Putting life to work: Metabolic labour and value production in the global bluefin tuna supply chain

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Abstract: Drawing on ongoing multi-sited ethnographic research on the tuna trap fishery between Sardinia and Portugal, this article focuses on a tuna trap in Algarve, examining how bluefin tuna is transformed into a lively commodity within capture-based aquaculture. Moving beyond the question of whether animals work, it aims to investigate the value animals hold for capital by analysing the new forms of labour mobilized in the global tuna supply chain. The study traces the everyday practices of feeding, monitoring, and killing through which tuna vitality is sustained, managed, and ultimately extinguished for market purposes. It argues that value is generated not merely from the fish's flesh but through the controlled exploitation of its biological capacity to grow: a process enabled by a quota system that converts biomass into surplus value. This process, which can be conceptualized as metabolic labour, represents a significant reconfiguration of work under contemporary capitalism and reveals the tuna as an active, though exploited, participant in its own valorisation. By focusing on the fragile interspecies relations and opaque metabolic processes involved, the article shows how this form of production, which depends on rendering life legible and controllable, ultimately requires that same vitality to be erased in a rapid, standardized death to preserve its commodity value.

Keywords: Metabolic labour; Lively commodities; Bluefin tuna; Multispecies ethnography; Supply chain capitalism.

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Introduction

En el mercado verde,
bala
del profundo
océano,
proyectil
natatorio,
te vi,
muerto.
(P. Neruda, *Oda a un gran atún en el mercado*)

Algarve. 28th August. 5 am.
I leave the house before dawn. At a brisk pace, I walk through the city centre towards the industrial port. I reach the docks, the lights from the administrative office spotlight on the concrete wet with morning dew. When I enter the office, two fishers are already stamping their timecards. I greet Mateus, the captain of the tuna trap, who agreed to take me out to see the feeding of two thousand tuna held in cages off the coast. The fishing season is about to end. Many of the tuna had been captured with the trap in early May. They were then transferred to cages, where they are fattened for a few months. Mateus puts on his jacket and tells me to wait a moment. Waiting in the office at dawn, watching the fishermen clock in, I realized I was about to witness something fundamentally different from the fishing practices I had encountered before. Here, the productive process does not end with capture. It continues long after the fish are taken from the open sea, in a system that is neither fully fishing nor fully aquaculture, but something in between: a hybrid production system that sustains life in order to extract value from it.
This article[1] examines the logic of this hybrid regime through ethnographic research conducted in southern Portugal, focusing on the tuna trap of Vila Formosa.[2] Located on the eastern coast of the Algarve, Vila Formosa hosts one of the few active tuna traps in Portugal. Today, however, the trap operates within

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[2] Vila Formosa is a pseudonym used to protect the confidentiality of the people who shared part of their lives and work with me. All the names of the people in this text have also been anonymized.

a profoundly transformed global industry. Alongside the seasonal fixed-net capture of migratory bluefin tuna, the company maintains offshore cages where live fish are held, fed, monitored, and ultimately killed for export, primarily to the Japanese sashimi market. What appears as a small-scale coastal fishery is in fact a crucial node within the global bluefin tuna supply chain. The analysis presented here is based on two and a half months of ethnographic fieldwork conducted during the final phase of the tuna fishing season. During this period, I carried out participant observation both onshore and at sea, joining fishers on multiple feeding operations in the offshore cages and accompanying the crew during a full day of the final killing operation. Fieldwork included observation of everyday work routines in the port and cage installations, as well as informal conversations and semi-structured interviews with fishers, divers, the trap captain, and administrative staff. My aim is to investigate how contemporary capitalism reorganizes relations between nature and value by enrolling animal vitality within controlled regimes of production. Focusing on capture-based aquaculture, I explore how bluefin tuna are transformed into *lively commodities* (Collard, Dempsey 2013), whose value derives not only from their flesh but from their biological capacity to grow after capture. Under the quota system regulating Atlantic bluefin tuna, biomass is calculated at the moment fish are transferred into cages. Any subsequent increase in weight produced through feeding exceeds the officially registered catch. This post-capture growth becomes a source of surplus value for the fishing companies. What is valued here is not simply animal flesh, but the fish's own metabolic capacity to convert food into biomass within a temporally extended regime of accumulation. To conceptualize this process, I draw on the notion of *metabolic labour* (Beldo 2017). I use this concept not to anthropomorphize tuna or compare their activities with human wage labour, but to describe how their capacity to eat, metabolize, and generate biomass becomes directly productive of value.

The sections that follow situate this ethnographic case within anthropological debates on non-human labour, introducing metabolic labour as a framework to analyse how non-human vitality becomes a source of value within the bluefin tuna supply chain. I then trace the historical transformations of the bluefin tuna fishery, from fixed traps to capture-based aquaculture, to show how the sea becomes a space where metabolic processes are increasingly managed as productive forces. Finally, I dive into the everyday practices through which tuna vitality is nourished, controlled, and suppressed: feeding, underwater monitoring, and killing. Through these situated encounters, I argue, anthropology can help us understand how contemporary capitalism reorganizes not only labour, but the very conditions of life upon which accumulation depends.

Metabolic labour: putting vitality to work

Over the past decades, anthropology has developed a renewed interest in the relationships between human and non-human subjects in the Anthropocene. Starting from the theorisation of multispecies ethnographies (Kirksey, Helmreich 2010), the discipline has increasingly moved beyond the notion of nature as a passive backdrop for human activity, examining instead how capitalist production depends upon the productive capacities of living organisms themselves.

In this article, I begin my analysis from a specific category of animals that are *put to work* (Moore 2015) in contemporary capitalism: the category of food animals, that is, the different varieties of non-humans that are raised and killed to feed human beings. Most social science research on food animals have focused on terrestrial species raised within industrial farming regimes: namely pigs (Blanchette 2020), chickens (Beldo 2017), and cattle (Gillespie 2020). Aquatic life, by contrast, has remained at the margins of this debate. While it has been examined in research of oceanic bioeconomies and technoscientific knowledge production (Helmreich 2009), and studies of aquaculture have illustrated how fish such as salmon become incorporated into industrial regimes of production (Lien 2015), less attention has been paid to forms of capitalist valorisation that operate at the interface between wild capture and farming. Capture-based aquaculture of bluefin tuna exposes a distinct configuration of value production. Here, wild animals are not bred within controlled environments from birth, nor are they simply extracted as finite resources. Instead, they are captured and subsequently inserted into a regime that depends on their continued metabolic activity. Surplus value emerges not only from extraction, but from the management of life itself. By following this process, I argue that bluefin tuna reveal a frontier of accumulation in which value production is reorganized around non-human bodies. Such a configuration invites a reframing of how labour is understood. Starting from Wadiwel's (2018, p. 531) proposal that the most relevant question for analysing the role of food animals is not so much whether animals work, but rather what specific value animals hold for capital, I approach this shift ethnographically. When referring to the *specific* value of food animals, I do not intend to follow the author in his analysis of animals as a distinct working class within the capitalist economy, but rather to focus on a contingent socio-ecological assemblage in which value emerges in relationships between humans and more-than-humans. If, as Marx (1976) argued, the relation between labour and nature is the source of value, then the lively practices of nonhumans complicate the equation. What happens when vitality itself becomes commodified? How do humans and non-humans become

entangled in situated practices through which value is produced? Animals are not simply inputs transformed by human labour. They grow, metabolize, and convert matter into biomass. As Barua argues, the animal body "becomes an accumulation strategy, where conditions for its growth are intensified to realize relative surplus value" (Barua 2019, p. 654). To conceptualise this specific contribution, I adopt the notion of *metabolic labour*. This concept, as proposed by Beldo (2017), refers to the value-generating work performed by the vital processes of living beings (such as growth, digestion, and cellular transformation) once these are enrolled within relations of capitalist production. I use this concept to analyse how animal vitality, specifically its organic capacity to eat, metabolize, and develop biomass, becomes a direct source of value creation within capitalist production. Within this framework, metabolic labour can be understood as what "remains after human labour is subtracted from the equation of the 'production' of animal flesh" (Ivi, p. 112).

As Wadiwel (2018, p. 535) argues, food animals play a peculiar role in capitalist production. They "enter the production process as a hybrid of both constant and variable capital. Food animals are deployed as both a raw material that will be 'finished' as a product by the production process and simultaneously labour that must work on itself through a 'metabolic' self-generative production". This reflection invites us to consider the temporal discrepancy between metabolic labour and human work. In metabolic labour, "bodily growth and the work done to produce commodities" (Barua 2025, p. 5), "are no longer separable in time." The rhythms of this non-human labour "are not sidereal and extrinsic to social relations, but immanent to the labouring activities themselves, emerging from dynamic movement and growth" (Barua 2016, p. 280). Haraway (2007) warns that when we label the practices of non-humans as "work" we risk reinscribing anthropocentric categories that flatten the difference among non-human experiences. As she reminds us, animals "are not human slaves or wage labourers, and it would be a serious mistake to theorize their labour within those frameworks. They are paws, not hands" (Ivi, p. 55-56). The animal engagement with production unfolds within distinct socio-ecologies and resists easy equivalence with human labour, for it is "characterised by intentionality and functionality being immanent in the labour process" (Barua 2017, p. 280). To speak of metabolic labour, therefore, is not to translate animal activity into human terms, but to unsettle and denaturalize the boundaries that capitalist production draws between human and non-human contributions in production. Why, then, retain the term labour? Because it allows us to overcome the invisibility of tuna as a passive object, a raw material on which human labour will build value, and to recognise non-humans as active participants in production. As Beldo points out:

> Within the existing vocabulary of capitalist production, labour is the term that best approximates the contributions of broiler chickens to the process of chicken farming. […] The image of the labouring broiler chicken at least inoculates against the temptation to view these immature and passive birds as wholly determined by external forces and instead recognizes their originary role in production, the adverse effects of which they would seem to experience every moment of their lives (Beldo 2017, pp. 124-25).

By foregrounding metabolic labor, this article asks how marine industrial food production reorganize living processes to produce value. In the following sections, I will focus on how metabolic labor unfolds in the tuna trap of Vila Formosa: through feeding activities that intensify growth, monitoring techniques that measure and manage vitality, and killing practices that ultimately extinguish the very life force upon which value depends. But before exploring these interactions in detail, we need to frame tuna farming within what Tsing (2009) calls *supply chain capitalism*: complex and inhomogeneous networks that characterises contemporary capitalistic production. Supply chains connect heterogeneous sites through flexible subcontracting, standardisation, and the production of value across unequal ecological and social contexts. In this regard, the global bluefin tuna industry exemplifies a form of supply chain capitalism, in which "labor, nature, and capital are mobilized in fragmented but linked economic niches" (Ivi, p. 149). I will now situate this labor regime within the history of bluefin tuna fishing, whose transformation set the stage for contemporary capture-based aquaculture. In this chain, metabolic labor constitutes a crucial link. What is accumulated is not simply fish, but non-human vitality reorganized into value. Understanding the dynamics of metabolic labour in contemporary tuna farming requires situating these practices within the longer historical trajectories that shaped the Atlantic bluefin tuna supply chain.

A brief history of the Atlantic bluefin tuna supply chain

Bluefin tuna fishing has been documented since Phoenician and Roman times (Di Natale 2018), although the specific techniques used in antiquity remain unclear. Gradually, however, a new system emerged which, beyond its probable Arab origins, found its most extensive refined application in Sicily: the tuna trap. Spaniards exported this new fishing technique to the rest of the Mediterranean: this prompted the migration of sailors, fishers, and specialized personnel to the Iberian, Provençal, and Sardinian coasts to establish new tuna fisheries and spread the more complex and profitable fishing system (Doneddu 2019).

The tuna trap or *tonnara di corsa* is named for its role in capturing tuna during their reproductive migration from the Atlantic Ocean to the Mediterranean Sea in spring. This fishing technique relies on a fixed system of nets, divided into multiple chambers, positioned at specific points along the coast to intercept the migrating tuna. It is thus a seasonal fishing system, deployable only during the period when tuna migrate to the Mediterranean for reproduction and pass through the areas where the traps are set. It is also a passive system, in that the nets remain fixed along the coast while tuna are guided naturally into the chambers along their migratory routes. Tuna traps remained the primary fishing gear for bluefin tuna in the Mediterranean for hundreds of years, harvesting tuna along their migration routes with minimal changes to the equipment used (Addis, Locci, Cau 2009). The traps became the backbone of local maritime economies, which sustained numerous communities throughout the centuries. Ben-Yehoyada (2017) shows that the tuna trap organized a regime in which cross-channel movements of fishers and commodities coexisted with the territorial fixity of the labor process itself, producing a historically specific configuration of Mediterranean mobility. Yet by the mid-twentieth century, this system began to collapse.

The establishment of ICCAT (the International Commission for the Conservation of Atlantic Tunas) in 1969 marked a turning point for the regulation of tuna fisheries. Created in response to the collapses of the North Atlantic tuna fishery due to overexploitation, ICCAT became the main supranational authority regulating tuna fisheries in both the Atlantic and the Mediterranean. What followed was a period of rapid industrialization and globalization of the bluefin tuna trade. By the late twentieth century, bluefin tuna had become a global luxury commodity, highly prized in the Japanese sashimi market and circulated as a symbol of status and refinement (Bestor 2001). Technological innovations, combined with the expansion of the Japanese sashimi market, transformed bluefin tuna from a mostly local, seasonal food into a high-value commodity. Central to this transformation was the development of purse-seine fishing. Unlike fixed traps, purse seines operate in open water: immense nets, sometimes extending up to two kilometres, encircle entire schools of tuna before closing at the bottom "like a bag" (hence the name). The efficiency of this technique far surpassed that of the traps, enabling massive catches driven by global demand.

In the 1990s, the bluefin tuna supply chain underwent another major transformation with the emergence of tuna farming, or capture-based aquaculture. Instead of killing the fish at sea, purse-seine fleets began capturing live tuna and transferring them to offshore cages for fattening. his innovation enabled producers to stabilize supply and better synchronize fishing with market demands,

aligning biological cycles with commercial rhythms. The Mediterranean became a fertile ground for the application of this new technique, with Spain and Malta turning out as the main hubs of this novel industry, hosting large-scale operations that are mostly connected to the Japanese markets. As Tsing (2012) would put it, it represents an attempt to make production *scalable*: to turn the irregular rhythms of the sea into a predictable, continuous flow of value.

These transformations occurred alongside the development of new transnational conservation policies. In 1998, ICCAT introduced national quotas aimed at reducing overfishing; however, this system initially failed to prevent the ongoing crisis, as allocated quotas often exceeded the recommendations of the ICCAT Scientific Committee. By 2007, facing a severe stock collapse, ICCAT launched a multi-year recovery plan that combined quota reductions, stricter catch monitoring, and new traceability systems. As a result, tuna traps, increasingly marginalized within the global supply chain, had to adapt in order to survive. While these policies aimed to ensure sustainability, they also enacted an epistemological shift: tuna came to be understood primarily as populations to be managed, a biological resource, rather than part of a discrete socio-ecology. This shift exemplifies the biopolitical logic of modern fisheries management. Yet the biological abstraction inherent in "stock" management obscures the histories, practices, and socio-ecological relations that shaped local fisheries (Campling, Havice, Howard 2012).

Garrett Hardin's (1968) *tragedy of the commons* theory permeated almost all political discourse on the exploitation of natural resources. According to Hardin, the overexploitation of shared resources results from individual rational calculations and competing interests, which leads to depletion; his proposed solution was privatization and regulation. This narrative had a profound influence on fisheries management, providing the ideological foundation for the quota systems still in place today. However, Longo and Clausen (2011) argue that the crisis of bluefin tuna fisheries is better understood not as a tragedy of the commons but as a *tragedy of the commodity*. The overfishing of bluefin tuna, alongside the simultaneous decline of traditional techniques such as fixed traps, cannot be explained by the mere lack of regulation; rather, it stems from the commodification of tuna itself. As Telesca (2020) argues, ICCAT's management of bluefin tuna has not primarily aimed to protect the species, but rather to maximize export revenues and support the economic growth of maritime powers, establishing a regime of value that turns the fish into a commodity and facilitates its "legal" extermination under the guise of conservation.

The processes described above had profound material consequences across the Atlantic and the Mediterranean: all tuna traps along the Portuguese coast were closed around the 1970s, as migration routes shifted and local catches dwin-

dled. The trap at Vila Formosa was opened in the 1990s by a foreign investor as an attempt to re-introduce tuna traps as a technique for fishing tuna in the Atlantic and integrate it into the emerging global tuna market. This articulation between local fishing practices and global production reflects the broader transformation of the Mediterranean and Atlantic fisheries in which tuna farming and fattening have assumed an increasingly central role.
The rise of capture-based aquaculture it is not merely a technological or economic shift, but a reconfiguration of the relations between labour and life. The transition from traps to fattening farms marks a deeper historical transformation in the bluefin tuna supply chain, a move from fishing practices to a more subtle labour regime, one that entails the "rendition of metabolism into work" (Barua 2025, p. 7). The tuna farm thus stands as the latest stage in a long history of technologically mediated encounters between humans and tuna, while it also reveals the contradictions at the heart of the blue economy governance frameworks: sustainability achieved through intensified control over life. This brief foray into the reconfiguration of the bluefin tuna fishery lays the historical groundwork for the ethnographic analysis that follows, exploring how, in the waters of Southern Portugal, the vitality and the metabolism of tuna become the very core of a process of value extraction.

A morning feeding: nourishing the lively commodity

Figure 1. A trawler used for feeding surrounded by seagulls inside a tuna cage (Photo by the author).

The daily morning feeding of tuna in the cages exemplifies the everyday practices of a labour regime in which tuna is not simply caught but becomes the focus of a process of nourishment and control, aimed at maintaining its life and growth. In order to do this, the tuna "must be severed from its home and family. Its former life must be nearly extinguished" (Collard 2014, p. 158). Here, I aim to emphasise not the idea of the eradication of tuna from the "natural world", but rather the production of a particular type of nature (Smith 1984). Within this site, a specific nature emerges, one that is "controllable" and "manageable". This is tied to the logic of the blue economy, where tuna is measured and quantified as part of an economic calculation to generate value.

The quota system described above underpins this entire configuration. Bluefin tuna quotas are not defined by the number of fish caught, but by their total weight. When tuna are transferred from the trap to the cages, their biomass is measured using stereoscopic cameras and verified by an observer appointed by the national fisheries authority. Quotas are calculated at transfer, based on the total weight entering the cages; any growth during the fattening period is not accounted for and thus represents additional biomass the company can sell. The temporal gap between capture and harvest is crucial. It is within this interval that the sustaining of life becomes a productive operation. By feeding the tuna and maintaining their metabolic activity, companies are able to generate weight that exceeds the officially registered catch. In other words, value is not extracted despite the fish being kept alive, but through the very processes that allow them to live and grow. For instance, a tuna weighing sixty kilograms when caged that reaches eighty kilograms at harvest produces twenty kilograms of surplus beyond the officially registered catch. Biological growth, the fish's capacity to eat, metabolize, and fatten, is thus directly converted into surplus value.

As I have already mentioned, in the transition from fishing to tuna fattening, the fish become as a valuable commodity on the global market. But what kind of commodity is tuna? Game? A domesticated animal? Following Castree (2003), we might instead ask: what kind of nature is being commodified in this process? Tuna is transformed from an animal captured to be sold as meat into a *lively commodity* (Collard, Dempsey 2013), whose value is not represented so much by simply being alive, but more specifically by the fact that they "retain their 'vital or generative qualities', qualities that can produce capitalist value as long as they *remain alive and/or promise future life*" (ivi, p. 2684). However, the tuna's value does not lie in their spectacular, encounterable "wildness" (Barua 2017) or in their construction as "companions" that "live in prolonged, controlled, and intimate contact

with their 'owners'" (Collard 2014, p. 154), but from an encounter that allows monitoring his metabolism and growth. This is particularly evident in the case of tuna: its ability to eat and consequently develop biomass become the fundamental processes through which economic gain is generated within this fishery. What is commodified, then, is not life in the abstract, but metabolic labour itself: the tuna's own bodily activity, through which additional biomass is produced beyond the moment of capture. To understand how this metabolic labour unfolds in everyday practice, let us return to that early morning at the port.

Other workers begin to arrive. They are mostly silent, while some of them get coffee from the machine. As we leave the port, the sky starts to fade from black to a pinkish grey. The trawler slides on the surface of the sea, in a silence broken only by the tinny sound of the engine. As soon as we reach the cages, the boat is tied to a rope that secures it to the middle of the cage structure.

Using a large hand-held net, the fishers lift the mackerel from the tank and dump them onto the side of the boat, where they are pushed into the water through small openings along the gunwale, with the aid of an electric pump. I ask why they do not throw everything in at once. One of the workers explains: "We cannot give much food together. They have to eat slowly". The tuna, however, remain practically invisible. Every now and then you can see occasional shadows floating on the surface, but it is difficult to spot them because of the opacity of the water itself. As soon as they start throwing the fish, dozens of seagulls arrive and begin circling around us, screeching. The sun rises behind the cages. For a moment, the surface clears and I see the tuna: huge, fast, metallic. The speed of their movements is startling. They appear and vanish in seconds, their bodies cutting through the water with rapid sweeps. At that moment, I realize how little of this process is actually visible. Watching them, I understand that everything depends on what happens beneath the water, in a space that resists human observation. Metabolic labour occurs out of sight: it is the tuna's own bodily work (eating, digesting, fattening) that generates surplus value. Yet this labour cannot be fully controlled. The process of converting biological growth into surplus value is fragile and uncertain. Tuna are not machines: their bodies and metabolisms are not fully controllable and manageable. They are living animals susceptible to stress, disease, and that can behave unpredictably. A tuna that stops eating, shows signs of sickness, or becomes overly stressed poses a threat to the accumulation of surplus biomass. Production therefore depends inextricably on a process that is barely visible to the human eye.

Figure 2. Turbulent waters, with tuna fins visible at the surface (Photo by the author).

As shown in the morning feeding, the conversion of mackerel into tuna biomass through metabolic labour that enables and sustains its bodily growth, occurs in an opaque environment below the refractive surface of water, largely shielded from direct human observation. As Swanson, Lien, and Ween (2018) observe, domestication should be understood not as a state of total control, but as a relational practice that unfolds through "unexpected combinations of cooperation and coercion and of asymmetry and intimacy" (ivi, p. 20). The unpredictable vitality of tuna exemplifies this very tension, revealing a form of domestication where the process of managing life remains fundamentally contingent upon the same vital forces it seeks to control. This opacity and unpredictability make it clear that external management alone cannot suffice: sustaining and understanding the tuna requires direct, close presence, allowing humans to observe and interpret the signals that emerge beneath the water's surface. A more in-depth encounter is required, one that attempts to establish some kind of relationship with this elusive life form through immersion in its aquatic environment. Its vitality must be translated from a wild unencounterable force into a series of decipherable individual behaviours and physiological signals: a *readable* life that must be managed to produce value. In the tuna fishery of Vila Formosa, this task falls to a distinctive category of workers: scuba divers.

The daily dive: "dealing" with tuna

The divers perform several tasks during their work. Their first responsibility is to guide the transfer of tuna from the trap chambers to the offshore cages, pushing the fish from behind as they pass through the nets. They also dive during other fishing operations, to correctly position the nets or ensure that the tuna or other fish caught for the local market do not get entangled in the nets. Their work, however, does not end there. Once the tuna are in the cages, they dive every day with them: checking the nets, ensuring the fish eats, and monitoring for stressed or unusual behaviour. Later in the season, as we shall see, it will be these same divers who enter the cages again to kill the tuna one by one. Among the divers in Vila Formosa, João is the most experienced. I met him one morning, just after he had returned from the sea while rinsing his gear, and he explained about what it means to him to "deal with" the fish:

> João: "That's one of those things you learn over the years, working with them every day. It's not just with tuna, with all the fish that enter the trap, you learn how to deal with them. You know how you're going to work with them, you know what their behaviour will be like, right?"
> Author: "And is there a difference between fish like sea bream, mackerel, and tuna?"
> João: "Of course, obviously, right? Sea bream and mackerel… it's a different behaviour; it has nothing to do with it. We're talking about big fish, right? That's where you can really deal with a fish's behaviour, because they are unique fish. Mackerel is a school. With a big fish, it's a… It's like when you have a dog, you know how to deal with the dog. For example, you see a dog, you're looking at a dog. It belongs to a friend of yours. But you've never been with the dog, you don't know the dog, but it belongs to your friend. You pet it first, you reach out your hand, you don't just throw your hand out, right? First you see how the dog is, the dog's behaviour, and then you go… The fish is the same. Tuna is the same, with sharks, with bigger fish, which are unique and singular. You learn the behaviour, you'll learn how to deal with it. Look, the water is like this, and it will do this. The water is like that, and it will do that. You more or less know how to deal with the thing, right?"
> (Conversation with João, 03/09/2025)

João's account is at once practical and slightly disorienting. He insists on the radical difference between tuna and other fish (correcting my attempt to group them with sea bream or mackerel) yet moments later compares them to dogs. The apparent contradiction is revealing. Tuna are not interchangeable units within a "school" but singular beings whose behaviour must be individually assessed. The analogy with the dog does it illustrates a mode of cautious relationality. One does not simply "grab" a dog; one observes, approaches slowly,

reads signs, waits for a response. Through this comparison, João gestures toward a practical engagement grounded in experience rather than abstraction. To work with tuna is to develop a capacity to anticipate movement, to sense agitation before it becomes visible, to interpret subtle shifts in the water itself. His knowledge is built through repeated immersion in the same environment as the fish. In this sense, João's immersion in the water is not merely physical but also a form of what Tsing (2024) describes as *attunement*: an "attempt to get to know, through alignment, how others express themselves in the world". In Portuguese, João used the verb *lidar com* to describe his relationship with the tuna: a phrase that I've translated as *to deal with*. This saying, however, means not only *to deal with* but also *to care for* and *to work hard at something*. This polysemy captures precisely the ambiguity of this engagement: a practice that is simultaneously relational and work-oriented, embodied and technical. To *lidar com* the tuna is not simply to manage them, but to but to enter a shared medium: the watery world that properly belongs to the fish; yet one that humans attempt to reorganize through enclosure, regulated feeding, and monitoring, in order to harness their metabolic capacities for value production. Through his immersion, the diver learns to perceive and interpret their movements, developing a situated understanding of their behaviour that makes control, and ultimately value production, possible. Observing this daily immersion makes visible a crucial dimension of metabolic labour. The tuna's bodily activity generates surplus value, but that activity must be sustained, interpreted, and stabilised through human forms of attentiveness. Value does not emerge from human control alone, nor from tuna vitality in isolation, but from this asymmetrical and ongoing interspecies encounter. In other words, the commodity status of tuna is only part of the story. Tuna is not, in fact, an inert material to be managed, but it is precisely through this encounter – odd, challenging, always partial – that we can begin to reflect on its capacity to act within these relationships. Recognising its subjectivity allow us to recover its role as an active participant in economic production (Barua 2016, p. 275).

Narratives about food animals usually emphasise their capacity to act as a form of "resistance" against the conditions of production (e.g. Wadiwel 2018). However, this approach is partial and limiting. As Pearson critically notes,

> describing animal behaviour as resistance is problematic. It risks projecting human motivations onto animals, thereby humanising animals. The 'nonhuman as resister' model is therefore deeply anthropomorphic and perhaps says more about human desires for animal liberation than the animals themselves. Furthermore, turning animals into resisters downplays the specificity of human resistance and politics, in particular the ability of humans to collectively assess current conditions and imagine

> and articulate a vision for the future and how to achieve it. […] Moreover, the focus on resistance overlooks other – and often less dramatic – forms of nonhuman agency and activity. The focus on nonhuman resistance therefore fails to capture the full extent of nonhuman agency (Pearson 2015, p. 713).

Following this critique, we might seek agency elsewhere. The agency of farmed tuna is not to be found only in struggling against capture but also in its biological capacity to act as a productive force. We can then speak of animal agency "even when farms function normally and efficiently and when animals 'comply' with the wishes of industry". (Beldo, 2017, p. 110). The agency of tuna is therefore manifested not only in opposition to the regime of control, but also through its vital capacity and metabolic labour which the fattening cages simultaneously depend on and attempt to manage. Yet there comes a point at which the tuna's vitality, the very foundation of its value, must be halted in order for that value to be realised. The metabolic labour through which tuna produce additional biomass during the fattening period cannot continue indefinitely: the surplus it generates only becomes economically meaningful once it is secured in flesh. In this sense, the shift from feeding and monitoring to killing does not interrupt the management of metabolic labour but marks its final stage. The next section examines how the killing of tuna is practically organised and enacted as part of this process.

Matança: the value of a "good" death

In the Vila Formosa trap and cages, biological growth is not the endpoint of the productive process. Instead, it finds its climax in death. Yet this death cannot be chaotic or excessively violent. It must be technically controlled, calibrated, and efficient. The value generated through months of feeding depends on the capacity to extinguish life without compromising flesh. In this regime, a "good" death is not external to production; it secures in flesh the value generated through metabolic labour and the subsequent biomass increase. The *matança*, the final slaughter of the season, makes this logic visible. Here, months of feeding and monitoring converge in a carefully orchestrated operation in which metabolic labour is brought to a calculated halt. What appears as a moment of termination is in fact the culmination of a prolonged process of value production.

One month later, in mid-September, I am back at the port: this time to observe the killing of fattened tuna, which will bring the tuna fishing season to an end. Inside the office the workers are already having coffee. Two men sit

at a table covered with boxes marked in Japanese characters, alongside crates of beer with the same unfamiliar writing. Mateus, the captain, tells me that they hope to finish the tuna fishing season in the next two days, depending on how many tuna they can process today. He says he does not want to rush, though; everyone is tired, and when fatigue sets in, accidents can happen. We leave the dock just before dawn. The sea is flat, the air dense with salt and diesel. After half an hour of navigation a ship appears on the horizon: a Japanese factory ship. It is immense, almost like a ferry, anchored and waiting not too far from the cages. At eight o'clock, the divers begin preparing to enter the water. The company has provided for everything for the working day: water, snacks, energy drinks. Two small boats are lowered inside the cage with a crane. When the divers finally enter the water, the operation becomes eerily silent. Two divers carry pneumatic guns mounted on cane spears. As soon as they hit the tuna, the guns fire a projectile into the fish's head, killing it instantly. From where I stand, I can see only the flashes of movement beneath the surface. Each tuna is shot individually. As soon as the body floats up, two men on the small boats hook them with ropes so that they can then be lifted by the crane onto the main boat.

Figure 3. A tuna is lifted aboard as workers prepare to bleed it out (Photo by the author).

The body is lifted quickly onto the main vessel, where two workers stab them in the flank with a knife and cut their gills so that they bleed out as quickly as possible. The tuna is then transferred, still hanging, onto another vessel that will ferry them to the Japanese ship. Mateus asks me if they have cranes in Sardinia too. I reply that they don't. "Here we are in the future," he replies.

The Japanese buyers want the fish to suffer as little as possible, because muscular contraction and the stress hormone generated at the moment of death would induce the production of lactic acid, which would discolour the flesh and therefore ruin the quality of the meat. For the company, stressed fish means a loss: the buyers would reject them, forcing them to sell on the local market at a lower price. To ensure this, a rigid and well-defined operational chain is necessary. If, during the months of fattening, human work revolves around keeping the tuna alive and eating, the *matança* reorients that knowledge toward a different form of labour: one that must end life without damaging the flesh. A few fishes that reach the deck still arrive alive are immediately subjected to *ikejime*: a Japanese technique in which a thin metal wire is inserted into the brain to cause instant death and prevent muscle movements. Then all the tuna are bled to prevent residual blood in the body from spoiling the meat. As the day goes on, the process becomes almost mechanical: bodies rise, are pierced, bled, lifted, and passed on.

All these actions are aimed at the extinguishment of the tuna vitality: the same vitality that, through metabolism, has produced surplus value, but which in death must be suppressed to preserve the flesh.

Even the language used to describe the event reflects this transformation. While the fishers refer to the event as *matança*, a Portuguese term meaning slaughter and evoking the violent taking of life (akin to the Italian *mattanza*), the technical language employed in policy documents and by ICCAT observers is "harvesting." The contrast is not merely semantic. Whereas *matança* foregrounds death as a forceful interruption of life, harvesting draws on an agricultural vocabulary associated with the collection of a crop. This shift in terminology moves the semantic field from the ocean to the farm, reframing the killing of tuna as the gathering of a cultivated resource. Yet the movement is more complex. In wild fisheries, "harvest" is usually used to describe the capture of fish, borrowing from agrarian language to naturalize extraction from the sea. In the case of capture-based aquaculture, however, the term operates twice over. Tuna are first "harvested" from the wild when captured in the trap; months later, the *matança* is again described as a "harvest," even though value has been significantly augmented through controlled feeding and metablolic growth. By calling the *matança* a harvest, the language not only softens the violence of slaughter but also obscures the metabolic labour that has taken place

in the meantime. The term collapses the distinction between capture and fattening, presenting the final killing as the simple collection of a resource rather than the culmination of months of managed biological transformation. In doing so, it contributes to masking the accumulation of surplus value generated through the fattening of the tuna after the fish's initial capture. The silence and calm of this practice mirror the technical and technological advances that have rendered the agency of tuna null at the moment of its death, transforming a living, vital animal into a dead commodity. When Mateus declares "here we are in the future" he is pointing precisely to these technical innovations that mark what Barua (2025) calls a *metabolic shift*: from the chaotic struggle of trap fishing to a regime of control over tuna metabolism, where life is converted into value through a "clean", controlled death. But this process also reshapes the relationship between tuna and humans, as we can see again from João's words:

> João: The *matança*, before, here in the company, it wasn't like this. It was more manual; it was like in the old days. […]
> Author: And it›s better as…
> João: It›s better in everything. It›s better in everything. Speed, quality of the product. Safety, too, despite being with a firearm, the safety too and… In that aspect. It›s hard for the diver, very hard.
> […] But in terms of quality, speed and safety it's better. For the tuna it's better. It doesn't suffer. It's quick. It's quick, of course. It's how everything has to be. For me, every animal, every animal that is going to die for some purpose, has to die quickly. It has to die quickly. And I'm also completely against killing animals, killing something that has no commercial value, or that is good for nothing.
> (Conversation with João, 03/09/2025)

For the divers like João, killing tuna quickly also carries a moral dimension. A fast, less painful death becomes a way to respect the tuna as a living being, even as it is being transformed into a commodity. Death "as it should be" ensures not only product quality but also the recognition of having respected the animal by not imposing unnecessary suffering, a moral consideration emerging from within the logic of commercial exploitation.

When the dead tuna land on the ship, they are immediately cut into pieces and frozen at -60 degrees, preserving them as if fresh throughout the journey. Here, the transformation is complete: from a vitality to be managed and nourished, to a vitality to be extinguished, to a dead commodity circulating in the global market. The Japanese factory ship on the horizon is but the next stage of the tuna's journey in the supply chain, a point where the vitality of the tuna, domesticated and then extinguished, finally enters the global market.

Coda: vitality, labour, and value in the making of global commodities

The journey of the bluefin tuna, from capture to fattening in offshore cages, represents more than a mere technological or economic transformation. It embodies a reconfiguration of the relationships between humans and nonhumans, vitality and value, in contemporary food production. Although this article only aims to offer a few insights from a broader ethnography that is still in progress, the exploration of the Vila Formosa trap has attempted to trace how the tuna transforms, from a fish caught to be sold, into a *lively commodity* (Collard, Dempsey 2013), whose value is produced and extracted through the control and exploitation of its own metabolism.

This ethnographic account shows that the tuna's value lies not simply in its flesh, but in its biological capacity to grow and convert biomass, a process enabled by the quota system that transforms biological growth into surplus value. This process of valorisation, however, is inherently fragile and opaque, dependent on a non-human vitality that escapes total control and on the construction of an asymmetrical interspecies relation. To analyse this specific non-human contribution to production, I have adopted the notion of *metabolic labour* (Beldo 2017). This concept allows us to recognize the tuna not as a passive raw material, but as an active, though exploited, participant in value generation, whose agency is manifested not only in a resistential behaviour but, notably, in its productive capacity to live, eat, and grow. The moment of the *matança*, the harvesting, represents the climax of the exploitation of this vitality and, at the same time, its negation: the vital force that created value must be suppressed in a rapid, controlled manner to preserve the quality of the once-lively commodity.

The case of bluefin tuna is but one instance of a broader phenomenon. From industrial aquaculture to livestock farming and plantation agriculture, supply chains are increasingly organized around the direct exploitation of metabolic and generative processes. This represents a fundamental shift in the frontier of accumulation, one that demands a corresponding shift in our analytical frameworks. For anthropology, therefore, the challenge is to explore, through ethnography, the specific ways in which lives are reconfigured and rendered productive. This requires immersing oneself into the practices and spaces in which humans and nonhumans intersect, tracing how global production chains depend on contingent and everyday relations. By paying closer attention to these encounters, anthropology can reveal the contradictions of a productive system that seeks to render vitality legible and profitable, while simultaneously erasing the difference and instability that constitute life itself. Rather than

searching for a universal definition of nonhuman labour, we might instead ask: what kinds of value are produced through specific ecologies of work, and for whom? How do material multispecies entanglements transform, adapt, or resist when enlisted into global circuits of capital? How is the very category of labour stretched when we attend to the vital, often invisible, activities of nonhumans within capitalist production? And what can an ethnography teach us about the ways practices of extraction and accumulation continue to reorganise not only human labour, but the very conditions of life on earth? Engaging with these questions is to reflect upon anthropology's pivotal role as a practice of situated attention: a practice that makes visible the intertwining between humans and non-humans. As João reminded me, this relation never appears fully legible. Just as the divers learn, through immersion, to sense the presence of tuna that remain largely concealed beneath the water, ethnography too proceeds through partial glimpses and situated attunements. Both diver and ethnographer depend on moments in which what lies below the surface becomes momentarily visible. In this sense, to study tuna's metabolic labour is to learn how to attend to the submerged processes through which value is generated. It is within these shared yet asymmetrical encounters that anthropology can grasp how contemporary capitalism reorganises not only labour, but the living worlds on which it depends.

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