselves but to date have not taken action on this – as one of them explained, 'there's no need to make a PERDES [formal government regulation] … we had planned it, but then we wondered what the procedural problems were, how to establish a legal basis. It seemed like a long [process] … [So] now [there are] only the rules of the game [between] fishermen.'

Some efforts to set rules for sea space allocation and use have been set by other regions in South Sulawesi. In Wajo Regency, for example, a 2012 regulation outlines limits on sea space use for seaweed farming. The regulation specifies that shipping lanes must be at least 200m wide, that the distance between seaweed farming plots should be at least 10m, the distance from any given seaweed farm plot to the shore should be at lease 50m, and that any given farmer should not own an area exceeding 2 hectares for longline cultivation (Pemerintah Kabupaten Wajo 2012). However, we were informed that these regulations are not enforced and that compliance is limited. In nearby Laikang village, rules have been set specifying processes for sea space sales, among other things. In Daiama village in Rote Ndao, rules for seaweed farming specify that farmers must seek a licence from a customary leader before establishing a new plot, and must report to this leader again at harvest time – although in practice monitoring of compliance is limited and violations are not strictly punished (Satria et al. 2017). These initiatives from other locations may offer insights that would support regulation in Pitu Sunggu, although farmers emphasised that they felt that limits on individual ownership areas were not practical as this would interfere with their strategy of geographic diversification (owning many plots in different areas to allow them to move seaweed around to avoid disease and maximise growth). In addition, although village residents stressed their ability to resolve conflicts internally, in practice this was complicated by the fact that people from other villages also farm and fish in Pitu Sunggu waters, and vice versa. Indeed, across Indonesia 10 per cent of farmers report that their farms are located outside their village (BPS 2022). Finally, it is worth noticing that prices crashed at the end of 2022 and in 2023 sea space limitations have not been a major issue due to drastic declines in production. It is clear that any effort to formally regulate and plan sea space use should carefully consider the context and unintended negative impact of such regulation and consult carefully with the communities involved.

Future developments

Intensification

The needs of village residents for sea space governance in the future will probably depend on the developments in the broader seaweed industry and in other marine industries. In Pitu Sunggu, prices increased dramatically following the construction of a major Chinese processing plant, BLG, in 2017, and this happened again in the 2022 financial year as prices doubled post COVID-19 (Langford, Zhang et al. 2022a; Zhang et al. 2023). As seaweed farming became more lucrative, contestation over sea space intensified, and governance systems for sea space have been put under additional stress. If prices continue to increase, it may be necessary to adapt these systems, although to date periods of intensive use of sea space have been temporary due to the effect of price volatility on demand for space. In addition, there is also the potential for seaweed farmers to transition out of seaweed farming and into higher-value products. In nearby Laikang, for example, some seaweed farmers have installed lobster grow out systems in areas of the sea previously claimed for seaweed farming. Lobsters are a very high-value product, and they use much smaller areas of sea space but they require high ongoing inputs. In Laikang, the activity is supported by a nearby fish processing facility which makes low-cost fish off-cuts available as lobster food – such inputs are essential to support lobster farming because lobsters are carnivorous and if not fed regularly and sufficiently will devour each other. Nonetheless, lobsters and other high-value marine aquaculture offer a pathway for further intensification of marine space use, and it is likely that sea space ownership developed for seaweed farming will form the basis of this use. As the use of marine space changes and intensifies, village residents, village governments, and, potentially, wider regional governments, may face challenges regulating an increasingly competitive sector.

Expansion

Initiatives to develop the seaweed industry often emphasise the large areas of space available to expand cultivation across more of Indonesia's coastline, and indeed globally. Pitu Sunggu is in South Sulawesi, reportedly Indonesia's largest seaweed producing province. As such they experience sea space shortages which are still emerging in other areas. In our field sites on Timor, Rote, and Semau islands in Nusa Tenggara Timor (NTT), surveyed farmers did not see access to sea space as a major issue. No farmers in these locations viewed the issue as 'very problematic', and only 30 per cent of farmers saw it as 'somewhat problematic' (Langford, Turupadang et al. 2022; 2023). This is compared to farmers in Pitu Sunggu, 23 per cent of whom found the issue 'very problematic' and a further 24 per cent found it 'somewhat problematic' (Langford, Waldron et al. 2023; Langford et al. 2024). These figures are for existing seaweed farmers, indicating that 47 per cent of Pitu Sunggu farmers who currently farm seaweed consider access to sea space to be an issue – the figures would probably be higher if the survey reflected the views of the community as a whole. In addition, these figures are from our 2021 survey, which was undertaken prior to the 2021–2022 price increases which intensified competition for sea space.

As efforts to expand seaweed cultivation into new areas proceed, it would be wise to develop some level of spatial planning in relation to sea space use prior to the establishment of the industry in new areas. While detailed monitoring of intra-village space distribution may not be feasible or desirable, some level of planning to allocate boat lanes and environmental protected areas (covering sensitive ecosystems such as coral reefs and seagrass meadows, as well as locations free of fishing and seaweed farming to support ecosystem sustainability) may prove important.

Conclusion

This chapter has described how seaweed has transformed patterns of ownership of sea space in an Indonesian village. Ultimately, the inability of crab netters to exclude seaweed farmers from the communal area used to catch crabs led to the enclosure of previously communal space by seaweed farmers. These seaweed farmers were often also crab netters, who participated in these processes of enclosure driven by entrepreneurialism as well as by the need to secure an area of space for their own use in a context of rapidly reducing public space. Construction of a foundation is recognised by the community to give the foundation owner a series of rights, including: the right to use the area and its foundation to farm seaweed at any time; the right to exclude others from farming seaweed in the area; the right to exclude other ocean users from operating in the area while it is in use for seaweed farming; and the right to lease, sell, or gift the foundation to another person. These rights are not formally recognised by higher levels of government and are recognised to varying extents by different types of actors (for example, government, banks, traders, family members, other seaweed farmers, other fishers).

Community understanding of the conditions of sea space use and access underpin the patterns of development of the industry. In Pitu Sunggu, the unequal distribution of sea space has led to the creation of a large labour trade for casual binding work. In addition, the high density of seaweed farms has impinged on the activities of other ocean users such as fishers and crab netters by reducing the space available for these activities and by impeding the passage of boats. Spatial planning could help new seaweed farming communities elsewhere in Indonesia to avoid some of the issues that have arisen in Pitu Sunggu and to support more environmentally sustainable outcomes. Understanding the pattern of sea space use for seaweed farming is critical to planning for a sustainable industry. These patterns of sea space ownership also affect the way that seaweed is farmed. Farmer decision-making about how to manage their farms is constrained by their access to different areas of sea space, as the next two chapters discuss.

Disclaimer

Our best guess is that seaweed farming was introduced to Pitu Sunggu around 2007, probably between 2005 and 2007. However, a number of farmers report farming before this time. This could be because they experimented with seaweed without adopting it permanently. Alternatively, it could be because they farmed in neighbouring villages.

Notes

1 Translated from the Indonesian word *pondasi* used to describe the seaweed farm foundations.
2 There is some uncertainty as to the date that farming was successfully achieved in this village as farmers in nearby villages were also beginning to experiment with seaweed farming around the same time, and prospective farmers often farmed outside the bounds of the village they resided in.

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