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The construction of toxicity in a French bay

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Abstract

In Bretagne, the westernmost region of France, the highly industrialized agricultural sector is the main driver behind an unprecedented proliferation of green algae on the regional beaches. Since the 1970s, the chemical compounds nitrogen and phosphate released through the leachate of the pig industry, serves as the main source of nutrition for these algae. Once the green algae are washed ashore, they start a process of decomposition and release the gas hydrogen sulphide. This gas can turn into a lethal substance for humans and certain animals when inhaled in high doses. Accordingly, state institutions apply security measures, such as information signs and barriers, to prevent human access to the most putrefying piles of green algae. By applying chemoethnographic and multispecies approaches, I seek to explore how the green algae and hydrogen sulphide interact with different human and more-than-human actors in the Morieux bay of northeastern Bretagne. Additionally applying ontological turn theories, I show how two major institutions active in the bay, the Agglomération Saint Brieuc and the Réserve Naturelle, create differing ontological worlds. Within this “ontological multiplicity” (Adams 2023), the toxicity of decomposing green algae is not perceived equally by all involved entities. Accordingly, this thesis argues that toxicity is not only highly contingent, but also a major driver for friction and contestation in the Morieux bay.

In der Bretagne, der westlichsten Region Frankreichs, verursacht der hochindustrialisierte Agrarsektor eine beispiellose Anschwemmung von Grünalgen an den regionalen Stränden. Seit den 1970er Jahren bilden Stickstoffe und Phosphate, die durch das Sickerwasser der Schweineindustrie in den Wasserkreislauf gelangen, die Hauptnahrungsquelle der Algen. Nach der Anschwemmung beginnt ein Verrotungsprozess, bei dem die gasförmige chemische Verbindung Schwefelwasserstoff freigesetzt wird. Wenn dieses Gas in hohen Dosen eingeatmet wird, kann es tödlich für Menschen und bestimmte Tierarten sein. Aus diesem Grund versuchen staatliche Institutionen mithilfe von Hinweisschildern und Absperrungen Sicherheitsrisiken einzudämmen. Diese Arbeit untersucht anhand chemischer Ethnographie und mehr-als-Menschlicher Anthropologie, wie Grünalgen und Schwefelwasserstoff mit verschiedenen menschlichen und nicht-menschlichen Akteuren in der Bucht von Morieux im Nordosten der Bretagne interagieren. Unter weiterer Anwendung von ontologischen Theorien

(ontological turn) zeige ich außerdem, wie zwei in der Bucht tätige Institutionen unterschiedliche ontologische Welten erschaffen. In dieser „ontologischen Vielfalt“ (Adams 2023) wird die Toxizität der sich zersetzenden Grünalgen nicht von allen beteiligten Akteuren gleich wahrgenommen. Daher argumentiert diese Arbeit dass Toxizität nicht nur in hohem Maße ungewiss ist, sondern auch soziale Spannungen und Auseinandersetzungen in der Bucht von Morieux verursacht.

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Introduction

Every summer, Bretagne, the westernmost region¹ of mainland France, experiences a phenomenon that residents call “marées vertes”. Roughly translatable as green tides, the term refers to a process through which the movement of the tides wash ashore green algae on certain beaches of the region. Once the algae leave the sea, they turn into a green, squishy carpet covering the sand underneath. Even though *Ulva armoricana*, as they are also referred to under its scientific name, is an endemic algae species to Bretagne, the “marées vertes” are unprecedented to the region (Menesguen 2018). More than this, subsequent process of decomposition of the green algae lead to the development of hydrogen sulphide. While this gaseous chemical compound is often easily discernible by its characteristic sulfuric smell that reminds of putrefying eggs, higher ratios can escape human and more-than-human olfactory capabilities. In such cases, hydrogen sulphide turns into a lethal compound that can end human and more-than-human life within seconds (Menesguen 2018). In Bretagne, a total of three humans, several dogs and dozens of wild boars suffocated upon exposure to this gas (Léraud and Van Hove 2019).

The unprecedented development and proliferation of *Ulva armoricana* in Bretagne is tightly linked to its intensive agricultural sector. After the Second World War, the French agricultural ministry decided to turn the region into France’s primary region for pork production (Atelier paysan 2021; Léraud and Van Hove 2024). Compared to 3,2 million human residents living in Bretagne, 7,3 million pigs are raised in the region’s livestock farms (Léraud and Van Hove 2019). While pork meat is highly important for the economic prosperity of the region, pig farming releases high amounts of leachate into the surrounding groundwater, creeks and ultimately the sea. This leachate is rich in nitrogen and phosphates which are the main nutrition source for the green algae. Thus, while the pork industry expanded in the 1960s, subsequent years experienced for the first time the infamous “marées vertes” (Menesguen 2018).

Amidst the ubiquitousness of hydrogen sulphide, nitrogen and phosphate, the toxic remnants of the pig industry in Bretagne is just one example of chemical pollution in

¹ Bretagne is both a political-administrative and historical region of France. A political-administrative region is further subdivided into smaller political units which are called Départements. Bretagne consists of four Départements.

a “permanently polluted world” (Liboiron et al. 2018). Extractive and polluting economic practices in a world of “late industrialism” (Fortun 2012) produce chemical pollution as an unavoidable concomitant effect from which “one cannot simply get out” (Murphy 2017, 500).

To understand and grapple with these “ruins of agrochemical industrialism” (Adams 2023, 5), this work draws on the relatively recent anthropological field of “chemoethnography” (Shapiro and Kirksey 2017) by using the green algae as a case study. More specifically, chemoethnography explores how chemical molecules themselves have social agency and build social relations with an array of actors, from humans, to animals, water and landscape structures (Shapiro and Kirksey 2017). Thus, chemoethnography focuses on the “emergent social forms that arise from chemical exposures and dependencies” (Shapiro and Kirksey 2017, 484). Despite a dominating “damage-centered perspective” through which chemical molecules have been predominantly approached and studied (Murphy 2017), these emergent social forms can also be life creating. In a polluted industrial site of suburban Sydney for example, Eben Kirksey (2020) witnessed the almost extinct green and golden bell frogs of finding a tranquil habitat amidst this permanent pollution. Accordingly, chemoethnography traces what chemicals do, how they impact and alter already existing social worlds, and how humans and more-than-humans grapple with pollution from which “one cannot simply get out” (Murphy 2017, 500).

This research further builds on the theoretical proposition made by multispecies ethnography. Like chemoethnography, this anthropological strand equally seeks to understand how more-than-human entities, such as animals, bacteria, fungi or water “shape and are shaped by political, economic and cultural forces” (Kirksey and Helmreich 2010, 545). Here, multispecies ethnography puts the more-than-human at the forefront of ethnographic research (Khan 2019) to unmake the epistemological approach that put humans at the center of research and European modernity (Rogelja Caf 2022).

During a 3-month research stay between July and September 2024 in the Saint Brieuc bay in northeastern Bretagne, I applied chemoethnographic and multispecies ethnographic approaches to research the emergent social forms among its many more-than-human entities. More specifically, I combined interviews and participant observation with a walking methodology (Springgay and Truman 2018; Sundberg 2014) to

attend to the more-than-human assemblages formed by the interplay of green algae, humans, hydrogen sulphide and the movements of the sea in the Saint Brieuc bay. During these ethnographic practices, I was guided by the major research question which concerns *how different actors contribute to the making and unmaking of toxic space in the Morieux bay*.

Beside multispecies ethnography and chemoethnography, this research question is further based on the theoretical proposition put forward by the ontological turn. This ontology-focused strand of anthropology asserts that the Western understanding of a universal, inert and objective nature does not hold when thinking through indigenous ontologies (Viveiros de Castro 1998). Instead, Viveiros de Castro (1998) maintains that the world is comprised by many natures that come into being through the intricate ontologies of the humans and more-than-humans who inhabit and co-constitute these natures. Accordingly, natures are not fixed, but instead depend on continuous practices of making and unmaking undertaken by various actors (Li 2013; Blaser 2009; Howe 2019). Combining these space-making practices with chemoethnographic approaches undertaken by Hecht (2012) who asserts that the detectability of toxicity is highly impacted by political and scientific arrangements, I trace how toxic space and toxicity comes into being.

In order to reply to this guiding question and engage with the anthropological works on matters related to pollution, toxicity, environmental health and space-making practices, the thesis is organized in six chapters. Following the present introduction, Chapter 1 traces the agricultural amendments and practices that lead to the unprecedented algae proliferation. The consequent Chapter 2 highlights the various anthropological and ethnographic approaches on which this research is based. Along this line, the research methodologies that I applied, as well as my reflections about positionality and research limitations constitute the topics of Chapter 3. The first ethnographic part of the thesis opens up the space for the gathered data on which this work is based. Therefore, Chapter 4 and 5 examine how the two main institutional actors in the bay – the Agglomération Saint Brieuc and the Réserve Naturelle – create this toxic space through various means and practices. Whereas the Agglomération focuses on and applies technoscientific and managerial approaches, the Réserve Naturelle engages mostly in the protection of the more-than-human life of the bay. Connected to these

findings, Chapter 6 sheds light on how residents, civil society associations and one activist group variously engage with the green algae and the bay's toxic space. Finally, the Conclusion gives answers to the outlined research question and highlights the additional topics that emerged during the research process.

Historical development and current situation of green algae in Bretagne

Global overview

Unprecedented algae bloom has been an ongoing phenomenon in different parts of the world throughout the last decades. Satellite images suggest that the highest density of floating algae are to be found in the Baltic sea, the Western Indian ocean including the Persian Sea, northern Australia and the Atlantic ocean off the coast of Brazil stretching into the Caribbean Sea (Qi et al. 2025). Since the early 2000s, their growth rate per year increased drastically by 13.4%. The reasons for this unprecedented global algae proliferation are caused by anthropogenic activities, such as the warming of the oceans and the accumulation of nutrients in waterways through processes of eutrophication (Qi et al 2025). For instance, the arrival of Sargassum (a brown macroalgae) on the shores of the Caribbean islands Martinique, Guadeloupe, Barbados, St. Lucia and Domenica is just one example of this globally increasing trend (Langin 2018). Even though the specific reasons for the algae's arrival remain contested, hypotheses suggest an interlude of increasing nutrient input from the Amazon river due to agriculture in Brazil as well as an alteration of hydrodynamic conditions and global ocean warming (Banydeen et al. 2024). During the process of decomposition, the algae release hydrogen sulphide (H_2S) and studies suggest that constant exposure can have negative effects on cardiovascular health, especially among pregnant women in Martinique (ibid).

In other areas, such as the Baltic Sea, the algae blossoming of *Alexandrium ostenfeldii* literally lights up the sea during night time due to its bioluminescent properties. Together with blooming cyanobacteria, both types of algae omit toxic properties that inflict harm on sea organisms and humans. Today, the Baltic Sea is one of the most polluted saltwater areas in the world (Kowalewska 2021).

Algae in Bretagne

Compared to global trends, the algae blossoming under scrutiny throughout this research appears as relatively minor. Bretagne, a region in the western part of mainland France, surrounded by the waters of the English Channel, the Celtic Sea and the Atlantic ocean experienced its first green tides – the literal translation of the colloquially used term “les marées vertes” - in the 1960s (Menesguen 2018). In Bretagne, two green algae species

prevail: *ulva armoricana* and *ulva rotundata*. Their French name “les algues vertes” can be literally translated into the English term “green algae”².

As the name suggest, the colour green is their most striking characteristic. A single alga is slightly rippled and is usually as big as an open human hand. Its materiality can be firm or slippery. When they are still in the sea, each alga floats separately in the water. They proliferate seasonally with the warm seasons, especially between June and August. They are washed ashore through the movements of the tides and often form long strips on the sand imitating the retreating tidal water. As soon as the algae are exposed to oxygen, a process of decomposition starts which turns their colour from green to brown or grey. Various gases are produced and released during this process, notably dimethyl sulphide (DML), dimethyldisulphide (DMDL) and ammoniac (NH₃) (Anses 2011). Around 12 hours after their arrival, they also produce hydrogen sulphide (H₂S) with its highly toxic potency. This latter gas gives the decomposing piles their characteristic sulfuric smell which reminds of putrefying eggs. This smell is often dispersed with the wind through entire bay and beach areas. The bigger the quantities of these piles the stronger is the smell and the more H₂S is released. Thus, a comparison to other global areas with algae proliferation cannot be made because it is the situated exposition of communities to the algae which render their experiences meaningful.

² I will alternate between the French and English wording throughout the thesis



Figure 1: Fresh alga on the researcher's hand (Photo: S. Stopfer, July 2024)

The Morieux Bay

Eight locations in Bretagne have been recognised as receiving high amounts green algae (Préfecture de Bretagne, n.d.). One of them is the Saint-Brieuc bay which is both the biggest bay regarding surface and the area that receives most green algae among the eight bays (Menesguen 2018). This bay is divided by the Hillion Peninsula, an approximately 3-km-long stretch of land that creates the Anse d'Yffiniac and Anse de Morieux, ("anse" translating in small bay). The Morieux bay is the central research location of this thesis. The bay is comprised by several beaches of which the following were important during the research and are to be found in Figure 2: Plage de Saint-Maurice (1), Plage de la Grandville (2), Plage de Bon Abri (3), Plage de Lermot (4), Grève de Saint-Guimond (5) and Plage de l'Hôtellerie (6). During my stay, I had the chance to reside in a camping trailer during the entire research stay which was located not far away from the beach entrance of Plage de Saint-Maurice. The 40-km-long Gouessant river, visible on the satellite image by its meandering curves, feeds into the Morieux Bay and is the main source of nitrogen and phosphate influx, the major nutrient source for the *algues vertes*. The river received region wide attention when dozens of animals and a jogger were found dead on its shores between 2011 and 2016. Thus, the river has been titled "Gouessant, estuaire toxique"

[Gouessant, toxic estuary] by some activists (Le Lay et al. 2016). The entire shoreline of the bay is accompanied by the Bretagne-wide hiking trail GR34 which descends closely to the Gouessant river and runs along both its shores until the path crosses the *Pont Rolland* bridge in front of a decommissioned hydroelectric power plant.

Four villages surround the Morieux bay: Hillion, Morieux, La Grandville and St. Maurice. The latter two are located close to the beach entrances while the former two, including Hillion as the municipal centre, are some hundred meters away from the next beach access. The morphology of the bay is relatively shallow which results in big differences of water levels between high and low tide. Thus, the green algae also stretch over a relatively large area. The enclosed nature of the bay further prevents water circulation and influx of fresh water (Préfecture de Bretagne, n.d.).



Figure 2: The entire Saint Brieuc Bay. On the right Anse de Morieux, on the left Anse d'Yffiniac. The numbers refer to the above-mentioned beaches. The yellow dot is Morieux village (Photo credits: Website "Remonter le temps"; Accessed December 10, 2025)



Figure 3. Coastal view of the Baie de Saint Brieuc. On the left Anse de Morieux, on the right Anse d'Yffiniac. The bottom left corner shows les bouchots, wooden sticks on which mussels grow; the green belt is an arriving line of algues vertes. (Photo credits: CEVA and Agglomération Saint Brieuc).

Understanding the origin of the algues vertes, or le remembrement

Even though *ulva armoricana* grow naturally in different parts of the world, the emergence and proliferation in Bretagne are linked to specific anthropogenic socio-historical contexts that emerged in the years after World War 2. Postbellum Bretagne was a region characterized with relative poverty, high amounts of peasant farmers, poor soil conditions and little arable land. The landscape was characterized by *talus* and *bocage* (specific landscape elements with little agricultural purpose). Talus are belts filled with trees, flowers and grass that served both as a demarcation line of different farming properties and as a lively retreat zone for non-domestic animals. Bocage are usually bigger land areas and they are a mix of hedges and pastures, filled with small trees, spikey plants, swamps and little creeks (Léraud and Van Hove 2024).

After World War 2, the landscape assemblage in France was profoundly altered through various processes, referred to as “le remembrement”, a term that can be translated as “land consolidation” or “Flurbereinigung”. The goal of these landscape changes was to enlarge agricultural fields and turn previously restricted areas into arable

land. These practices of *le remembrement* were manifold and included several approaches. Rivers were drained, sealed, rectified or merged. Forests and fruit trees, including *talus* and *bocage*, were cut down to turn the land arable. Land elevations and small hills were ablated to also turn them arable and make them more accessible. The network of access roads was drastically extended to make the fields better accessible for agricultural machinery. Single plots of land, usually disseminated over a wider area, were merged. These processes resulted in larger and better accessible plots of agricultural land (Léraud and Van Hove 2024).

The processes and practices of *le remembrement* occurred in the historical context of post-war France. With the imposition of the Marshall Plan, French agricultural products started to circulate in the global free market and had to compete with their US-American equivalents. However, the French agricultural sector was not well equipped, both financially and materially, to compete with the already industrialized US-American sector (Atelier paysan 2021). Hence, the French state decided to implement land consolidation practices all over the French countryside to turn France into “a global agricultural power” (Léraud and Van Hove 2024, 5).

Beside these vast physical landscape changes, the composition of the post-war society was further impacted. Most peasants, owners and cultivators of these lands, were either deprived of their land or could not bear the increasing capital expenditures that a growing agricultural sector demanded from them (Atelier paysan 2021). Thus, most of them ended up at manufacturing belts of newly established factories. In 1961 for example, already 70% of the workforce of the Citroen factory in Rennes/Bretagne was composed by former peasants (Léraud and Van Hove 2019, 66). Rural land exodus was the consequence (Atelier paysan 2021). The local population often organised to demonstrate or block municipal buildings, such as in 1971, 1972 and 1974 in a village in central Bretagne not far from Saint-Brieuc (Léraud and Van Hove 2019, 64). However, the French state responded with an application of police forces, including the notorious CRS, to siege entire villages, such as a two-and-a-half-year deployment in a village only some kilometres from Bretagne (Leraud and Van Hove 2024, 25). Some lines of a song highlight the feelings of nostalgia that *le remembrement* caused (Tradart 1971).

J'étais un pays humble et beau,
land,

I was a humble and beautiful

J'étais un' terre nourricière,
(...)

En été dans les chemins creux
S'enlaçaient les amoureux,
Les rossignols des alentours
Leur sifflaient des chansons d'amour...
(...)

I was a nourishing land

During summer in sunken lanes
The lovers embraced each other,
The nightingales were around
They whistled love songs

Furthermore, the song also highlights how le remembrement was ideologically embedded in technoscientific and modernist approaches:

Les techniciens sont arrivés
Les techniciens ont ordonné
Aux paysans manipulés
Toutes les haies ont arrachées,
down,
Tout' les collines ils ont rognées,
Toutes les mares ils ont bouchées,
Les vert' prairies ils ont drainées,
drained,
(...)

The technicians arrived
The technicians decreed
To the manipulated peasants
All the hedges have been torn

They have trimmed all the hills,
They have blocked all the ponds,
The green meadows they

Mais gare à vous gens de Paris,
Car toute gloire est éphémère,
Refrain:

But beware people of Paris
Because all glory is ephemeral

C'est la faute au remembrement
Si l'eau disparaît des fontaines,

It's the fault of le remembrement
When water disappears from the
wells

C'est la faute au remembrement
Si plus rien n'arrête le vent !

It's the fault of le remembrement
Nothing can stop the wind now!

Those peasants who did not leave and remained in the agricultural sector often experienced high amounts of debt due to the increasing pressure to purchase new machineries (Atelier paysan 2021; Léraud and Van Hove 2024). The new application and dependency on machineries not only contributed to the decline of a versatile agricultural

sector with different crops and animal husbandry but especially to its development into a producer of raw materials and supplier for other industries. Chemical fertilizers (i.e. nitrogen and phosphate) became the most important components to reach high crop results (Atelier paysan 2021, 38).

Another decisive development of the agricultural sector of Bretagne was the establishment of above ground pig farming lots, an industrial sector that was non-existent in the region prior to the war. The Département Côtes-d'Armor with its capital Saint Brieuc was developed into the national centre of pig industry, resulting in the nick name of the deputy "le député du cochon" [the pig deputy] (Leraud and Van Hove 2019 69). In 2015, the region of Bretagne produced 58% of France's pork meat, far outnumbering the human population of the region – 7,3 million pigs reside next to 3,2 million humans (Léraud and Van Hove 2019, 70). Both, the chemical fertilizers and pig manure are unprecedented sources of nitrogen and phosphates. After oversaturating arable land, the rainwater carries them into the phreatic layers of the sub soil and eventually end up in estuaries and the sea via small creeks and rivers (Menesguen 2018). There, these chemicals turn into the main nutrition source for the green algae. Data suggests that the modernisation of the agricultural sector already multiplied nitrate rates in rivers by 10 in 1985 (Leraud and Van Hove 2019 70). The specific morphological conditions of the coastline of Bretagne together with warm weather conditions further favour the green algae growth through its shallow and enclosed bays and relatively high temperatures and clear water conditions (Ursachi 2023).

First algae arrival and lethal exposures

The mix of anthropogenic, morphological and meteorological conditions resulted in the first major green algae appearances in the 1950s. More unprecedented and clearly discernible arrivals with media interest occurred in 1968 and the consequent years (Menesguen 2018). Initially, local politicians and residents were primarily concerned how the algae covered up beaches and negatively impacted tourism, a highly relevant economic sector for the region (Léraud and Van Hove 2019). As a result, consecutive collective beach clean-ups took place in Lannion and Saint-Brieuc (Ménésguen). In 1977, scientists from the predecessor of the IFREMER (an officially recognized oceanographic research institution) concluded that the major cause for the growth of *algues vertes* was the influx of nitrogen and phosphate produced and released by the region's agricultural

sector (Léraud and Van Hove 2019). However, this link remained contested over the next two decades by farming advocacy groups and local politicians. In 1999, the French state officially recognized the agricultural origin of the green algae (ibid).

In the meantime, several human and animal casualties occurred on different beaches but always in the immediate surrounding of *algues vertes*. In 1984, the first dog deceased on a beach in the Morieux bay and others followed in 1991, 2007 and 2008 (Léraud and Van Hove 2019). Wild boars were the most frequent victims. Throughout summer 2011, a total of 36 of them were found around the Gouessant estuary, not far from the cabin where I resided. During the last days of my fieldwork, I ran into a cadaver of a wild boar myself when I walked close to the estuary. In total, three humans deceased on different beaches. In 1989, a 26-year-old person died when jogging around the beach Saint-Michel-en-Grève. A worker in charge of removing the green algae with an excavator fell into a coma on the same beach in 1999, but eventually survived. Ten years later a similar incident occurred in 2009 when a truck driver passed away due to a heart attack while driving his truck loaded with green algae. The most recent human casualty occurred in 2016 next to the Gouessant river when a 50-year-old jogger was found dead on its shores (Léraud and Van Hove 2019).



Figure 4: Piles of decomposed green algae on the beach Saint-Maurice (Photo: S. Stopfer, August 2024)

The health impacts of algues vertes

In contrast to the Sargassum in Martinique where several studies on human health consequences exist (Banydeen et al. 2024; Resiere et al. 2021), green algae exposition in Bretagne did not attract high amounts of scholarship. Several research participants during the fieldwork pointed to this circumstance with dissatisfaction. After the first human casualty in 1989 a local French newspaper already suggested that “the green algae may have killed” (Léraud and Van Hove 2019, 139), but comprehensive scholarship commenced only around 2007/2008 when several dogs passed away (Ursachi 2023). The event in 2009 on the beach of Saint-Michel-en-Grève was a further turning point and rendered the proliferation of algues vertes into a general public health concern among residents (Bourblanc 2025).

In 2011, the Agence nationale de sécurité sanitaire de l'alimentation, de l'environnement et du travail (ANSES) [the national agency for food, environmental and occupational health safety], published a document addressing the associated risks of gas emissions from the algues vertes (Anses 2011). Throughout the document, they repeatedly mention the lack of studies on health impacts. Nevertheless, they concluded that the mix of gas omitted by decomposing algues vertes can irritate eyes and respiratory mucosa, potentially leading to pulmonary edema and neurotoxic consequences when a body is exposed to the algues vertes at a relative distance. Loss of consciousness, cardiac attack or coma can happen when a body is directly exposed to decomposing piles, such as falling into one or cracking one open (Anses 2011). The document does not touch upon chronic exposition of residents or workers, a concern that several research partners continuously mentioned to me. A more recent document published in 2021 by the *Haut conseil de la santé publique* [High council of public health] equally mentions irritation of eyes, mucosa and possible endema as possible consequences but insist on the importance of the time and quantity of exposure (HCSP 2021). They assert that above 200 ppm (parts per million) neurological symptoms such as headaches, dizziness, coordination problems, nausea, vomiting, fatigue, disorientation, loss of consciousness and coma can occur. Immediate effects can be expected above 500 ppm, such as cardiac and respiratory disruptions, lack of consciousness and coma, often leading to a rapid

death. As with the previous document published by Anses, chronic exposition is only briefly mentioned due to a persisting lack of studies. However, they suggest that repeated exposition between 50 to 100 ppm can affect the nervous, ocular, digestive and respiratory system of the human body.

Amidst the relative lack of scientific studies, especially regarding chronic exposition, residents have long sought for other means to report on the consequences of hydrogen sulphide on their bodies. Various societal efforts such as citizen-science projects and social movements in combination with embodied knowledge have played a key role in framing the *algues vertes* as detrimental to human health (Bourblanc 2025). Some residents themselves measured and documented hydrogen sulphide levels with easily affordable measuring devices because they felt neglected by the data material provided by the state. As a result, these efforts undertaken by some citizens also pressured the government and local authorities to install monitoring stations on beaches to detect hydrogen sulphide emission. As some of the subsequent chapters will show, these monitoring stations sparked contestation and disagreements among some group of residents.

The *algues vertes* also impact maritime and coastal environments. The quantities of green algae tend to suppress other entities in the water, especially phytoplankton which is an important source of nutrition for other seaborn animals. The foreshore (fr. *l'éstran*) and other coastal habitats, important retreat and living zones for various organisms, are impacted by the release of hydrogen sulphide and the competition for oxygen. A further anthropogenic impact factor is the mechanical removal of *algues vertes* through machines. While they pick up stranded piles of *algues vertes*, they also remove fish eggs, other algae and organisms that reside on the foreshore. The weight of the machines also compresses the sand structure on the beach (Savelli and Louvigny 2025).

Governmental reaction and ongoing contestation

The unprecedented numbers of casualties between 2007 and 2009 (i.e., three dogs, one horse, one human) put increasing pressure on local and national authorities. Doctors and veterinarians who oversaw the deceased bodies tried to prove the lethal link of the gas emitted by the *algues vertes*. Nevertheless, their attempts were either silenced and discredited by local politicians or their demands for autopsies were denied. In the case of the truck driver's death in 2009, the procureur of the republic initially categorized the

cause of death as natural but relatives and an activist organisation contested this reasoning. Thus, the procureur decided to carry out a post-mortem autopsy which should further prove that the cause of death was due to the driver's unhealthy lifestyle (Léraud and Van Hove 2019). Ultimately, the cause of death remained contested.

Given the increasing awareness, concerns and pressure of residents, the French state launched a first action plan in 2010 titled "Plan de lutte contre la prolifération des algues vertes (PLAV)" [Plan to combat the proliferation of green algae]. This plan has been prolonged three times and is now running until 2027 (Ursachi 2023). This initial plan had two concrete layers (Dalmas et al. 2010). First, pre-emptive actions were designated to reduce the influx of nitrogen into the soil, the phreatic layers and the sea. Here, increased emphasis was placed on evaluating and amending agricultural practices. Revitalizations of specific landscape types, such as bocage or humid zones were another important focus point. The second goal of this action plan was curative and primarily entailed the mechanical removal (ramassage) of green algae to decrease security concerns at the specific beaches (Dalmas et al. 2010).

This initial plan was prolonged in 2017 resulting in a second plan between 2017 to 2021. An additional scientific layer was added with the aim to link different research institutions to expand scientific data production on the algues vertes (*Plan de Lutte Contre La Prolifération Des Algues Vertes 2017-2021* 2015). This plan was further prolonged in 2022 mostly because the nitrogen reduction in rivers since 2015 was considered insufficient. In addition to the three existing layers, a fourth layer was introduced to better emphasize the sanitary component of the green algae. Through this layer, measuring devices were installed at the beaches and people who have been exposed to gas should be treated better (*Plan de Lutttes Contre Les Algues Vertes 2022-2027*, n.d.).

Despite increased political efforts to reduce nitrogen influx and algues vertes proliferation, contestation over their lethal properties did not cease. The death of the jogger in the Gouessant estuary in 2016 made this most tangible. According to investigative journalist Inès Léraud, the widow of the jogger was immediately convinced by the mayor to withdraw the demand for an autopsy and to bury his body immediately (Léraud and Van Hove 2019). As it was the case with the deceased truck driver, the body was exhumed after some time to carry out an autopsy. Critics argued that this was done

intentionally because hydrogen sulphide dissolves in the human body after some days. Thus, a death due to algae exposition is only verifiable immediately after. Local frictions extended into activist groups, family members and their friends on one side and farmers on the other side. The former claimed and accused the local politicians to neglect, downplay and manipulate the danger of green algae whereas the latter perceived themselves as scapegoated. This contestation and ambiguity did not cease. The questions to what extent the algae and their emitted gas are toxic, where they are toxic and who is responsible for their proliferation continuously arose during the research. Thus, contestation about toxicity became a common thread throughout the research stay. Accordingly, the next chapter delivers the theoretical tools to approach and grapple with this contested toxicity.

How anthropology was “learning to see”³

Anthropology as an academic discipline underwent several paradigm shifts during its often uncanny history. From its active role in the formulation of scientific racism amidst European expansion and colonialism throughout the 19th century and early 20th (Asad 1975), it developed into a tool for positivist data collection throughout the 1950s specifically discernible in visual anthropology (Henley 2013). Some decades later in the early 1990s, the Writing Culture debate put in question certain key assumptions that guided the discipline previously (Clifford and Marcus 1986). Accordingly, the assumed neutrality and objectivity of the anthropologist with which they give the reader a glimpse into the culture of the other was fundamentally refuted. Instead, the authors of the foundational work “Writing Culture” argued that the perspective and narratives through which ethnographies are written are utterly dependent, influenced and constructed by the researcher’s position of power. Here, ample focus and emphasis was given to the constructedness of the ethnographic reality.

The subsequent chapter not only serves as the theoretical basis for the thesis but also briefly highlights how the specific topic and the theoretical approach is an outcome and continuation of the many watershed moments that utterly restructured and remade the discipline of anthropology. In doing so, the chapter continues with a subsequent theoretical development after the Writing Culture debate, the ontological turn. Acclaimed by some anthropologists as a moment when the discipline was “learning to see” (Viveiros de Castro 2015, 3), I outline how this turn provides one fundamental theoretical basis for this thesis. Then, I proceed by outlining the theoretical ambitions of both multispecies ethnography and chemoethnography. The second major part of this chapter weaves together the theoretical approaches provided by the ontological turn, multispecies ethnography and chemoethnography to apply them to the green algae in the Morieux bay. More specifically, I highlight how these theories are embedded in the research question and theoretical approach of this thesis.

The foundational importance of the ontological turn

Some years after the Writing Culture debate and subsequent debates about the distinction between subject and object in anthropology, the ontological turn emerged to

³ (Viveiros de Castro (2015, 3)

put in question yet another dichotomy commonly assumed by anthropology and modernist science, the distinction between nature and culture. Even though this turn entails reconsiderations on epistemological as well as on ontological ground, the latter receives more attention. More specifically, anthropologists working on and with the ontological turn focus on how research participants know the world, and on examining the different beings and entities that exist in the specific world the research partners imagine and inhabit (Holbraad and Pedersen 2017).

In his foundational article on “Amerindian Perspectivism”, Eduardo Viveiros de Castro (1998) outlined how entities in specific Amazonian regions – from humans to jaguars and spirits - conceive themselves and others. In this perspectivism for example, a jaguar does not perceive themselves as an animal but rather as a human being. Consequently, they also perceive their food from the same human-categories but just in relation to different entities: while manioc beer is manioc beer for humans, for the jaguar blood is manioc beer. What Viveiros de Castro (1998) seeks to exemplify with this example is that beings do not just interpret the same substance differently but that they inhabit worlds in which different substances are the same social thing. The crucial difference is the specific bodily perspective through which a jaguar or a human perceives differently. Most importantly, the idea of Amerindian Perspectivism puts forward a framework to inverse dominant conceptions and hierarchies of nature and culture. The modernist and predominantly Western understanding of nature is based on its universality which assumes nature to both exist independently and externally to humans and that its physicality is similar. In contrast, culture, more specifically human culture, is an unstable and non-universal condition that changes depending on the specific geographical locality (Viveiros de Castro 1998). Accordingly, Viveiros de Castro (2013) coined the terms “multinaturalism” and “naturalist multiculturalism”. Whereas the former refers to Amazonian ontologies of many natures and one culture the latter refers to the modern conception of one universal nature that is inhabited by many cultures. In a similar vein, Philippe Descola (2014) refutes in his book “Beyond Nature and Culture” the universality of the modernist split between nature and culture by outlining and comparing several indigenous ontological perspectives. In his description and analysis of different ontologies, he outlines how the Euro-American naturalist ontology creates a distinction between humans, animals, objects and the environment. More specifically, it is only

humans that have subjectivity, intentionality and moral agency. Hence, this specific ontological perspective turns all other entities that are not humans into inert, passive and objective entities that can be measured, consumed and exploited. This division, as Descola (2014) argues, is the foundational element for the hierarchy between humans, animals, plants and other entities with the former as the most rational and subjective entity on top.

Researching the more-than-human world

Starting around 2010, anthropology witnessed yet another theoretical development emerging under the names of multispecies ethnography or more-than-human anthropology⁴. The overarching aim of this approach is “to decenter the human in the Age of humans” (Rogelja Caf 2022, 11) and to move beyond the naturalist ontology that separates nature from culture. One of the foundational articles of multispecies ethnography for example, argues that

lines separating nature from culture have broken down, (...) encounters between Homo sapiens and other beings generate mutual ecologies and coproduced niches (Kirksey and Helmreich 2010, 546).

Additionally, multispecies ethnography emerged at a time when anthropologists increasingly found themselves and their research topics amidst a worsening environmental crisis, the consequences of late industrialism and extractivist economic practices under capitalism (Khan 2019; Tsing et al. 2019; Fortun 2012; Kirksey 2014). Some years prior to the foundation of multispecies ethnography, meteorologist Paul J. Crutzen and botanist Eugene F. Storer proposed in 2000 the term “Anthropocene” to describe a new geological epoch that assumes humankind as a geological force profoundly impacting and altering the planet (Crutzen et al. 2021). The proposition of this term further sparked discussions in the discipline of anthropology and was perceived by Anna Tsing, Andrew Mathews and Nils Bubandt as a “wake-up call urging us to reinvent observational, analytical attention to intertwined human-and-non-human histories” (2019, 188).

⁴ I will use the term multispecies ethnography throughout the thesis

Other anthropologists already gazed at these intertwined histories. Donna Haraway (2008) for example argued in their book “When species meet” that humans cannot be perceived as autonomous species because their life is always comprised and constituted by other entities. Through these entangled human and more-than-human histories then, both entities are becoming and living with (Haraway 2008). Anna Tsing argues in a similar vein that “human nature is an interspecies relationship” (Tsing 2012, 541). Equally, Noorani and Brigstocke (2018) highlight that human social relations are always comprised by more-than-human beings. Accordingly, one of the major points of interest within multispecies ethnography is the focus on what is emerging amidst these human and more-than-human assemblages (Tsing 2015, 18). Within these assemblages, the active and agential role of more-than-humans in making worlds is specifically emphasized. A highly illustrative example is a beaver who not only amends entire river streams but whose dams also create new lifeworlds for themselves and other entities such as fish (Tsing 2015). Thus, multispecies ethnography puts the practices, relations and entanglements of more-than-humans at the forefront of ethnographic research to decenter the human (Khan 2019). It is important to note however, that animals or plants for example are not just added to the ethnographic research practice, but their capacity for creating lifeworlds utterly reshapes common understandings of agency and relatedness. Moving beyond the nature – culture divide as Kirksey and Helmreich (2010) suggest, renders visible how humans and more-than-humans, these include animals, plants, trees, bacteria, fungi, soil, etc., always live in and co-create these environments interdependently.

Thus, putting more-than-human entities at the forefront of ethnographic research renders their lived experiences and entangled lives both palpable and visible. This visibility clearly speaks to Eduardo Viveiros de Castro’s suggestion that anthropologists were finally “learning to see” (2015, 3). In a similar tone, Naveeda Khan (2019, 3) suggests in their article that the Anthropocene and adapted ethnographic research methods “allow us to see this time otherwise”. Accordingly, ontological turn approaches and multispecies ethnography were and still are important watershed moments to grasp, research and relate to the various other-than-human entities that inhabit different spaces. Some years after the introduction of the ontological turn and multispecies ethnography, another

more-than-human entity crept in the ethnographic lens of anthropologists: chemical compounds.

The chemical world and ethnography

Thus, beside the ontological turn and multispecies ethnography, I add another theoretical layer: chemoethnography. This new strand of theoretical and ethnographic engagement can be perceived as a continuation and sub-discipline of multispecies ethnography as it equally inquires the question on how to best approach and include more-than-human entities in ethnographic research. The interrelationship of these two ethnographic approaches becomes clear when examining authorships: Eben Kirksey who is co-author of one of the foundational article of multispecies ethnography discussed above (Kirksey and Helmreich 2010), equally co-drafted one of the foundational articles for chemoethnography (Shapiro and Kirksey 2017). Nevertheless, other anthropologists already carried out chemoethnographic research when it was not yet coined. Kim Fortun (2001) on her work on the exploded chemical plant of Union Carbide in Bhopal/India for example, put increased attention on the chemical to not only understand their entanglement in continuing British imperialism but also to see how they form life themselves.

Chemoethnography is a highly useful theoretical and ethnographic tool because it enables to approach chemicals as entities and trace how they actively shape the social worlds they inhabit (Shapiro and Kirksey 2017). Accordingly, ethnographers have put increased attention on how chemicals move in abstract landscapes such as industrial processes engaging in extraction, militarization and monoculture (Kirksey 2020; Nading 2020). One of the major assumptions of chemoethnographic approaches then is the ubiquitousness of chemical compounds. In an article discussing the persistent organic pollutant polychlorinated biphenyls (PCBs) and their effects on daily lives, Michelle Murphy suggests that “one cannot simply get out” (Murphy 2017, 500). Similarly, Timothy Choy (2016) reminds us that chemicals became a persistent part of the atmosphere and that humans continuously breathe with and through them. The author summarized this as a condition in which humans constantly “con-spire” with and through chemicals. Moving to their own body, Susanne Antonetta (2001) shows how chemicals are already constituting human bodies from an early fetus state onwards. Chemical pollution in the area where the author grew up, brought dichlorodiphenyldichloroethylene (DDT) into their

mother's breastmilk and consequently into the author's body. Thus, disregarding whether one approaches the chemical from an individual or societal perspective, chemical exposure is often persistent and inescapable in late industrialism (Kirksey 2020; Fortun 2012).

These examples of chemical pollution highlight that their influence is not just inescapable but also gives them a certain agentive force with which they impact the environments in which they circulate. Accordingly, chemical molecules can "alter, attenuate and augment relationships" between them and other entities, such as human bodies (Kirksey 2020, 23). In this context, Shapiro and Kirksey (2017) coined the term "chemosocialities" which summarize and highlight the "longstanding relationships and emergent social forms that arise from chemical exposures and dependencies" (484). This further breaks with a specific epistemic habit through which chemicals have been and still are commonly perceived through the lenses of natural science (Murphy 2017). Often, chemicals are perceived as isolated individuals who harbour in laboratories and abstract formulas (Murphy 2017). This epistemological understanding however, forecloses the fullness and ubiquitousness in which chemical molecules perform, alter and shape their own lives and other entities. By acknowledging that "toxins permeate living things, human and not human" (A. L. Tsing, Mathews, and Bubandt 2019, 189), chemoethnography further opens up the opportunity to move beyond seemingly fixed categories of life and non-life. Mel Chen (2012) for example, started from their own experience with lead intoxication and recounts how it shattered certain heteronormative beliefs and the dichotomy of life and death. In the case of their research and their personal experience, the human body became objectified, and the object in form of the chemical molecule lead became animated. Chen's (2012) account shows the fragility of "well"-established categories and underpins that chemoethnographic research can shed light on "what life might or could be like" (Shapiro and Kirksey 2017, 490). Accordingly, chemoethnographers can also uncover the life-providing properties of chemical molecules. The industrially polluted Sydney Olympic Park for example, turned into a thriving environment for the golden and green bell frogs, a species that was about to go extinct (Kirksey 2020). Thus, a site polluted by chemical molecules turned into a live-providing environment.

Even though chemical molecules can turn into actors themselves, it is often difficult to grasp them not only ethnographically but also with scientific measuring devices (Nading 2020). Thus, toxicity often remains elusive, and in the wake of ubiquitous pollution, scientific methods for risk perception often fail to provide objective clarity (Nading 2020). Furthermore, Gabrielle Hecht (2012) illustrates in her work on uranium mines in South Africa that political and scientific arrangements can impact the perceived toxicity of chemical substances, rendering the health consequences of emanating radiation sometimes invisible and impalpable to workers. In the 1940s for example, when radiation was first put under scientific scrutiny in South Africa, research suggested that the mines and radioactive substances pose health dangers to workers. From the 1950s onwards however, the vantage points of the scientific approaches shifted and focused more on interpretations and average pollution thresholds. In turn, the mines were considered less toxic. Hecht (2012) then further showed how shifting scientific research approaches, safety standards, racialized labour and political interest impact whether uranium's toxicity is publicly visible or not. Thus, Hecht's research (2012) shows that "technopolitical mechanisms" and changing scientific approaches and paradigms amend the perceived and communicated toxicity of chemicals.

Back to the Morieux bay

After outlining the theoretical and practical developments of the ontological turn, multispecies ethnography and chemoethnography, the remaining sections of this chapter weave the theoretical groundwork into the specific context of the research: the Morieux bay in northwestern France.

Green algae and global entanglement

As a first step, I want to highlight how the green algae proliferation in the Morieux bay needs to be understood as continuation and consequence of a globalised capitalism. Several wordings of multispecies and chemoethnographic literature, such as "damaged landscapes" (Tsing 2015, 18), "the ruins of agrochemical industrialism" (Adams 2023, 5) or "capitalist ruins" (Tsing 2015), combined with ethnographic examples highlight how capitalist extractivism is often the prerequisite under which chemical pollution occurs (Fortun 2012; Tsing et al. 2019; Haraway et al. 2016). In the Morieux bay, the mix of nitrogen, phosphates and pesticides that flow from the agro-industrial feedlots and fields

through the Gouessant river into the sea ultimately lead to the blossoming of the *algues vertes*. In turn, they are washed ashore and produce the lethal gas hydrogen sulphide during their process of decomposition. Here, agro-capitalism not only produces the *algues vertes*, but also manifests through them.

To better understand the chemical pollution and the consequences of industrial agriculture in the Morieux bay, it is helpful to apply the conceptual tool of the Patchy Anthropocene, formulated by Anna Tsing, Andrew Mathews and Nils Bubandt (2019). For the unfolding of the Anthropocene, the authors argue that simplifications, restructurings and enclosures of land plots need to take place to ensure exploitability and human dominance over them. Tsing et al. (2019) call this process modular simplification. Even though these plots of land are enclosed and controlled via pesticide application or monitoring, they either leak or are less controllable as they appear. The authors coined such leakages or loss of control feral proliferations. Tsing et al. (2019) show that this can occur in form of coffee rust, a fungus that moved via globalized supply chains to wipe out entire coffee plantations (Tsing et al. 2019). Sophie Chao (2021) provides another example of feral proliferations by highlighting how the emergence and rapid expansion of parasites, such as the larvae of *Mahasena corbetti*, severely pressures oil palm plantations in West Papua. In the case of enclosed and simplified banana plantations, this staple food was already wiped out by the fungus *Fusarium oxysporum f. sp. cubense* (*Foc*) in the 1960s and which currently transmutes in southeast Asia (Dita et al. 2018).

Even though the agricultural sector in Bretagne cannot be compared to the plantation systems of these ethnographic examples, the processes of modular simplification and feral proliferation can be equally applied to this specific French context. As I outlined in the previous chapter, profound restructurings, clearing and reallocations of agricultural land was carried out under the name of “le remembrement” in Bretagne during the 1960s (Léraud and Van Hove 2024). Then, as pesticides, phosphates and nitrogen leaked from the plots of land and pig lots, they enable the proliferation of green algae. In their decomposing state, the algae then manifest as the feral proliferation of the specific agricultural system of Bretagne.

Olfactory properties of the green algae

The provided ethnographic examples of coffee rust, *Fusarium oxysporum* and the larvae of *Mahasena corbetti*, all highlight how feral proliferations are destroying certain

lifeworlds, such as the banana, oil palm and coffee plantations. Even though the green algae in the Morieux bay also have feral properties and are able to end the life of humans and more-than-humans, most of the time they are not feral. As outlined above, Eben Kirksey (2020) highlighted how the chemically polluted Sydney Olympic Park enabled the proliferation of the green and golden bell frogs. Instead of applying a lense that predominantly focuses on the damage that chemicals are often perceived to cause (Murphy 2017), I approach the Morieux bay and its human and more-than-human assemblages from an understanding that new forms of life can emerge in chemically altered environments (Kirksey 2020). Anna Tsing summarised this approach neatly: “What emerges in damaged landscapes, beyond the call of industrial promise and ruin?” (Tsing 2015, 18).

The most imminent emergence of decomposing piles of green algae are the toxic gases. The most prominent among them is hydrogen sulphide, characterised by its specific sulphuric scent that reminds of putrefying eggs. Depending on the quantity of decomposing green algae, the scent of hydrogen sulphide can often fill, penetrate and linger in certain beach areas for entire days. The senses as focus point of anthropological enquiry is not new. David Howes (2019, 20) for example, situates a “sensory turn” within the discipline around 2010 which emphasized that the senses are often shaped by the socio-cultural background and can therefore not be universalized. Some years later, Sarah Pink (2015) examined in their book “Doing sensory ethnography” how ethnographic research can expand its focus from interviews and participant observation to include sensory perceptions such as taste, smell and touch. While Sarah Pink’s and David Howes’ work certainly influenced my ethnographic approach and helped me to shift my focus on the very materials that stimulate human senses, I am not too eager to grapple with the senses ethnographically. Instead, I am interested in what these materials, so the toxic gases, *do*.

Here, Clare Brant’s (2008) article on smells, scents and odours is a helpful linking figure. Instead of focusing on olfactory characteristics and experiences, they show how scents can influence spatial, political and cultural configurations. The application of perfume or deodorant for example, creates a “scent circle” which is a subjective and individual boundary in which the wearer of the perfume distinguishes and demarcates themselves from other scents, smells and odours (Brant 2008, 547). Despite the

individualized application of perfume, the scents that emanate always impact bigger parts of a group. Accordingly, the application of scents can also be regulated, as it was the case in an office-building in Halifax because certain employers became concerned about potential toxic properties of perfumes (Brant 2008). This further serves as an example of one of Brant's further major points, namely that scents are not space-bound but instead linger, swirl and drift away (2008).

From a chemoethnographic lense, smells and scents of chemical molecules are often a decisive vantage point through which affected groups make sense of, engage with and discern chemical harm. On their work on formaldehyde, a widespread chemical in domestically used plywood and paintings, Nicholas Shapiro (2015) highlighted how its specific smell helps to "sense the world well before cognition catches wind of protracted chemicals" (375). Similarly to the scent of perfumes described by Clare Brant (2008), the odour of domestically applied formaldehyde has "place-making and place-disrupting capacities" (Shapiro 2015, 374).

Putting these ethnographic accounts of domestic formaldehyde and deodorant together shows how visibly imperceptible chemicals alter, shape and impact spaces through their olfactory properties. Moving back to the Morieux bay, the same approaches can be applied to the hydrogen sulphide emanating from decomposing green algae. As both a chemical and more-than-human actor, the question arises of how this gas with its strong scent impacts, alters and shapes the space in the bay? This question and the assumption that chemicals have "place-making capacities" (Shapiro 2015) translates into the main research question of this thesis.

"How do different actors contribute to the making and unmaking of toxic space in the Morieux bay?"

The production of environments and toxic space

The previous subsection elaborated how the gas hydrogen sulphide and their accompanying scent of putrefying eggs can make and unmake space. As more-than-human actors, they reside on the beaches, the foreshore and the riverbeds of the Morieux bay. In this subsection I proceed with the theoretical conception of Eduardo Viveiros de Castro's (2013) multinaturalism as outlined at the beginning of this chapter. Here, the

theoretical perspectives of the ontological turn are applied to grapple with the specific spaces of the Morieux bay in which the human and more-than-human actors reside. More specifically, I follow and apply Mario Blaser's ontological inquiry to "focus on what kinds of worlds are there and how they come into being" (Blaser 2009, 11). As it is the baseline of ontological turn literature, the modernist nature – culture divide is put under scrutiny because this approach perceives and relates to nature, the environment and the natural surrounding as a concrete and passive given whose only change derives from different geographical physicalities (Descola 2014). The ontological turn in contrast, argues that different natures and worlds exist and they are not a given and fixed entity (Viveiros de Castro 1998). When this approach is applied to the context of this thesis, the question arises which worlds and natures might exist in the Morieux bay. While I will devote enough space to answer this question in the major ethnographic chapters 4 and 5 of this thesis, my focus point here is to explore how many natures and different worlds come into being and exist at the same time.

The research of Fabiana Li (2013) is particularly helpful in this regard. Drawing on their research on the expansion of the Yanacocha gold mine in Northern Peru, the author asserts that geographical entities prone for extraction carried specific meanings and associations that changed over time. People residing near the Yanacocha gold mine perceived the Mount Quilish/Cerro Quilish both as a sacred entity and as an aquifer providing clean freshwater. While these associations were commonly shared among residents, the author showed that Mount Quilish was not always perceived as a sacred mountain and important aquifer in previous anti-mining protests. Accordingly, Fabiana Li (2013) examined how residents unmade, remade and underpinned the specific connotation of the mountain. Here, the author emphasizes the engaged and continuous practices undertaken by several societal groups, such as indigenous residents and activists, scientists and local politicians. To establish Mount Quilish as an important aquifer for example, activists teamed with scientific experts who underpinned with hydrological studies and reports that the mountain holds significant amounts of water in subterranean layers. These scientific findings were then translated into easier accessible language and disseminated among a broader public. The Mount Quilish was attributed with certain phrases such as "water sponges" or "a mountain that holds water" (Li 2013, 407). These associations stabilized the image of the Mount Quilish as an aquifer in the

broader public. The connotation of the mountain as a sacred entity (“Apu”) was not newly invented. For many peasant farmers, the Mount Quilish was never a passive and inert object. However, this perception was not publicly accepted and widespread until a catholic Father mentioned the sacredness of the mountain in sermons and articles. These works reached urban residents who then framed the protection of the Mount Quilish and the stopping of mine activities as a catholic duty. Eventually, the sermons and articles also reached other societal groups, such as environmentalists and journalists and the recognition of the mountain as an Apu became widespread.

Fabiana Li’s (2013) ethnographic example examines not only the continuous practices through which Mount Quilish was associated with and turned into an aquifer and an Apu, but also emphasises that natural entities are not inertly given. Most importantly however, Li argues that Mount Quilish “emerged as different entities” (2013, 400) and not only as an aquifer and Apu but was also perceived and framed by mining companies as a valuable deposit of gold that can be extracted. Here, Li (2013) applied theoretical frameworks of the ontological turn to explore the “multiple socionatural worlds” of Mount Quilish to explain why residents, activists and mining companies could not find a common resolution for amending mining practices.

Li’s insights (2013) particularly speak to the Morieux bay because it helps to explore the potentially different ontologies through which the research site emerges depending on the engagement of the various actors, ranging from human to various more-than-human entities, such as birds, green algae and hydrogen sulphide. As Fabiana Li puts it themselves “an attention to multiple worlds reveals the collaborative processes of enactment that brings entities into being” (Li 2013, 410). Accordingly, I am paying particular attention to how such spaces, whether they are toxic, natural or technoscientific, come into being. Brant’s (2008) analysis on smells and scents serves as additional foci point as the author highlighted their space-making capacities. Additionally, I apply Hecht’s research results that suggest that “technopolitical mechanisms” can impact how toxicity is framed, narrated and perceived by those being exposed to it.

Thus, equipped with ample theoretical frameworks, approaches and tools, the next chapter explores how I applied these theoretical approaches methodologically and examines my own positionality in this undertaking.

Methodology & Positionality

Inviting more-than-human subjects into our research is not just a question of theory but also a matter of methodology, since these two are or should be closely interrelated (Rogelja Caf 2022, 14).

Awakening to the arts of noticing⁵

How then do more-than-human theories become methodological approaches? Tsing, Mathews, and Bubandt remind that a reinvention of observational and analytical attention needs to be undertaken to better grapple with the “intertwined human and nonhuman histories” (2019, 188). This includes unlearning certain histories that we have been told and letting go of a supposedly universal vision of the world. Thus, it is about noticing different worlds, as Anna Tsing invites us to do in her book “The mushroom at the end of the world” (Tsing 2015). She notes:

Twentieth-century scholarship, advancing the modern human conceit, conspired against our ability to notice the divergent, layered, and conjoined projects that make up worlds. Entranced by the expansion of certain ways of life over others, scholars ignored questions of what else was going on. As progress tales lose traction, however, it becomes possible to look differently (Tsing, 2015, 22).

In order to learn how to look differently, two prerequisites have to be considered. First, anthropocentric visions about the world have to be discarded. If one engages with the world through a dominating and hierarchical gaze, then it blindfolds the many entanglements that exist between humans and more-than-humans. Second, certain group of humans need to let go of the notion of progress. The hegemonic vision of the world makes us believe that humans are different from the rest of the world because we supposedly act consciously and intentionally while other beings are dependent on us (Tsing 2015). While we like to believe that we constantly leap forward, we leave the rest of the world behind. We think that temporality is singular, but this in turn blindfolds the manifold other temporalities that existed and continue to exist.

⁵ (Tsing 2015)

Consequently, Tsing urges us to “reorient our attention” via the arts of noticing to understand that a world outside the human gaze exists (2015, 22). This, of course, is not a new endeavour and, as the previous chapter showed, is enacted by Indigenous people all over the world since time eternal. These times of serious social upheaval however, can serve as a wake-up call and an opportunity to unlearn hegemonic visions of the world for those whose minds have been subtly colonized.

The art of noticing includes an increased focus on assemblages – a concrete but unbounded physical space which is shared by multiple species. Paying attention means to reveal how these species influence each other, whether they eat each other or cooperate, while at the same time acknowledging that they also do this without human revelation. This can further highlight the limitations of human knowledge: there are certain movements in an assemblage that will remain intangible forever but might well be known by some of the species engaging in them. Thus, the art of noticing allows us to “appreciate the multiple temporal rhythms and trajectories of the assemblage” (Tsing 2015, 24).

Building on fieldwork experience, propositions for an engaged multispecies ethnography are often highly grounded in abstraction and can often remain intangible to the reader as they sometimes lack concreteness. However, these approaches became more concrete during the research process itself because methodological theory inevitably turned practical. When I started to perceive the Morieux bay as an open and unbound assemblage, potentially overlapping with other yet unnoticeable assemblages, multispecies ethnography became palpable. The assemblages under scrutiny are inherently place bound and further helped to turn abstract theory more tangible methodologically and concrete. In order to grapple with the arts of noticing, I had to slow down, and slowing down brought me to a quite concrete method: walking.

A walking methodology

From baby steps to walking

When a friend and study colleague visited Saint Brieuc for the first time in April 2024, walking was the first thing we did to engage with and get to know the area. Back then, walking seemed rather unpleasant because the full array of Breton weather conditions revealed itself to us. In some short moments rain punched into our faces from all possible

directions, soon after we dried up again through the bright sun and a whipping wind. We still made it to Yffiniac where we pitched our tent in a hidden place some meters next to the shore. On the next day, we traversed the Hillion peninsula in again rapidly changing weather conditions. Further on, we traversed the Gouessant river over a decommissioned railroad viaduct where signs and photographs reminiscently keep on dwelling over a once glorious past. There, we returned back to the GR34 and accompanied the river for some kilometres to its estuary. I was fascinated because it was the first time that I saw all the entities unfolding in front of my own eyes – entities that I only saw until then via the screen of my laptop. Thus, together with my friend, we were “walking worlds into being” (Sundberg 2014, 39).

Walking theoretically

As many others on this planet, I walked and keep on walking over many distances in my life. Rarely however, is this act perceived as a way to create knowledge. For some, such as the Zapatistas in Chiapas (Sundberg 2014), Springgay and Truman (2018) in Wee Jasper and Rogelja Caf (2022) in Slovenia, walking is essentially this. I drew my inspiration through their works and approaches to apply walking as a methodology to engage with more-than-human worlds in the Morieux Bay

When we walk, we move and we move through a specific space. Thus, sometimes more consciously other times more unconsciously, we engage with a space and get to know it. It is tightly linked to the Tsing’s “art of noticing” (2015), as Sundberg, without making the link themselves, suggests:

Walking (...) may help to foster recognition of the multiplicity of knowledge systems. As we humans move, work, play, and narrate with a multiplicity of beings in place, we enact historically contingent and radically distinct worlds/ontologies (Sundberg 2014, 39).

Springgay and Truman (2018) elucidate in their thorough account “Walking methodologies in a More-than-Human world: WalkingLab” that walking research is characterized by four major themes: place, embodiment, rhythm and sensory inquiry. Place is especially important and useful in the specific case of my research. While walking does not produce toxic space, it definitely produces the space I engage in: the Morieux

bay and the Gouessant estuary: “walking becomes a way of inhabiting place through the lived experience of movement” (Springgay and Truman 2018, 4).

Furthermore, walking highlights the connection of bodies and minds with their surrounding environment, and it is through this embodiment through which the space is engaged with. Thus, embodiment is the process by which our bodies play an essential role in shaping how we experience and understand the world. Here, researchers focus on walking as a lived experience and examine what it means and feels like to move a body through a specific space.

Rhythm, as yet another major theme of walking research, points to the everyday connection of walking: during some hours of the day humans might walk faster and more often, while in other moments, movement is not occurring. These rhythms are often tightly linked to capitalist life structures. Another approach to rhythm is in regard to the pulsating movements of the feet, hands, limbs or breath.

The remaining theme that Springgay and Truman (2018) discern in walking research is the indispensable and invariable value of the senses. While the whole body of the researcher engages in walking, so do all their senses. Thus, moving beyond the dominating visual sense, smelling, touching and hearing also contribute to a broad understanding and engagement with the space.

The sensory inquiry is part of a broader anthropological catalogue regarding the senses, such as sensory ethnography and multisensory anthropology (Pink 2015; Howes 2019). Both accounts highlight the active and omnipresent role of the senses in ethnography and acknowledge that it is often through the senses through which meaning and an embeddedness to a specific place is produced. Furthermore, Howes (2019, 18) describes a “participant sensation” instead of participant observation in ethnography which emphasizes how a research site and topic is not just experienced and sensed in isolation but by communal engagement with others.

As outlined by Sundberg (2014) communality and reciprocity is also highly discernible in the Zapatista approach to walking. In this context of anti-colonial liberation for autonomy, walking becomes inherently political and solidary. Accordingly, they emphasize that walking does not occur in isolation from other humans and more-than-humans and therefore becomes a *walking with* (Sundberg 2014). This communality highlights the “multiplicity of life worlds” in which many entities make place similarly or

differently. Furthermore, the reciprocity of walking moves knowledge creation away from the individual and turns it into “learning as an engagement with the other” (Sundberg 2014, 40).

Walking practically

I literally walked the Morieux bay into being. It obviously existed before me, but not the reciprocal engagement and embeddedness between the bay and me. Guided by multispecies ethnography, I decided to put the more-than-human entities to the forefront (Khan 2019). I aimed to river-center my research and take the Gouessant river as the starting and reference point, as Rogelja Caf did with the Rižana river in Slovenia (Rogelja Caf 2022). The first limitation arose already here: where does the river start, where does it end and where is it actually located? Rogelja Caf (2022) pointed out that the human gaze only discerns the running water on river’s surfaces. While its water emerges from underground water chambers through springs, a substantial part of it still moves under the soil in the river basin. Thus, anthropocentric demarcations do not hold here. Nevertheless, I decided to stick with my anthropocentrism because it actually *is* the visible surface water that mostly carries nitrogen, hosts the birds and serves as a medium through which the algae move.

Following Springgay and Truman’s (2018) methodological advice, I carried out place-making through walking not only in April when I first walked through the Bay, but especially during the first week after my arrival. I did several circumnavigations of the bay on foot, sometimes over the foreshore during low tide, other times via the GR34 that wiggles with the Gouessant river on both its shores. Different perspectives and encounters emerged, sometimes with human passers-by, but more regularly with the mud and sand that likes to swallow feet, the trees that grow differently on the two shores of the river, and the birds that vocally inhibit the space.

The rhythm through which I engaged with the bay and walked with it was determined by the movements of the tide. A full tide made it impossible to traverse from St.Maurice to La Grandville and invited me to opt for the terrestrial GR 34. The weather conditions, albeit irregularly, further influenced the rhythm and often prevented me from leaving my accommodation.

While I walked the bay into being, my senses were on alert mode. The face skin was often the first recipient of the weather conditions, especially heavy wind and rain or bright

sun. Furthermore, a light salty taste sometimes covered my lips. As Shapiro (2015) notes in their article on bodily exposure to the domestic chemical formaldehyde, the nose is often one of the first sensory organs that notices chemical exposure. In the case of chemical pollution in a working class neighbourhood of Mexico city, Roberts (2017) points out that toxicity is often entangled in everyday life and shows how residents live with its toxic smell, dust and sewage. Equally, the extremely pervasive smell of spoiled eggs that emanates from piles of decomposing green algae often lingered in the Morieux bay and served as a marker for its toxicity. Sometimes, this scent was carried away by the wind, or covered by the sea, but often it also permeated my place of accommodation. The ears were exposed to the movements of the sea, the singing of the birds and the rushing of the wind. A further sensory experience came from my feet. As I walk barefoot a lot, I can directly sense and explore the very ground I am walking on. Thus, walking was not only a sensory way to touch and experience the texture and materiality of the soil, but also an embodied approach through which my body engaged with the bay.

The barefoot walks helped me to distinguish recently formed sand banks from older ones, feel the process of decomposition of the *algues vertes* or the solid and spiky underground of the GR34. It linked the sensations with specific feelings. It was often curiosity that accompanied me on my walks, further stimulated by the composition of the soil. But there were also feelings of caution and fear that were often sparked by the decomposing *algues vertes* combined with the sensing of my nose and the touching of my feet. Even though I sometimes walked in areas where a lot of green algae were decomposing, I rarely was overcome by a feeling of dizziness. At some point during the research however, my bodily involvement became too much: I started to dream about *algues vertes* and woke up in a state of stress. Furthermore, certain sounds, such as the humming of machines or tractors, constantly made me aware about certain actors' engagement with the green algae.

I most often walked through the bay by myself. Nevertheless, I also aimed for the reciprocal walking approach, as practiced by the Zapatistas (Sundberg 2014). Accordingly, a hobby ornithologist, residents from St.Maurice and la Grandville and the employees of the Agglomération Saint-Brieuc accompanied me from time to time. During these walks, they shared their knowledge, we engaged in discussions or imagined

together possible explanations when we did not know further. Through this practice, individual research partners became intellectuals and experts.

A walk to the classics: interviews and mapping

Interviews

The “arts of noticing” (Tsing 2015) and “walking with” (Sundberg 2014) were accompanied by 15 interviews with 15 different research partners carried out over the period from July to September 2024. 12 of them were informal and not recorded, meaning that I either took fieldnotes during the conversation or immediately after the conversation. The 3 recorded interviews turned out to be of little use for this research and thus have not been included. Most of the engagements were semi-structured, meaning that I developed some questions prior to the conversation but remained open to reformulate them during its course. Thus, the questions served as a starting point to introduce topics and concepts that I wanted to engage with but still allowed for ample space to allow the conversation to engage with emerging sub-questions and sub-topics. The general topics I inquired varied according to interview partner such as their profession or their personal trajectory. Topics included the historical development of the bay, the research partner’s perception of toxicity, the influence of *algues vertes* on their respective life and jobs, and the specific working approaches of the state institutions working in the bay. I interviewed various people, including a mussel farmer, the employees of state institutions, activists, representatives of a civil society association, farmers and several residents of La Grandville. Often, these interviews resulted in several consecutive and less formal meetings throughout the course of the research and turned into important contact points during the research period. I consulted most of them on a regular basis, sometimes even up to three times a week. The relationship with other research partners, such as an hobby ornithologist, certain residents, my hosts in St. Maurice and several of their friends unfolded via highly informal ways, either through my hosts established social network or via my own efforts. The employees of the Réserve Naturelle, an environmental institution in the bay, are an important exception here because an interview never occurred and our exchanges remained constrained. Even though they never declined a direct interview demand, they gave me the impression to indirectly but consciously evade my requests and presence. Consequently, I reconsidered my strategy and joined them during public

events through which I tried to establish better connections. During these events, I could dwell with them over certain topics.

Mapping

A useful tool that accompanied me during some of the interviews and engagements was a printed topographical map of the Morieux bay. I relied on it when research partners recounted the many changes which occurred in the bay and it helped me to better grasp their perception, visualize them and locate them for my own understanding. I retrieved the map from the website “Remonter le temps” which allows the juxtaposition of satellite images from the same place taken in different time periods. My aim was to create an interactive map and introduce participatory research methods into my fieldwork but often research partners did not fully accept my proposals and demands or I insufficiently highlighted the map to them. Accordingly, my map did not take the shape as the many projects outlined in the book “This is Not an Atlas” (kollektiv orangotango 2019) which compiles different mapping projects that highlight, visualize and connect political struggles, social inequalities and ongoing colonial relations and land theft. Nevertheless, the map often served as a strong visualizer and orientation tool for my own navigation in and understanding of the bay.

Place, time and duration

During the first field trip in April 2024, I was lucky enough to having been introduced to two extremely kind and hospitable people in St. Maurice, that I call by the pseudonyms Josh and Celine throughout the research. On a slight elevation, they live in a wooden cabin often host friends or travellers in a separate caravane trailer on their compound. This caravane became my refugee from July to September 2024. Retrospectively, I could not have imagined a better starting point and accommodation for the research because its proximity – just some meters above the beach access of St. Maurice – enabled me to partake in the Morieux bay in a continuous and embodied manner. The smell of decomposing algues vertes, the sounds of the machines and the movements of the tides all permeated the thin walls of the caravane. Its openness also fostered sociability: with the neighbours who live just some meters away, with the mosquitos who appreciated human connection and with the many passers-by on the street who parked their car to access the beach.

During the first days of my research, the physical and social proximity to Josh and Celine was extremely important and helpful. Both retired, or about to retire, they have a vast and well-connected group of friends, comprised by 15 to 20 people, and proactively tried to connect me to them. Josh often directly introduced me to them, arranged meetings with people that he considered important, or proposed people to me I should meet. Celine's influence occurred on a more subtle layer. Previously employed at a local water treatment facility, she acquired a positive reputation in the area. Mentioning her name often made my work of approaching residents or institutions much easier. After some weeks of enjoying and using their network and gatekeeping, I became wary that my encounters only unfold through their network, as it was the case with a hobby ornithologist, a fisherman and members of a civil society association. I understood that I increasingly became dependent on them for providing me with social ties. It felt comfortable and easy at the beginning, but I became reluctant and even frustrated when I received more proposals. Their eagerness to connect me with their friends and contacts came from a very generous stance, but I sometimes reacted pitiful and felt the urge to prove to myself that I can establish my own network. Furthermore, I also knew that a more independent and diverse research network would be better for my overall research. Thus, I tried to limit their influence and focus more on building up my own network, which was eventually also successful. As the next sub-section outlines, my positionality tremendously helped in this endeavour.

Me, white male but exotic

After an excursion to Saint-Brieuc with a friend of my hosts we returned to a well-known moules frites bar just some kilometers away from Morieux. My hosts who were also there and surrounded by a big group of friends, introduced me loudly: "This is Sebastian, he lives with us. He is the anthropologist from Austria". I exchanged kisses with almost all of them, we shook hands, engaged in small-talk and exchanged phone numbers. After some time, I got tired and left. Back in the caravane, I still pondered on the happenings of the day and then continued reading "Americanah" a novel by Chimamanda Ngozi Adichie (2013). The book portrays Ifemelu, a Nigerian born woman who left her country's military dictatorship to move to the US and pursue further education. The page I was reading while lying on the bed struck me. She mentioned how her arrival in the US and the subsequent months were accompanied by difficulties, non-acceptance and dislike emanating

towards her from most of the people she encountered. During the time at the university campus, she felt mostly alone, felt overseen by most of her peers and often denounced her non-American origin. I was immediately relating and comparing her experiences in the US to mine in Morieux. My first days here were characterised by feelings of overload and excitement which resulted in voluntary retreat to the caravane because I *could not* handle the amount of people I got introduced to anymore or bear with the countless offers of help I received. Ifemelu's experiences came up as a mirror, rendering visible the unequal realities both of us were experiencing. The juxtaposition clearly made tangible how my whiteness tremendously helped me to get access to the field, to be accepted and respected. My whiteness comes in as a privilege, it works like "a system (...) a catering system, a way of staying or being well acquainted" as Sara Ahmed (2014) outlined in their blogpost.

The many offers of help and the kindness needs to be situated in the context of the white space of the Morieux region. In stark contrast to Ifemelu's experience and strategies, my origin was not denied, I did not have to adapt my French accent nor did I change my appearance. Even though I was foreign to my research site, I was perceived as a good, interesting and acceptable foreigner because I am a white European. My origin has been actively emphasized by some of my research partners, which I call here a form of "positive" exoticizing. The attributes "autrichien" [Austrian] were emphasized in small-talks or introductory phone calls, as if my foreignness would increase the likelihood that people want to engage with me. In some instances, it did. Coupled with my whiteness it laid the ground structure for what Sarah Ahmed means with "being well acquainted". Nevertheless, for such a system to work, there needs to be reciprocity. This came in form of a predominantly homogenous white middle-class research group. Accordingly, in some moments during my research I wondered how I would be perceived if I would be a black anthropologist from rural Zimbabwe doing the same research on the *algues vertes*. And sometimes, I thought about the satirical mockumentary "Das Fest des Huhns" which depicts black anthropologists coming to Austria to research the traditional way of living in a mountain area (Wippersberg 1992).

Even though I am reflexive here about my position and my whiteness, I often intentionally used the privileges emanating from my exoticized whiteness. Often, I embraced my accent to signal my non-French origin, or I pretended insufficient French

skills to avoid taking position on delicate topics such as the *algues vertes*. I could allow myself to do this because I knew that I will not be outcalled for insufficient language skills, non-integration or micro-racisms. I knew that I probably would not face any mental, professional or social consequences due to the assurance that whiteness gives me. The positive exoticizing and my foreignness to the field often helped me to easily build trust among research partners and obtain specific information. A statement from a research partner epitomizes this bluntly “You, you are from Austria, you need to know the truth”.

The presumably isolated knowledge production

During a writing retreat in the Swiss mountains with some anthropology friends from Bern, we eagerly engaged in conversations and discussions about the way how ethnography produces knowledge. We pondered on the consideration that knowledge is never created in isolation and that the assumption of the isolated researcher does not hold. Rather than sticking with anthropological “heroes” such as Malinowski, we concluded that friends, family members and research partners comprise the research process. Often, they carry out emotional labour, especially when fieldwork is annoying and difficult, they give advice, read texts or just listen.

My research stay in Bretagne was similarly sustained by friends, family, my hosts and several research partners. Often, they were there in emotionally difficult situations and even with research partners, emotional exchanges took place. Without doubt, the research would have taken a different path without them, and it was with and through them that the research was possible. Instead of being isolated, I was surrounded by people with whom I shared, talked, thought, ate and laughed together. I consciously decided to not put this paragraph in the acknowledgement section of this thesis because it played an integral part of my methodological approach in the field. Furthermore, I want to highlight that the image of the wise, white, male researcher who set out to explore the exotic proved wrong during most of the research encounters. The writing retreat further highlighted that the boundaries and definitions of what a research partner is or should be are often elusive, intangible and context-specific. During the research in Bretagne, research partners were not only those with whom I conducted interviews, but also those who cared for me, thought with me and advanced research matters.

In a concluding remark during the writing retreat in the Swiss mountains, we summarized our thoughts and conclusions in the following statement:

We acknowledge that all our knowledge is based on stolen knowledge. Further, we acknowledge that all our knowledge is co-produced by all humans, more-than-humans and the colonial ghosts that haunt us

The production of toxic space

High tides mean high quantities of green algae

The third week of August was characterised by high tide coefficients, the highest that I experienced during my stay over the summer. These coefficients indicate how high the sea will rise and move land inwards, specified with the exact times when this occurs. During these August days, the peaks were expected in the morning with a maximum coefficient value of 107. The movement of the tides are one key factor for the arrival of *algues vertes* on the beaches and, disregarding all other factors like wind and weather, there is a straightforward correlation of high tides and green algae proliferation: The higher the tide coefficients, the closer the *algues vertes* will arrive on the shores and remain there to decompose. During these days, I spent a considerable amount of time on the beaches to both understand and predict how the incoming sea would eventually deposit piles of green algae in the Morieux bay.

However, I was not the only person with this motivation. While I was on my way down to the beach of La Grandville on an early sunny morning, a man was just about to step up the aluminium stairs that separate the beach from the parking lot. Equipped with a digital camera, a phone, a yellow device hanging around his neck and a yellow reflective vest, we exchanged a brief smile before we started to exchange. “I am already driving around the beaches for two hours; it was an early morning for me” he stated. “But I need to monitor the high coefficients because they might carry a lot of green algae”, he carried on. Gustave, as I got to know him, was highly active that week to both predict possible algae arrival prior to the high tides and to determine which piles potentially become dangerous once the sea retreated.

Gustave is an employee of the Agglomération Saint-Brieuc, the official institutional body that is responsible for managing the piles of *algues vertes* arriving on the beaches of the Saint-Brieuc bay. Through the daily beach tours, he not only predicts where green algae might pile up but also determines where toxic and hazardous no-go zones in the Morieux bay form. He is quite familiar with this practice and usually visits the different beaches of the municipality of Saint-Brieuc every weekday during the summer months May to September. The tide coefficients are however not the only factors that influence green algae arrival, as the rapidly changing weather, the sea currents, wind directions and

precipitation all impact the algae's arrival in highly unpredictable ways. In this volatile situation, Gustave gets a hold of it by relying on his experience: checking the weather and tide forecasts regularly, he knows that certain wind directions swirl up the sea and cause the *algues vertes* to remain in the water. Taking this together, Gustave's objective is to sense and predict toxic harm long before it occurs by mostly relying on his body and situated and place-based experiences.

This chapter will highlight and examine the various ways through which the Agglomération engages with the green algae's toxicity and how certain practices render the emission of hydrogen sulphide visible and palpable. I rely on multispecies and chemoethnographic concepts and findings to better understand the practices of the Agglomération. Before I start elaborating on the toxic space-making practices of the Agglomération, I will briefly outline its institutional basis and areas of responsibilities.

The Agglomération Saint-Brieuc Bassin-Versant

The Agglomération is an amalgamation of different communes from the wider Saint Brieuc region, and they are responsible with various tasks such as garbage removal or biodiversity conservation. Within the Agglomération, the sub-entity "Programme Bassin-Versant" [hydrographic basin programme] is charged with the protection and restoration of the quality of water and the aquatic environments (Saint-Brieuc Armor 2022). Twelve employees are working on interrelated topics, such as river restorations, natural water purification, reduction of agricultural leachates such as nitrates, pesticide and phosphates, prevention of land erosion and installation of flood protections. Here, the name Bassin-Versant comes not as a coincidence. Literally translated as watershed or hydrographic basin, it is an "area where all water flows to the same outlet" (Oublié et al. 2020, 62). Correspondingly, as an employee explained to me later, their work not only engages with the main rivers of the region, such as the L'lc, Le Gouet, L'Urne and Le Gouessant, but also with the smaller feeders and the entirety of the watershed of the region. This programme is also responsible for the mechanical removal of the green algae (*la ramassage*) which are washed ashore on the beaches of the different communes (Saint-Brieuc Armor 2022). The programme's work is funded by the European Union, the French state, the Agence de l'eau Loire-Bretagne [water agency in Loire-Bretagne], the Bretagne region and the Conseils Départemental des Côtes d'Armor [regional advisory board of Côtes d'Armor]. Two employees are working specifically on the *algues vertes*

agenda: Laure is responsible for the administrative office work and the communication between the Agglomération, the different communes and other agencies. She is a year-round employee with a fixed contract. In contrast, Gustave, whose paths I crossed in St. Maurice, is hired seasonally between April and October when green algae proliferation peaks. His tasks include the daily beach patrols in the dedicated areas to evaluate the potentially dangerous quantities of *algues vertes*. The primary objective of this green algae subsection of the Programme Bassin-Versant is to prevent the development of sanitary risks for humans posed by decomposing *algues vertes* through their emittance of hydrogen sulphide.

The scientific, material and sensual foundations of toxic space

This first section of this chapter outlines how the Agglomération Saint-Brieuc engages with the Morieux bay. Here, a geomorphological document serves as the basis for their approach and demarcates their working environment. Furthermore, through Gustave's daily beach patrols, measuring devices, demarcation lines and no-go areas, the Agglomération not only determines the danger of the decomposing *algues vertes*, but also render their toxicity tangible. Thus, I argue that it is through their specific practices through which toxic space in the Morieux bay is both discursively and materially created. The first subsection of this chapter describes in detail these manifold tools, approaches and practices.

Geomorphological basis

Gustave's daily beach patrols have a highly technical and institutionalised basis. A cartographic document, authored and compiled by the two distinct amalgamation of communes, the Agglomération Saint-Brieuc and Lamballe Terre & Mer, depicts all the beaches under their jurisdiction where *algues vertes* arrival occurs. The document is comprised by 28 pages and each page contains a satellite image of a 1500-meter wide beach section that gives detailed information about soil composition, entry roads and zones for possible algae removal. Six assorted colours indicate the type of soil which include pebbly, sandy and vaso-siltic.

Specific demarcated red areas highlight the zones where mechanical collection of the *algues vertes* has been considered feasible. On some beaches that are important for this research, the dedicated area for algae removal is rather small: on the beaches Saint

Guimond and Hôtellerie, located on the western part of the Hillion peninsula in the Yffiniac bay, the demarcated zone only stretches between 60 to 125 meters. In contrast, the zones at the beaches of Bon Abri and St. Maurice, located in the Morieux bay on the eastern side of the Hillion peninsula, range between 700 to 1800 meters. According to the document, both beaches and the respective designated collection zones are comprised mostly by sandy and sandy-silty sediments. In contrast, the beaches of Saint Guimond and Hôtellerie are mostly comprised by muddy-silty sediment layers. Thus, careful reading of the document suggests that algae removal is more suitable on sandy, pebbly and silty sediments, while sediments comprised by rocks, mud and mud-silt combinations are uncommon. Laure, who is co-drafter of the document, affirmed my reading of the document and suggested that rocky, muddy and pebbly sediments are highly complicating the removal of the algae.

While the demarcated zones for algae removal in the geomorphological document appear as fixed and rigid, Laure pointed out to me during several exchanges that the boundaries of these dedicated spaces are often ignored and violated in practice. If there are piles of algae some meters outside the dedicated boundary, or further out on the beach towards the sea, their removal is chosen as a priority and abiding by the official borders is neglected. Often, cartographic approaches tend to represent and treat maps as objective, fixed and stable representations of reality (kollektiv orangotango 2019; Crampton and Krygier 2015). This is also the case with the geomorphological document of the Saint Brieuc bay. Despite maps' assumed rigidity and objectivity, they also tend to neglect the biases and negotiation processes through which maps came into being (Crampton and Krygier 2015). Laure and Gustave, who are the main authors of the geomorphological document, prioritized the inclusion of the beaches and the designation of algae removal zones to the beaches' importance for human leisure activity. If the beach is considered as a main access zone for humans, then algae collection was chosen as a pre-emptive measure to diminish sanitary risks. Thus, since the beaches Bon Abri and Lermot attract high numbers of tourists, they are prioritized for algae removal compared to the beaches Saint Guimond and Hôtellerie.

Barriers, signs and demarcations

While the above-described document provides the theoretical geomorphological backbone of the work of the Bassin-Versant, material objects classify and arrange certain

parts of the designated beaches. Constellations of wooden sticks, ropes and buoys comprise entire beach sections of the Morieux bay. These objects and the resulting demarcation lines are important for the workings of the Agglomération. Nevertheless, the research showed that the constellation of specific demarcation signs, their discursive content and their consequent perception remained contested by various residents and by different actors involved.

I encountered one demarcation line on a daily basis as it was not far away from my accommodation. After the access road to the beach in St. Maurice, around a dozen vertical wooden sticks protrude the sand and are placed at a distance of around seven meters. Connected with a white rope, they form a demarcation line. The remaining space turns into a narrow, tractor-wide entryway while the restricted area opposite the line opens up into a vast landscape, filled with sand, grass and decomposing *algues vertes*. A sign is attached on one of the wooden vertical sticks, indicating “Accès interdit. Protection des dunes. Quiétude de la faune.” [No entry. Protection of the dunes. Tranquility for wildlife.]. Another sign on a metal stick some meters behind the demarcation line reads “Algues vertes fraîches en cours d’égouttage. Accès interdit au public.” [Fresh green algae being drained. No public access.] This sign indicates a “zone des ressuyage” [drainage zone], as outlined in the geomorphological document, where piles of *algues vertes* are stocked over night to lose water and weight. Thus, the no-go-area serves two official purposes: the first sign is there to protect a rare bird, the little ringed plover who arrived in this beach section to breed in 2022. The second sign indicates that the no-go-area is also used for algae storage and permits collection machines in the space. Prior to its demarcation some years ago, residents from St. Maurice used the area to go on extended hikes or as a playground for their children.

Additionally, various different warning signs are found all over the beaches in the Morieux bay, on hiking paths next to the sea, on fences or on parking lots. The signs often warn of the hazardous consequences of green algae proliferation and their source of origin. Graphic images of a tractor for example, suggest that nitrogen originates from certain agricultural practices. This narration is new and is not traceable on signs whose origin date is older. Thus, the content of the signs also reveals how the positioning of political institutions evolved regarding the *algues vertes*: the most recent wave of signs was distributed by the communes and its content and narrative drafted by the Préfecture

de Bretagne, the major regional political institution directly belonging to the French Ministry of Interior. Furthermore, the content is in line with the national action plan to reduce green algae proliferation (*Plan de Lutttes Contre Les Algues Vertes 2022-2027*, n.d.).

Other signs equally inform about the green algae by focusing on their imminent danger derived by their decomposition. In big capital letters on a read fond, they warn “Attention danger à proximité” [Watch out, danger is near]. In subparagraphs they call upon the passers-by to remain vigilant and avoid degraded zones. Pictures of brown and degraded piles of algae further convey the danger to the reader.

The above-described signs are encountered on a frequent basis in the Morieux bay. Once, a research partner put it bluntly, “there are just too much of these signs”. In contrast to this opinion, these signs are fundamentally important for the Agglomération because through them they can inform about the imminent danger of decomposing green algae and their emittance of hydrogen sulphide. During one occasion, Laure explained to me that “we put a lot of signs, it is our task to make it clear where sanitary risks are”. Through these signs then, the Agglomération not only informs where toxicity lingers, but also renders the algae’s hazardous consequences “legible” (Murphy 2008, 696). In their article “Chemical Regimes of Living”, Michelle Murphy (2008, 696) argues that “the emergence of technoscientific practices – such as within genomics, biotechnology and neurochemistry” turned the ubiquitousness of chemicals and chemical pollution more tangible throughout the last decades. Even though the author never mentions information signs as a technoscientific practice, their communicative characteristic clearly conveys the algae’s toxicity to ordinary passers-by. Accordingly, as I argue, their hazardousness is rendered palpable, and together with the above described buoys that form demarcation lines, they are integral for the Agglomération to communicate and create toxic space.

The body as a sensor

While the signs and buoys are a clear material demarcation for toxic space in the Morieux bay, the following section shows how less palpable and more subjective practices have equal “place-making capacities” (Shapiro 2015, 374).

As I outlined at the beginning of this chapter, Gustave, employee of the Agglomération Saint Brieuc, embarks on the different beaches that have been prioritized by the geomorphological document to determine where sanitary risks for humans could

emerge. When Gustave tours the beaches, he is equipped with a small yellow device which hangs around his neck on a black strap of cloth. Inquiring about what it does, he explained to me that “it detects hydrogen sulphide and it starts to piep when it passes the threshold”. The threshold that Gustave mentioned is set at 5 and 10 parts per million (ppm) of hydrogen sulphide in the atmosphere. According to this measuring scheme that was determined by the Agglomération, the threshold at 5 ppm serves as an initial warning sign, whereas the latter at 10 ppm indicates that the person wearing the device is in an imminent danger zone and should leave it immediately.

Whenever I accompanied Gustave on the beach patrols however, this device never played a crucial role and I never observed any direct engagement between the employee and the device, such as touching it, looking at it or actively using it. Furthermore, the alarm of the device never went off. Puzzled by Gustave’s apparent indifference to the device, he told me that “my belly starts turning around and my nose starts to itch already below the first threshold”. Consequently, Gustave further told me that the security device with which he is equipped to make him aware of an hazardous situation rarely goes off because he relies on his body as the primary sensor of toxicity.

Through his work on domestic formaldehyde in the plywood of US-American trailers, Nicholas Shapiro (2015) provides useful insights to grapple with Gustave’s toxic sensing. The author showed how the bodies of interlocutors are “the primary means of discerning protracted and low-level encounters with domestic chemicals” (2015, 369). Shapiro showed that through the “chemical sublime”, residents witness and recognize toxic exposure through bodily engagement, bodily corrosion or direct harm (2015). Given the often impalpable characteristic of chemicals (Nading 2020), this sensing often occurs subconsciously, passively or protractedly.

Through the “chemical sublime”, Gustave senses and predicts toxic harm long before it occurs. In their work in a highly polluted Argentinian town, Auyero and Swistun (2010) equally show how residents sense toxic harm through their bodies before technoscientific devices recognize them. In all ethnographic contexts, whether in the Morieux bay, the polluted town in Argentina or the trailer parks in the southern US, human bodies become primary measuring devices for toxicity long before states recognize the harm (Auyero and Swistun 2010, Shapiro 2015). This knowledge is embodied and based on years of toxic exposition.

This “bodily knowledge” as Shapiro termed it (2015, 370) is not the only way through which Gustave senses, traces and predicts the toxic potential of decomposing green algae. Beside his sensing practices, he further visualizes and imagines where specific piles of algae that still float in the sea would be washed ashore by the movements of the tides. During one beach visit for example, he told me how he traced an entire swirl of green algae that was washed ashore on the exact spot where he predicted it. This precise prediction stems from his knowledge of the movements in the bay, such as the tides, the wind and the currents. He further pays attention to the specific visual appearance of the green algae that are already piled up on the beaches. According to Gustave, the colour is an important strong indicator for their toxicity: light-green colours indicate freshness, meaning that the algae only arrived some hours ago and do not pose any sanitary risk. A brown-sandy colour indicates dried algae that potentially contain toxic gases under their crust. Grey-black colours arrive when fresh algae are mixed with mud and freshwater and remain in its position for consecutive days.

During the numerous occasions when I accompanied him on his beach patrols and when he applied his sensing, smelling, visualizing and predicting skills, I often remained quite astonished and puzzled. After I expressed my astonishment, he just shrugged his shoulders and told me that “it is just a bit my feeling, that ‘s all” to revitalize his embodied skills.

Despite his modesty, Gustave ‘s embodied practices are fundamental to predict and sense toxic harm. He emphasized during several occasions that the daily visits are integral to the successful workings of the Agglomération because it is only through his practical engagement that he can observe specific trends of algae movement. Additionally, it is his sensual assessments of the green algae that contributes to the formation of toxic space in the Morieux bay. By predicting the specific spots on the beaches where green algae are washed ashore he also assumes that they could decompose there and release the toxic gas hydrogen sulphide. Here, the toxic space does not materialize but is instead constructed imaginatively. In a similar vein, when Gustave ‘s body functions as a sensor, he also acknowledges that toxic space can form.

Toxic space-making of permanent measuring stations

In stark contrast to the mobile and rather inactive measuring devices used by the Agglomération, permanent gas monitoring stations are positioned on various beach

entrances of the bay. 17 of these devices are to be found in the designated eight *algues vertes* bays in Bretagne and seven of them are located in the Saint-Brieuc bay. Five such measuring stations are in the vicinity of the research area. On the western part of the Hillion peninsula these beaches are: Hôtellerie (25/06/2020)⁶, St. Guimond (27/06/2022) and next to the Maison de la Baie (27/05/2024). On the eastern side of the peninsula measuring stations are at the beach of La Grandville (27/05/2024) and St.Maurice (19/05/2022) (Air Breizh, n.d.). In 2024, these devices were active between May 27 and October 31 (ibid).

The Haute Conseils de la Santé Publique (HCSP) [High council of public health] set a threshold of 1 ppm. If a measuring station passes this limit, the HCSP suggests a “total prohibition” of the specific beach area (Haute Conseils de la Santé Publique 2022). The initial motivation behind the installation of these measuring stations was to assist the Agglomération in overseeing and determining on which beaches green algae proliferation could become dangerous and toxic. Accordingly, governmental authorities, respective commune and the Agglomération are informed by Air Breizh, the institution responsible for the monitoring, as soon as the threshold of 1 ppm is exceeded.

It is important to note the difference between the thresholds of hydrogen sulphide formulated by the High council of public health (1 ppm) and the threshold of Gustave´s personal device (5 ppm and 10 ppm). On their website, the HCSP states that “in areas identified as hazardous, the HCSP recommends a total ban (...) if the monitoring system installed in the area detects more than 1 ppm” [translated by the author] (Haute Conseils de la Santé Publique 2022). In contrast, Laure and Gustave abide by a much higher threshold, despite the fact that they do not really give importance to them (as outlined in the section above). Laure even questioned the validity of the 1 ppm threshold because there have not been scientific studies in Bretagne that suggest this.

In the context of toxic space making, it becomes clear how technoscientific quantifications of toxicity are not universally applicable units of reference when a chemical molecule is toxic and when not (Murphy 2008). Furthermore, when political and scientific parameters change, as Gabrielle Hecht (2012) pointed out in their research on uranium mines in South Africa, the perceived toxicity of chemical matter can also be

⁶ dates in brackets indicate the installation date of the measuring device

affected. While the political and scientific arrangements in the Morieux bay did not change significantly over the last years, the differing thresholds of hydrogen sulphide clearly highlight that not all institutions share the same perception of toxicity.

Laure also pointed out to me that “we do not really take the results of the measuring stations into consideration”. More specifically, she meant that these results are not a significant determinant in the decision-making process to assess the hazardous consequences of decomposing green algae. For them, the measured results contain a high degree of ambiguity and randomness because hydrogen sulphide production highly depends on the temperature and sun exposition. If the temperature is high, more gas is produced and released. Furthermore, the aerial transmission of the gas is determined by the direction and force of the wind. Thus, the fixed measuring station could significantly fail to recognize high portions of gas in the air.

Amidst this lack of scientific data and the ambiguity of the results, Laure and Gustave consider the permanent measuring stations only as an “additional information source”. As it is the case with the portable devices, the two employees of the Agglomération heavily rely on their own sensual engagement, prediction and understanding of the space. Despite the high degree of indifference and neglect with which Laure and Gustave perceive the results of the measuring stations, they still play a crucial role in producing toxic space. Here the Agglomération does not have any means to question the results of the measuring stations.

On June 21, 2023 and July 5, 2024, the results of these measuring stations at the beach St Guimond were exceedingly high: 1049⁷ ppm (Pasquier 2024) and 1224 ppm on July 5, 2024 (Veillard 2024). For a better understanding, already 500 ppm can lead to immediate lethal cardiac and respiratory issues (HCSP 2021). As a result, access to the beach was restricted and the beach entrance was fenced off by iron barriers. On them, laminated A4 documents indicate that the “release of hydrogen sulphide poses a danger to public safety” [translated by the author].

Despite the fences and information signs, the most palpable consequence of these extraordinarily high rates of hydrogen sulphide was the scent of putrefying eggs that

⁷ The difference between the suggested threshold of the HCSP (1 ppm) and the measured quantity of hydrogen sulphide (1049 ppm) is striking. I rely on the rates provided by the newspaper articles (Pasquier 2024; Veillard 2024). No other sources could be found to proof them.

covered the beach, the access road and even the adjacent neighbourhood with a sulfuric stench. When I was there, the smell turned unbearable after some minutes and I started to feel unwell and slightly dizzy. Due to increasing health concerns, I only stayed there for a couple of minutes until the smell forced me to disappear.

Beside the material consequences of the measured hydrogen sulphide, such as the fenced off beach, and the subsequent toxic space creation, there is also a subtler form of toxic space making. Here, the stench of putrefying eggs plays a significant role. Through her work in a working class neighbourhood in Mexico City, Elizabeth F. S. Roberts (2017) showed how the pollution and the subsequent stench in an around the quarter created a “toxic boundary” and determined “what gets inside”. Similarly, the smell of putrefying eggs at the St. Guimond beach acts as such a boundary and creates and demarcates toxic space. Long before the iron fences inhibit access to the beach, the strong stench already suggests the hazardousness of the area when walking the bending street to the beach. Here, Brant’s analysis (2008) of smells, scents and odours can further be applied. The author argues that deodorants for example, create a “scent circle” around people and its smell ultimately creates space (Brant 2008, 547). Equally, I argue that the hydrogen sulphide and the accompanying strong stench takes the form of an extended “scent circle” that demarcates the toxic space that was created by the results of the measuring stations. Thus, it is not only technoscientific devices, as Michelle Murphy (2008) argues which make toxicity legible, but also less quantifiable forms, such as scents and odours.

Toxic space in practice

The remainder of this chapter outlines how the Agglomération engages with this toxic space in practice. To achieve their main goal of reducing sanitary risks for humans, they chose to remove the green algae mechanically. Furthermore, other practices, such as river regulations, siltation projects and the trial of different machines, have been applied and tested to further remove the green algae. Despite their seemingly straightforward and technical forms of application, these practices depend and are nourished by experimentations and imaginations by Laure and Gustave. Before elaborating on this constant creative experimentation, I will outline the Agglomération’s most established means of reducing the green algae, their toxicity and the toxic space in the Morieux bay.

Green algae removal - La ramassage

I was inside the caravane on a cloudy afternoon when I suddenly started to notice a pieping sound that I never recognized before. Trying to make sense of it, a feeling of ethnographic obligation overwhelmed me and I started to inquire the source of the sound. I left the caravane and headed towards the beach where the sound seemed to emerge. The sound intensified while I was walking and some meters below the Chapelle St. Maurice, I encountered two machines rolling over the fresh green algae carpet. A yellow excavator with a black shovel and a hydraulic closure mechanism in front rolled over the beach to collect them with their moveable grappler. Line after line, the excavator amassed a mixture of algae and sand piling them on the beach. Whenever the excavator reversed, the pieping sound emerged. Feeling slightly relieved after I resolved this puzzle, I observed the second machine, a green tractor with an attached red trailer, that remained immovable while the excavator was moving around. The person in the cabin, dressed in a greyish overall, was constantly following the moving excavator with their eyes. After some minutes, the conductor of the excavator gave a quick hand gesture towards the cabin of the parked tractor. The machine started moving and the driver placed the trailer in close distance to the pile of amassed algae and the excavator started to load the piles onto the trailer. Filled with a mix of fresh and decomposing algae, the tractor embarked towards the entrance and ascended the asphalt road.

Filled with 25 to 30 tonnes of green algae, each trailer heads to a private treatment facility at a 30-minute drive westwards of St. Maurice. There they are stored, exposed to oxygen and finally processed into a sort of compost. The excavators, tractors, trucks, trailers and their responsible conductors belong to and are employed by a private company hired by the Bassin-Versant to mechanically remove the algues vertes that have been washed ashore. Besides their contract with the Agglomération, the company is also active in the agricultural and construction sector. The legal authorisation for this endeavour derives from the above-mentioned geomorphological document through which the respective communes permit the machines to roll on the beaches and to collect the algues vertes. In return, Laure and Gustave inform the communes daily about the collected and removed quantity of the green algae. This information is obtained by the conductor of the excavator who fills out and signs a document for each truck or trailer that is leaving to the treatment facility in Lantic. This information includes the specific beach

where the algae were collected, the date and the time. As soon as the trailers arrive at the treatment facility, they are weighed and this information is added to the document. This information further determines the financial cost of the algae removal and is comprised by the quantity of collected algae, the transportation distance and the treatment costs.

Even though the removal of the algae seems to be a straightforward and diligently organised task that is based on the transmission of information from the Agglomération to the externally employed conductors, this process is comprised by several technical, personal and bureaucratic limitations and constraints. On a day in July for example, a trailer filled with green algae slid sideways down the entrance ramp at the beach in St. Maurice and bumped onto the sand. Even though nobody was injured, the trailer had bumps and abrasions and the collection of the algae was significantly impaired for the day. On another day, the workers also had to stop the collection process because an unidentified object, it later turned out as a mattress, was floating in an algae removal zone. Only after the technical division of the commune removed the mattress, the workers could proceed with their task. Furthermore, the working relationship between the Agglomération and the conductors from the external enterprise is marked by uncooperation, distrust and concealment. As Laure and Gustave pointed out to me several times, the conductors often neglect their orders and assess the zones for algae collection themselves. As a result, they sometimes operate their machines in beach sections that are considered as too toxic and as no-go zones. This can spark further conflict between the Agglomération and other political institutions active in the bay. Yet another source of distrust are the financial costs. Laure was sometimes sceptical whether the actual collected quantities of green algae correspond with the numbers on the invoices from the external company. Another bureaucratic obstacle for the removal of green algae are the movements of the tides. Environmental regulations and safety standards only allow the machines to enter the beaches some hours before and after high tides. This often results in a rather limited timeframe for the conductors to pursue their removal tasks.

Collaboration and imagination

These personal, technical and bureaucratic obstacles and challenges of the mechanical algae removal significantly impact how the two employees of the Agglomération can achieve the main objective of their institution, the reduction of sanitary risks for humans

who access the beaches. During our meetings, Laure often mentioned increased levels of stress not only due to the workload but also due to the high responsibility of her tasks. For her, the removal of green algae is fundamental because it directly reduces the production of hydrogen sulphide and the subsequent toxicity lingering in the Morieux bay. One Friday, so before the algae removal company goes into the weekend, she mentioned that “we cannot just leave the algae rotting, they become too toxic”. Accordingly, for Laure and Gustave, the reduction of toxic space is a key area of responsibility of the Agglomération. Since the removal practices are often impaired by external factors, the two employees are constantly seeking for other practices that helps them to engage with and reduce decomposing piles of algues vertes. Gustave and Laure told me that they often research for new mechanical tools and vehicles during their working and leisure time. Even though the websites they referred to and the machineries they are looking for have a highly technical component, they also heavily rely on their imaginations and develop new collaborative ideas and approaches for the removal of green algae. More specifically, they envision the amendment of entire beach sections through river regulations, additional sand layers or the installation of a bridge over the Gouessant estuary. In the following section, I briefly outline the different ideas and approaches of the Agglomération through which they further attempt to reduce the toxicity of the green algae in the Morieux bay.

Around 2020, governmental institutions issued the construction of a boat that could collect the freely floating green algae in the open sea. Prior to the construction, the Agglomération, fishermen and mussel farmers advised for an amphibious boat with wheels that could remove algae even in shallow waters. However, this advice was not incorporated in the planning and construction. Therefore, the boat arrived as a big and bulky vehicle that was only operational in more profound waters where fewer algues vertes are freely floating. Since its first unsuccessful trial in 2022, the boat is stationed in the harbour and waiting for readjustments and a reduction in its size. As this technical process stagnates, the boat ceased to be a reliable option for Gustave and Laure.

Due to this failed attempt, the two employees of the Agglomération searched for other viable machineries themselves. Through extensive internet searches, Laure came across the vehicle BeachTech 5500 that was tested for the first time on the beaches of the Saint Brieuc bay in June 2024. Given the vehicles small size and subsequent enhanced

mobility, it can access beach sections that remain inaccessible for the much bigger excavator. Furthermore, the BeachTech is light in weight and therefore does not compress the sand and soil on the beaches, a problem often associated with the excavators. The vehicle was not specifically designed for algae removal. Instead, its operational areas are touristic beaches where trash such as cigarette buds, bottles and other materials are collected. Therefore, the technical equipment is not fully compatible for the tasks that Laure and Gustave want to use it for. During our common exchanges, Gustave added with sincerity and conviction, “I will just change the rolls of the machine and weld a metal part onto it when I have time off in winter”. Through this practice, he wants to turn the BeachTech compatible for collecting *algues vertes*. On another occasion, Laure jokingly suggested, “we just hire you and you can be the first driver of the BeachTech next summer”. Given my extensive knowledge about the green algae, she added that I am only missing a reflective vest and a backpack with the logo of the Agglomération Saint-Brieuc.

In their search for other viable alternatives, Laure and Gustave do not act in isolation. They constantly exchange with other communes and rely on their private network, specific expertise and individual imaginations. During a trip to the Alps for example, Laure got inspired by a pending bridge that connected two mountain slopes. She immediately envisioned a similar bridge connecting the two sides of the Gouessant estuary to prevent tourists from taking shortcuts through beach sections where green algae decompose and create hazardous consequences for humans. Accordingly, Laure perceives the bridge as a significant actor for reducing sanitary risks for tourists and residents. Due to high financial costs, the implementation of this bridge is still pendant.

Gustave and Laure also frequently exchange with other institutions who administer algae collection in other bays of Bretagne. One important partner and source for inspiration is the Agglomération in Saint-Michel-En-Grève. After the death of a horse on this village in western Bretagne, authorities took action and decided to prevent the arrival of *algues vertes* by readjusting the beach and its riverine environment (Léraud and Van Hove 2019; *Algues Vertes. Polémique Après La Mort d'un Cheval* 2009). The rectification of the rivers that arrive at the beach, the allocation of pebble and sand and the consequent elevation of the entire beach serve as an inspiration to Laure and show what measures are possible. The measures taken in Saint-Michel-En-Grève often inspired Laure and Gustave’s ideas about how to envision and arrive at a hazard-free Morieux bay.

this exchange is highly influential about what measures are imaginable and how the space should be amended. Accordingly, river regulations and raising of sand levels are among Laure and Gustave's imaginary repertoire.

Accordingly, the Agglomération already carried out river regulations at the beaches of Saint Guimond and Hôtellerie where Laure reported a considerable improvement of the situation. More concretely, less *algues vertes* are piled up on the former shores of the river and therefore, less algae also decompose. Furthermore, the amendment of the riverbanks also enabled the excavators to better access specific areas and remove putrefying piles of *algues vertes*. At the beach of La Grandville, Laure also envisions the straightening and channelling of the river to remove its turns and loops and to prevent an accumulation of algae therein.

In Saint-Michel-En-Grève, the raising and flattening of sand levels were another decisive action to reduce the accumulation and decay of green algae. Furthermore, a siltation project was successfully carried out in spring 2024 at an adjacent beach in the Saint Brieuc bay (Molla 2024). In both cases, the flattening of beach areas enabled the excavators and tractors to better access and remove the green algae. At the beach of St. Maurice for example, Laure pointed several times to the formation of a “trap” and a “problematic zone” where green algae would “get stuck and produce a lot of hydrogen sulphide”. Since Laure often perceives this zone as an imminent danger for human health, she considered ordering the excavator to quickly flatten the sand bank on the beach section to contain any danger.

Unmaking of toxic space meets bricolage

When Laure and Gustave told me about the BeachTech 5500 and their suggestion that I could become the machine's first conductor, we all burst out in laughter. However, their joke is emblematic for their approach of dealing with and reducing the toxicity of the green algae in the Morieux bay. How Gustave and Laure approached problems regarding the algae removal, brought in their own ideas, and considered amending certain technical conditions, often reminded me of the idea of the “bricoleur” that Claude Lévi-Strauss (2022) famously described in his book “*La pensée sauvage*”. According to Lévi-Strauss, the bricoleur uses existing materials, ideas and symbols to adapt them to new circumstances. Here, an important undertaking of the bricoleur is improvisation to deliver solutions within the given context. Lévi-Strauss further suggests that the bricoleur's

range of opportunities is finite, meaning that they can only work with what is given. Here the author refers to existing material in the surrounding of the bricoleur, inherited objects, myths and symbols.

Beside the well-established mechanical removal of the green algae with excavators and tractors, Laure and Gustave's additional approaches are highly based on constant creative experimentation. Following Lévi-Strauss "bricoleur" (2022) they combine existing material with their specific embodied expertise of the bay. After they ordered the BeachTech 5500 for example, Gustave's proposition to weld additional roles on the machine is based on his intimate and sensual knowledge of how the algae behave under mechanical pressure. Regarding the collection boat, both Laure and Gustave were well aware that only an amphibious vehicle could collect the green algae, since they predominantly linger in shallow water. Furthermore, Laure's knowledge of the movements of the tides and the green algae helped her to assess where sand banks form into traps and hazardous zones. Thus, taken together, the two employees diligently combine their existing place-based knowledge to think about and create alternative solutions for removing the green algae. In contrast to Lévi-Strauss (2022), their toolbox is not finite and restricted to the materials, ideas and myths circulating within the Agglomération Saint Brieuc. The frequent exchanges with their partner institution in Saint-Michel-En-Grève, the exchanges with mussel farmers and fishermen, and their own extended internet searches highlight how the additional approaches to remove green algae were based on constant collaboration.

The approaches of the Agglomération that resemble Lévi-Strauss's (2022) description of the "bricoleur" matter in the context of this chapter and the overall research question of how toxic space is made and unmade in the Morieux bay. In the context of the Agglomération, they often engage and deal with the toxicity of the green algae through sensual and place-based knowledge, experimentation and collaboration.

Conclusion

Before jumping to the overall conclusions of this chapter and pondering on the implications of the Agglomération's "bricoleur" approaches to toxicity and toxic-space making, I want to briefly summarize and return to the arguments made in the first part of this chapter.

This chapter described the various practices through which the main institutional body of the commune, the Agglomération Saint-Brieuc, engages with the toxicity of the green algae. Following Li's (2013) claim that specific geographical locations are not given but exist only through constant stabilization and enactments, I focused on how the combination of the Agglomération's practices coupled with the movements of the green algae and their accompanying gas hydrogen sulphide constantly reproduce and unmake toxic space in the Morieux bay. For the Agglomération, a geomorphological document builds the theoretical basis and demarcates the beach sections that the institution considers most exposed to the hazardous consequences of green algae decay. Additionally, signs and barriers act as demarcation lines that signal to beach visitors the specific areas where the toxic consequences of hydrogen sulphide are most imminent. From 2020 onwards, regional departmental institutions issued the installation of permanent measuring stations to detect atmospheric hydrogen sulphide. Despite the dense network of stations, covering most of the beaches of the Saint-Brieuc bay, and delivering constant results of hydrogen sulphide presence, the Agglomération only uses them as marginal markers and evidence for toxicity. Instead of relying on "technoscientific practices" to make toxicity "legible" and palpable (Murphy 2008), the Agglomération heavily relies on sensual and "bodily knowledge" to detect, determine and act upon hydrogen sulphide's toxicity (Shapiro 2015, 370). Additionally, the scent of hydrogen sulphide had equally important space-making capabilities as the practical undertakings of the Agglomération.

This sensual and place-based knowledge is also strongly influencing the Agglomération's approaches through which they seek to reduce the hazardous danger of decomposing green algae. Since their main approach, the mechanical removal (la ramassage) by excavators and tractors, poses significant personal, bureaucratic and technical challenges, the two employees of the institution are actively seeking for alternative solutions. Here, I argue that these solutions are strongly influenced by Lévi-Strauss "bricoleur"-like approaches (2022) which are based on using the existing materials and ideas that are prevalent. As the sections above showed, these alternative solutions are also significantly influenced and determined by the Agglomération's sensual knowledge of the combined movements in the bay, such as green algae, tides and currents. As it is the case with the toxic-space making practices described in the first

part of this chapter, the removing and unmaking practices of toxic-space are also strongly determined by this sensual engagement of the employees of the Agglomération. Taking this together, I argue that toxic space and toxic space-making is more a sensual and subjective endeavour than it is a technoscientific practice that relies on biotechnological and toxicological data (Murphy 2008). While the latter are also influenced by the subjective and ideological background of the researcher, sensual and place-based knowledge is much more attuned to the specific individual understanding of the world. In the chapter that follows, I trace how other subjective perceptions of toxicity are prevalent in the Morieux bay and how this toxicity can also change depending on the specific lens of the involved entities.

Toxic environment through multispecies perspectives

Depuis quelques années, nous noterons également la présence de Bernache Cravant. Chez nous, elles sont moins nombreuses, une centaines, tout au plus, qui anime notre baie chaque hiver (Delachaux and Niestlé 1974, 5)

[In recent years, we have also noticed the presence of brant geese. In our area, there are fewer of them, a few hundred at the most, which enliven our bay every winter]

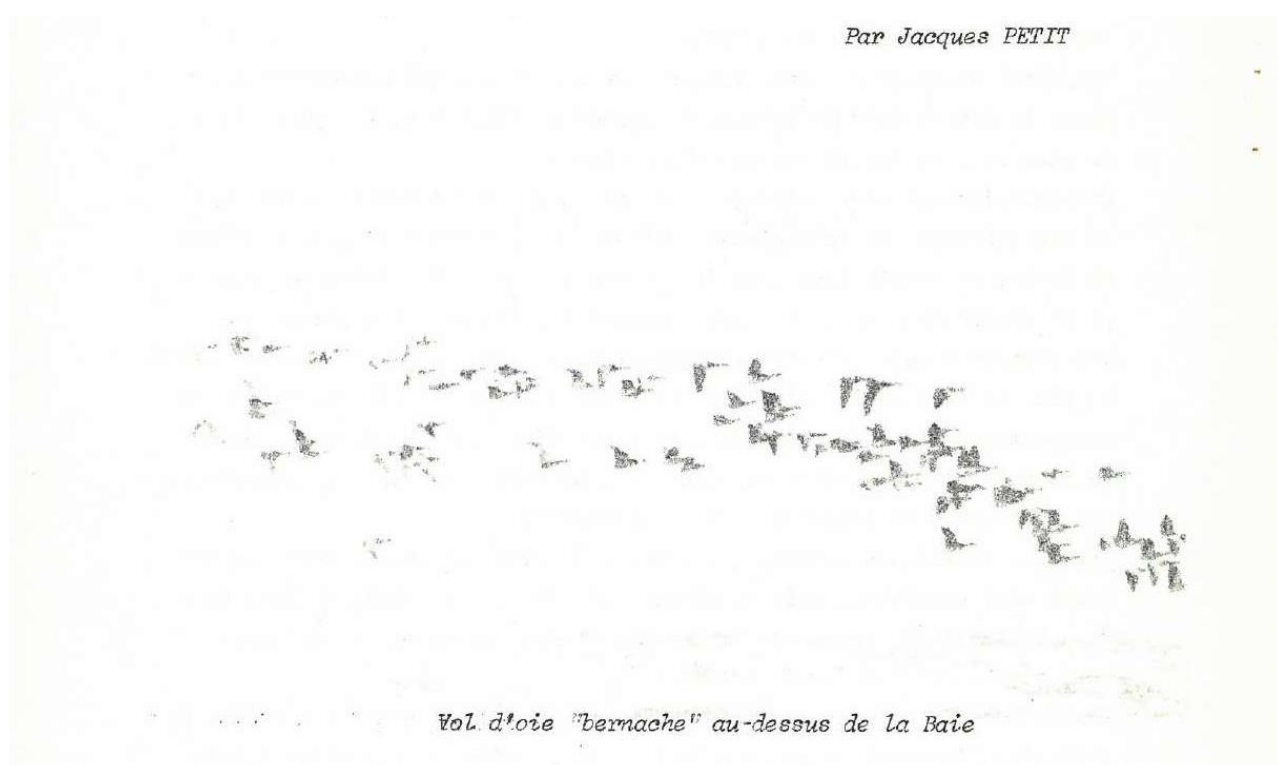


Figure 5: Flight of the brant geese over the bay (Photo credit: Jacques Petit in Delachaux and Niestlé 1974, 3)

Introduction

The Saint Brieuc bay with the adjacent Morieux bay is an important breeding and resting zone for various different bird species. Some birds, such as the little egret, different heron varieties and seagull varieties are living in the bay for the entire year (Ponsero and Sturbois 2023). Others, such as the brant geese, and the Eurasian wigeons visit the bay only from October to January. During the warmer periods of the year, they migrate to Spitsbergen, Greenland and Siberia (Ponsero and Sturbois 2023; Réserve Naturelle 2004). Given the bay's international importance for birdlife (Ponsero et al. 2009), the *Réserve Naturelle*

*Baie de Saint-Brieuc*⁸ [Nature protection area of the Saint Brieuc bay] was established in 1998 to ensure the protection and continuation of birdlife in the Saint Brieuc bay. Next to the Agglomération whose engagement with the Morieux bay was outlined in the previous chapter, the Réserve Naturelle is an equally important institution. The latter's tasks, objectives and understanding of the bay however, differ significantly.

Tracing these differences and applying a similar approach as in the previous chapter, I examine the various practices through which the Réserve Naturelle engages with the birdlife and the natural space in the bay. Applying Fabiana Li's analysis (2013) that natural entities are not rigidly given but rather created through continuous practices and reenactments, I focus on how the natural space with which the Réserve Naturelle engages comes into being. More specifically, I show how their applications of buoys, signs and regulatory frameworks demarcate this space materially and legally. Furthermore, regular bird counting practices underpin the bay's importance for birdlife quantitatively. Ultimately, the Réserve Naturelle communicates this natural space and their specific perception to a wider audience through sensibilization tours.

The second major point of focus in this chapter is in relation to toxicity and the brant goose, a duck variety that started to reside in the bay in the early 1980s and depicted on Figure 5. In contrast to the potentially hazardous human engagement with the green algae, the brant geese devour them in their fresh state and relies on them as their major source for nutrition (Ponsero et al. 2009). Through this example, I illustrate how chemical compounds, such as hydrogen sulphide, are often not equally toxic for all entities who engage with them. In contrast, I argue that the concept of toxicity itself cannot be understood through universal terms. Instead, its toxic potential always depends on the perception and perspective of the specific human or more-than-human entity who engages with the chemical molecule. Accordingly, I argue that toxicity is a contingent concept which is highly influenced by time, space and perspective of the entity who is exposed to chemical matter.

Before diving into the core arguments of this chapter, I outline the historical and institutional development of the Réserve Naturelle as an important institution operating in the Morieux bay.

⁸ I will use the shortened French term *Réserve Naturelle* throughout the thesis

The Réserve Naturelle from a historical and institutional perspective

The Réserve Naturelle was established in 1998 with the clearly determined goal to preserve the biological and geological diversity of the bay, both on land and in the sea (Réserve Naturelle 2018a). Before its creation, the bay itself was exposed to various interests that imagined different projects on the site. After ideas resurfaced that proposed the creation of polders, the establishment of a big naval port or the drainage for an airport in the Saint Brieuc bay, one journalist put it neatly in 1972 “the bay is becoming a sort of promised land” (Réserve Naturelle 2018b, 2). Even though none of these projects have been carried out, the bay was still used to bury 1 million cubic meters of waste, served as a sand extraction site and a motocross park (ibid). Additionally, the arrival of *algues vertes* in the 1970s was considered by some as yet another form of pollution (Ponsero et al. 2009).

To counter these perturbations, a small environmental movement formed in the bay. Some expositions to inform about the bay’s biodiversity culminated in first attempt to create a Réserve Naturelle in 1981 (Réserve Naturelle 2020). This triggered opposition from other actors operating in the bay, especially hunters, mussel farmers and horse riders, who saw their activities endangered. In 1994, Le Conseil National de Protection de la Nature [National council for nature conservation] assessed the site and concluded that it is of national and international importance for its biodiversity, birdlife and geological formations. Accordingly, around 3000 hectares are under the highest institutional form of French environmental protection since 1998 (Réserve Naturelle 2020; 2018a). Within the institution’s historical narrative, the creation in 1998 is perceived as a watershed moment, which left nothing unchanged in the bay. From this moment on, as a brochure (Réserve Naturelle 2020) recounts, every decision and every project had to first and foremost take into account the protection of the bay’s biodiversity, with a special focus on the conservation of its fauna and flora, its animals and soil, while simultaneously preventing any form of artificial intervention (ibid). The specificities of the Saint-Brieuc Bay require the Réserve Naturelle to particularly take care of the bay’s vast foreshore and salt meadows (fr.: *pré-salés*) to assure its importance as a national and international bird migration site (Réserve Naturelle 2020, 23).

From an institutional perspective, the Réserve is part of the political region Bretagne, bringing it under the direct responsibility of the French state under supervision

of the regional préfet⁹. The préfet appointed two institutions, the Agglomération Saint-Brieuc and VivArmor Nature, to co-manage the Réserve Naturelle. An additional advisory body delivers a scientific perspective on the projects and objectives the Réserve Naturelle is carrying out. This body is further complemented by a consultative committee, consisting of public administration members, elects, and members environmental NGOs.

How the territory of the Réserve Naturelle comes into being

After outlining the historical development of the Réserve Naturelle, the following subsection examines how the institution engages with the Morieux bay and its biodiversity. The Réserve Naturelle applies specific practices to achieve their main objectives: the protection and preservation of biodiversity in the bay. The entity under protection and preservation however, needed to be created first. Here, the focus is mostly on the birdlife in the Morieux bay to show how the institution constitutes their institutional and environmental basis through discursive and material practices. The practices of the Réserve Naturelle are not singular to the Morieux bay. Thus, throughout these subsections, I will outline how certain anthropological literature discussed in the theoretical part of this thesis speaks to the practices undertaken by the Réserve Naturelle. More specifically, Fabiana Li's research (2013) highlights how the Mount Quilish in Peru was turned into a holy mountain and important aquifer through specific and continuous practices undertaken by various actors from civil society. On a similar note, Cymene Howe (2019) showed through their research how the objectification and quantification of the numbers of animals determined the environmental viability of the construction of a wind park in Mexico. As I will show, schematic counting of the different bird species in the Morieux bay is an important means through which the Réserve Naturelle derives its institutional legitimacy.

Buoys, signs and sensibilisation tours

Yellow buoys are the most visible practice through which the territory of the Réserve Naturelle is constructed. Located at its extremities and placed every 100 meters, they form a line in the sea that stretches from Plage de Beliard in the east and Plage du Valais in the west. Through this line of buoys, the institution demarcates and communicates the

⁹ State representative and head of a Département

boundaries of its territory. Additionally, information signs are positioned at the beach entrances and inform people that they are about to enter the Réserve Naturelle. On these signs, cartographic maps of the bay indicate the boundaries of the institution's territory and clearly depict the demarcation lines formed by the yellow buoys. These signs also inform about the precepts which are to be legally observed by any human who enters the Réserve Naturelle to not disturb the biodiversity within.

Additionally, the Réserve Naturelle carries out sensibilisation tours to convey the content of the signs and the general objectives of the institution to the many people who visit the beaches in the Saint Brieuc bay. In a team of two, comprised by one employee and one volunteer dressed in green warning vests, they walk over the beaches of the Saint Brieuc bay to inform people about the Réserve Naturelle. Often, they also correct certain behaviours of beach visitors when they do not align with the institution's reglementary framework.

To further and more concretely underpin how the Réserve Naturelle creates and sustains their territory, I provide two ethnographic encounters with Luc, an employee of the institution.

Space through birds – Bird countings

It is an early Monday morning in late August and I am appointed with Luc, an employee of the Réserve Naturelle. Our task for the day is to count how many birds of each variety are currently residing in the bay. This year-round endeavour is one of the most important undertakings of the Réserve and gives the numerical legitimacy to the institution's existence. Furthermore, it underpins and perpetually sustains the Saint Brieuc bay's national and international importance as a breeding zone for birds. Numbers of residing birds already exist since the 1970s when hobby ornithologists started for the first time to systematically count the birds in the Saint-Brieuc bay. The biweekly time frame has been introduced early on, resulting in a large and reliable set of data. This enables the Réserve Naturelle to make correlations between fluctuations of bird numbers and perturbations occurring in the bay, such as the algues vertes (Ponsero et al. 2009).

Equipped with a telescope on a tripod and a binocular, Luc and me headed to the beach of Bon Abri as our first stop to count the birds. While I was struggling to not only set up the tripod but also to discern the different bird species on the foreshore in front of us, Luc already smoothly skimmed the beach. He continuously whispered bird names with

an excited voice: “oyster catchers, sandpipers, seagulls, Eurasian curlew.” Additionally, he had a small, mechanical counting device in his left hand which he pressed whenever he saw a bird of a specific species. After some 20 minutes at Bon Abri, Luc concluded that we already counted all the birds on this beach section.

We repeated this process on five different beaches and ended up counting a total of around 2200 birds in the Morieux bay. The rankings were led by oyster catchers (1081), followed by sandpipers (334) and Eurasian curlews (256). From another perspective, we counted representatives of 11 different species. Every time before we left a beach, we added the respective numbers into an A4 spreadsheet. During the tour, Luc received regular phone calls and mentioned bird names and the places where he saw them. He later told me that it was a colleague of his who toured the different beaches of the Yffiniac bay at the same time when we were in the Morieux bay. Often, as Luc told me, entire flocks of birds can relocate from one bay to the other and it is important to avoid double-counting.

At the end of the tour, Luc and the other employee merged all the numbers to obtain the final results. This process is repeated every 14 days when the tide conditions are similar with a coefficient of around 80. They need to adapt to the arrival of the high tides and set out two hours before they arrive. Thus, they also often embark in early mornings, late evening or sometimes also during the night. Here, the employees adapt both to the movements of the tides and the movement of the birds.

Space through laws

The Réserve Naturelle applied and enforces a neat reglementary framework to protect and preserve the biodiversity of the bay. These laws enable the Réserve to legally execute the protection of their territory. Accordingly, various prohibitions have been formulated, such as letting dogs roam freely on the beaches, putting a parasol, leaving the designated walking paths, kayaking or kite surfing. To oversee these prohibitions, the Réserve Naturelle can enforce these reglementary framework through an environmental police to which some of the employees belong to. Their affiliation is displayed by an additional badge on the general uniform of the Réserve Naturelle and they patrol the beaches on a daily basis to oversee whether beach visitors act in compliance with the Réserve’s reglementary framework.

Luc is also part of the environmental police and his role became palpable during our joint bird counting mission. While we were both looking through our binoculars, Luc suddenly exclaimed that he saw dogs running freely around the beach in Bon Abri. His index finger pointed into the direction to underpin to me the state of urgency. He added with discontent and frustration that all the birds on the beach flew away because of dogs. Upon encountering this situation, which clearly violates a regulation of the Réserve Naturelle, Luc decided to immediately return to Bon Abri and face the perpetrators. After a hurried car ride back to Bon Abri, Luc pulled out an official ID, a laminated document indicating specific breaches of law with the respective fines and a template which looked like a payment slip. With his still strong determination, he ordered me to remain seated in the car and ran off to the beach in the direction of the dogs. He returned after some minutes and appeared seemingly relaxed and satisfied. Upon asking him how the situation unfolded, he told me that he fined the dog owners and instructed them to take their dogs on a leash. He underpinned that he managed to contain the danger because dogs pose a serious threat to the birds in the bay.

Reflecting about the incident, I was particularly astonished about Luc's change of behaviour. I got to know him as a rather calm and considerate person who occasionally gets excited about specific birds. When he encountered the breach of law however, he turned fully determined and moved in a fast pace to contain the source of danger for the birdlife. His approach underpinned his fierce conviction that the ecological standards can only be retained when a solid structure of regulations is at its base. By doing so, the pristine nature, biodiversity and birdlife is protected and ultimately, the Réserve Naturelle is sustained.

The Réserve Naturelle's space-making practices in a wider context

The sensibilisation tours, combined with the prohibitions and law enforcements, the bird counting and the various signs and buoys all lay the basis for the Réserve Naturelle to demarcate their territory under protection and preservation. Carrying out these practices enables the institution not only to render visible the space, but also to create the natural space filled with biodiversity and bird life in the first place. In this section, I seek to bring the space-making practices into conversation with existing ontological turn, multispecies and chemoethnographic literature.

In their joint ethnographic research on the establishment of a wind park in Mexico's Isthmus of Tehuantepec, Cymene Howe and Dominic Boyer (2019) trace the importance of more-than-human beings for the park's implementation. More specifically, Cymene Howe encourages ethnographers to engage in "species thinking" in times of the Anthropocene as a means to illuminate how human histories and more-than-human histories are tied together (2019, 139). While this is based on multispecies ethnography, such as the accounts by Tsing et al. (2019), Haraway (2008) and Noorani and Brigstocke (2018) as outlined in the theoretical chapter, Howe's account (2019) is particularly useful in the context of the bird-counting endeavours of the Réserve Naturelle. Similar to the Morieux bay, wind park developers, a governmental institution in charge of the environment and local advocacy groups in the Mexican Isthmus demanded exact species numbers to underpin that animals inhabit the designated construction area of the wind park. The birds for example, needed to be "sighted (seen) and sited (located)" (Howe 2019, 155). When Luc and me visited the different beaches in the Morieux bay, we carried out similar practices of first seeing them, then locating them on the specific beach section, and finally quantifying them into numbers. Howe (2019) already argued that such practices are fundamentally important to not only make visible the more-than-human life in the Isthmus but more specifically to create the natural space, or the fauna and flora, with quantitative species data. Linking this to Fabiana Li's research on a gold mine in Peru, I argue that the ethnographic examples from the Isthmus and the bird counting missions undertaken by the Réserve Naturelle are the specific practices of "continuous enactment and stabilization" through which natural spaces are discursively and quantitatively created (Li 2013, 400). Furthermore, the sensibilisation tours at the beach entrances constitute another major practice of the Réserve Naturelle. Through them, the institution conveys their ontological viewpoint of the Morieux bay to a broader public. Similarly, Li (2013) emphasized how the hydrological studies that underpinned Mount Quilish's role as an important aquifer needed to be translated and communicated to a broader public. This practice both popularized and reinforced the Mount Quilish's association as an aquifer in the region.

The other practices undertaken by the Réserve Naturelle, such as the yellow buoys, the information signs at the beach entrances and the reglementary framework, clearly create and communicate the boundaries of the institution's designated territory.

From the Réserve Naturelle's perspective, these practices not only communicate the boundaries but also regulate what gets inside and what cannot be tolerated within. In the context of a highly polluted working class neighbourhood in Mexico city, Elizabeth F. S. Roberts (2017) argues that the highly penetrating smell of sewage and other liquids created an invisible boundary that prevented bigger threats, such as the police, from entering the neighbourhood. She refers to them as "toxic boundaries" that determine "what gets inside". To apply this concept of the "toxic boundary" to the practices of the Réserve Naturelle, I need to invert the categorization. From Luc's perspective, the reglementary frameworks and the buoys are essentially there to prevent any disturbances and human interference from the outside to ensure the birds' livelihoods. Thus, the Réserve's boundaries might not be toxic, but it is the human interferences that are perceived by the institution as creating hazardous conditions for the many residing birds within the demarcated territory.

When I juxtapose these ethnographic findings to the green algae as the broader context of this research, it becomes clear that they did not play any significant role in these boundaries and the potential danger of toxic human interference. It appears as if for the Réserve Naturelle, the beach sections which pose toxic hazard for humans are not equally perceived as toxic by the institution. The subsequent section addresses the relationship of the Réserve Naturelle and the green algae more in depth and highlights that they might not be toxic for all the entities that reside within the Morieux bay.

The Réserve Naturelle and the green algae

During one of the sensibilisation tours, I deliberately asked the two affiliates of the Réserve Naturelle whether they also inform about the dangers of the green algae which decompose on the beaches. They univocally negated and underpinned that it would be the mission of the different communes to sensitize about the dangers of the green algae and not the Réserve Naturelle.

Their specific positioning was not a singular account but rather reflects the Réserve's general approach, framing and standpoint to the green algae in the bay. During my encounters with the employees of the Réserve, the algues vertes often remained a circumstantial topic, even though I addressed them several times. During the bird counting for example, Luc mentioned that the algae do not have any impact on the birds and the workings of the bay. He affirmed this by mentioning the designated time

schedules during which the collection machines of the Agglomération have access to the beaches in the specific demarcated zones to not disturb any birds. Another employee once made it quite clear to me and told me that it is not at all their task to work in the green algae.

Despite this clear stance, the *algues vertes* are still entangled in the webs of life in the bay and the Réserve's working environment. During another meeting with Luc, he mentioned in a calm and unastonished manner that some birds eat the fresh *algues vertes*. He went on and explained that "if there would be less *algues vertes*, there would also be less birds". I was puzzled both by his honesty and the content of the statement itself and asked myself what this would mean. Are the green algae important for some birds as a food source? How are they specifically entangled in the food circuits of birdlife in the bay? How does this impact the relationship and perception of the Réserve towards the green algae? I pondered for some time on these questions after Luc's remark and then remembered an article a hobby ornithologist once mentioned to me. After I asked him if the *algues vertes* pose any risk to the birds in the estuary, he negated and pointed towards a scientific article which mentioned them as an important food source for the birds.

This article was co-drafted by Alain Ponsero who also serves as the current curator of the Réserve Naturelle and four other researchers affiliated with French research institutions (Ponsero et al. 2009). The article addresses one specific duck variety, the brant goose which is depicted in Figure 5 at the beginning of this chapter. 200 of them were first seen to reside in the Saint Brieuc bay in the 1970s and their numbers augmented to roughly 3000 in 1982 (Ponsero and Sturbois 2023). When the Réserve Naturelle was created in 1998, they determined the brant geese as the "emblematic species of the Réserve Naturelle" which gives "the Saint-Brieuc Bay its international importance" (Réserve Naturelle 2004, 1). Soon after the institution was created however, the numbers of the birds in the bay dropped significantly and between 2015 and 2022, only 1500 could be counted (Ponsero et Sturbois 2023). In their article, Ponsero et al. (2009) attribute this decrease to yet another development of a more-than-human entity in the bay, the green algae. Increased efforts to restore the water quality and to reduce nitrogen rates in the rivers decreased the quantity of green algae that proliferate and end up on the shores of the Saint Brieuc bay. While this might be beneficial for the Agglomération, the brant geese

in contrast are threatened in their livelihood. The green algae account for 90% of the birds' food, or in another scale, the brant geese consume 500 tonnes of them in one season (Ponsero et al. 2009). From this vantage point, Luc's statement needs to be taken at face value. If there are less green algae in the bay, then there are also less brant geese inhabiting the bay.

As a result, Ponsero et al. (2009) already pondered on the question of how to substitute the diminishing food source of the brant geese. They suggested *Puccinellia maritima*, a herb that predominantly grows in the salt marshes, as one potential food substitution. However, the already existing patches of *Puccinellia maritima* could not satisfy the demands of the birds in quantity. Therefore, the authors discussed the establishment of dedicated zones where the Réserve Naturelle could plant additional patches of this plant. While this endeavour was not carried out in 2009, and to my knowledge also not until my research stay in summer 2024, the authors saw the Réserve Naturelle confronted with what they called a "management dilemma" (Ponsero et al. 2009, 11). As the authors acknowledge themselves, this dilemma is mostly caused by the specific value and importance the Réserve Naturelle attributes to the brant geese. Taking again Cymene Howe's research findings (2019) from the establishment of a wind park in the Mexican Isthmus, she equally shows how different human actors are "placing species in a relational cast of worth" (169). The author then traces how this hierarchy of species becomes political. Providing an example of the sea turtle, she shows how wind park developers frame them as an important species that needs to be protected. For most of the residents however, they harvest the eggs of the sea turtles in the night because they perceive them as a local food delicacy. To protect the sea turtle, the wind park developers employed security guards to patrol the beaches and prevent residents from taking the eggs. In one case, a resident was imprisoned after taking eggs. However, this person was an important figure in resisting the establishment of the wind park. Accordingly, various residents perceived the harvesting of eggs as a pretence to impair anti-wind park activism (Howe 2019).

The ethnographic examples of Howe (2019) highlights that hierarchies created by humans to categorize and govern over more-than-humans can often lead to ambiguities, violence and unintended consequences. In the case of the brant geese and the significance the Réserve Naturelle attributed to them compared to the many other bird

species also residing in the Morieux bay, this leads to the before mentioned management dilemma. Nevertheless, the brant geese are an important actor that legitimizes the existence of the Réserve Naturelle in the bay as it was given an emblematic status and considered as a “species of conservation importance” (Howe 2019, 162). In the context of this research, the ambiguity arises when focusing on the birds’ food: the green algae. To address this ambiguity, the following final section of this chapter focuses on the important question for whom the toxicity of the green algae become has hazardous consequences?

Toxic for whom?

How do the birds perceive the Gouessant estuary? I very much perceive it as the manifestation of a blasted landscape of late industrialism. But when I sit on the shores of the estuary watching all these birds singing, swimming, diving, I wonder how they perceive the bay (Field diaries July 2024).

A damage-centered lense

Until now, this chapter highlighted the various entities that engage in the multispecies life of the Morieux bay: the different bird species and their human caretaker, the Réserve Naturelle, and the green algae. The high numbers of birds who frequent the bay for recreational or reproductive purposes render the area a nationally and internationally important site for bird migration. Among them, the brant geese have been selected by the Réserve Naturelle as a signatory species who give even more importance to the Saint Brieuc bay as a significant site for birdlife. As the previous sections showed, the brant geese highly depend on the proliferation of green algae in the bay because they are the major source of nutrition for this duck variety.

As the note from my field diaries suggest, my major vantage point through which I perceived and made sense of the bay was based on blasted landscapes. Thus, the “emergent social forms that arise from chemical exposures and dependencies” as Shapiro and Kirksey (2017, 484) noted, remained veiled by what Michelle Murphy coined a “damage-based research” (Murphy 2017, 496). This epistemic approach tends to overemphasize the destruction of landscapes haunted by toxic pollution, rather than also

opening the research gaze on the forms of life that emerge. Such an approach often neglects and forecloses potentially existing lifeworlds in such “doomed” landscapes, and also tends to perpetuate racist and supremacist narratives. When I reflected about the development about my own perception of the bay, I heavily relied on and was influenced by the comic of Inès Léraud and Pierre Van Hove (2019) and the works of certain activist groups who specifically attempt to discursively render the estuary a toxic space, void of any form of life. In a pamphlet of an activist group, they wrote: “What's striking about these places is their rigid appearance, deserted by all forms of life, as if out of time” (Le Lay, Gravigny, and Caussimon 2016, 6) [translated by the author].

Inès Léraud’s comic book (Léraud and Van Hove, 2019) further underpinned the deadliness of the bay by providing the numbers of deceased animals and humans. I was well aware that my perception had to shift and that I had to allow my mind to wander in order to uncover assemblances and webs of life that would otherwise remain intangible to the human gaze (Tsing 2015; Haraway 2016). Thus, I had to focus on the alternative and marginalized stories that swirl around, as Vincanne Adams (2023) reminds us in their book that addresses the toxicity of the herbicide Glyphosate:

While it is not hard to tell at least one story of glyphosate’s toxicity (...) one can also tell other stories about how we got here with this chemical and how it alters our ability to do things (Adams 2023, 8).

Decentering the damage centered approach with which I initially arrived at the fieldsite was extremely important to encounter and grasp how green algae might not only produce toxicity and toxic space. The article from Ponsero et al. (2009) was highly influential in this endeavour because it literally stated that life amidst green algae pollution is possible. In the abstract, they write: “It is quite singular to see that, in this bay, a wintering area of international interest for a water bird developed thanks to serious environmental perturbation” (Ponsero et al. 2009, 1). Thus, this gave a first hint on how the birds perceive the Gouessant estuary and the algae proliferation. Accordingly, I managed to expand my ethnographic scope and took inspiration from Eben Kirksey’s research (2020) in a polluted industrial zone in Sydney/Australia. There the author encountered the proliferation of golden bell frogs, an endangered species that found its habitat amidst

pollution. Accordingly, I incorporated some of Kirksey's questions of focus that he emphasized when doing ethnographic research in chemosocial worlds. These questions are:

Which species are flourishing in polluted shadowlands? (...)

What conditions of social life have emerged in polluted landscapes and waterways? (Kirksey 2020, 24)

Algae as life creators

This brings me back to the Morieux bay where the brant geese found a safe and tranquil habitat. The needs and protection of the two birds are amplified by one of the main institutional actors in the bay: the Réserve Naturelle. They operate as the judicial and material caretaker of the multispecies site and focus on the protection and the preservation of its nature. As we have seen, the *algues vertes*, and specifically their potential toxicity, take a rather marginal position in their discourse.

This stands in stark contrast to the other important institutional actor, the Agglomération Saint-Brieuc who assesses certain areas of the bay regarding their hazardous toxicity to humans. Their objective then, is to diminish and remove the sources of toxicity: the decomposing piles of green algae.

How the Réserve Naturelle often neglects them but how they are entangled in the life of their emblematic species, the brant geese, are the other stories of toxicity and chemicals (Adams 2023). This story deviates from the toxic main story which is recounted by the Agglomération or the comic by Inès Léraud and Pierre Van Hove (2019). Here, toxicity is not a steadfast, rigid or neat conception that can be neatly attributed to any chemical. Instead, the toxicity of the green algae highly depends on the position, world view, time and space through which one perceives and engages with a chemical molecule. Furthermore, the conception of toxicity is usually derived from a human vantage point and silences any more-than-human conception of and engagement with toxic properties (Adams 2023).

Moving beyond rigid conceptions of toxicity, it becomes clear that the *algues vertes* have also life-providing qualities in addition to their lethal properties. They serve not just as a "viral but also a vital interlocutor in the swirl." (Adams 2023, 38). The vital comes in form of life creating services: the *algues vertes* do not just produce hydrogen sulphide and

environmental upheaval, but also food and a bay where the brant goose can nourish themselves. Thus, the *algues vertes* call for “ontological multiplicity” (Adams 2023). In line with discarding the damage centered approach, ontological multiplicity invites us to look at what the *algues vertes* can become by partnering up with other entities and trace the new assemblages of life that potentially emerge (Adams 2003, 38). Here, the green algae are also not a passive provider of life, but rather a “living thing that partners with other living things” (Adams 2023, 49). The algae and the birds engage in what Sophie Chao (2021) calls “mutualistic alliances”, or a situation “in which each species has an interest in seeing the other maintain its existence.” (483).

In the context of the brant geese this alliance is quite straightforward: the *algues vertes* maintain the bird’s existence by serving as a source of nutrition. There is also a reverse connection, albeit induced by humans. As already mentioned before, the arrival of the brant geese was fundamentally important for the creation of the Réserve Naturelle. As soon as they arrived, specific protective measures were undertaken to ensure that the ducks stay in the bay. As soon as the abundance of green algae declined, the Réserve faced the above mentioned “management dilemma”: should they opt for water restoration measures or the substitution of the birds’ main source of food (Ponsero et al. 2009). Given the ambiguous positioning of the Réserve Naturelle regarding their discursive and practical engagement with the *algues vertes*, I argue that they quietly accepted the algae’s continuous arrival in the bay to ensure that the birds could further reside in the bay. Thus, the arrival and continuous existence of the brant geese in the bay also ensured a certain ongoing proliferation and acceptance from the side of the Réserve Naturelle.

Even though the green algae are eaten by the brant geese, they still benefit from the bird because the Réserve Naturelle has strong interests to not contribute to reducing the proliferation of green algae. As the brant geese inhabit the Morieux bay, nourished by the *algues vertes* and with the help of the Réserve Naturelle as their institutional caretakers, they create space and territory. This ensures the livelihood of the respective intertwined entities. In the context of oil palm plantations in West Papua, Sophie Chao calls this more-than-human survival:

The capacity of mutualistic species to share - rather than lose - their space and resources with oil palm points to interspecies community-building and cooperation as alternative strategies of more-than-human survival (Chao 2021, 483).

Thus, forms of cooperations emerge among the brant geese, the green algae and the Réserve Naturelle that sustain the lives and habitats of the respective entities.

Conclusion

This chapter showed and emphasized that the meaning and hazardous consequences of toxicity can change depending on the vantage point and ontological worlding through which an entity perceives the green algae and their accompanying gas hydrogen sulphide. For the Réserve Naturelle, the main institutional body that takes care of the more-than-human life in the bay, the *algues vertes* and their toxicity only play a minor role.

For the brant geese, the more-than-human entity that received most attention in this chapter, the green algae are an important source of nutrition. Furthermore, the algae in their decomposing state, which is toxic to humans, do not pose any hazardous consequences for the duck variety. These unintended and unexpected entanglements between the brant geese, the green algae and the Réserve Naturelle create life instead of ending it. In this world, the described entities engage in “mutualistic alliances” (Chao 2021) and “chemosocialities” (Shapiro and Kirksey 2017).

Beside the green algae and the brant geese who engage in space-making practices, the Réserve Naturelle is the most important actor who creates the natural space in which the more-than-human entities reside. Here, the installation of buoys, the reglementary frameworks, the bird counting missions and the sensibilisation tours first and foremost help the Réserve Naturelle to demarcate their territory and communicate its boundaries to a broader public. As I have shown, these practices refer to Fabiana Li’s research (2013) on a gold mine in Peru, where they asserted that natural spaces are not a given but rather emerge and depend on residents’ practices. This is not to say that more-than-human entities would not exist without their human counterparts. Instead, with its focus on the natural space of the Réserve Naturelle, this chapter emphasized that different ontological worlds, or as Vincanne Adams (2023) would say “ontological multiplicity”, can exist in the same place, and that these worlds are created by certain

practices (Blaser 2009). In contrast to the Agglomération whose perception of the Morieux bay is highly based on a danger and damaged centered lense (Murphy 2017), the Réserve Naturelle rather focuses on the live sustaining entities that swirl in the bay.

Frictions, contestation and counter-narratives

Rubbing two sticks together produces heat and light; one stick alone is just a stick
(Tsing 2005, 5)

Introduction

On a windy afternoon, Luc, employee of the Réserve Naturelle, and me were standing on an elevated point on the shores of the Gouessant river overseeing its estuary filled with birds, green algae and mud. We intentionally came here because we were about to count the specific bird species, a routine practice undertaken by the Réserve Naturelle to give evidence to the estuary's importance for birdlife. While I was trying to keep up with Luc's bird counting speed, I was thinking about this roughly 80-meter gap between the two shores of the river that remains impassable to humans. The many hikers who follow the wriggled GR34 are obliged to circumnavigate the river, increasing their hiking distance from 80 meters to 5 kilometres – a circumstance that often prevented me from walking more often to the other side of the Morieux bay. While I was still pondering on these thoughts, a project idea that Laure from the Agglomération once mentioned to me came to my mind. Driven both by self-interest and curiosity about how Luc would perceive this idea, I interrupted the bird-counting silence and uttered: "What do you think about a pendant bridge that would connect this side of the river with the other side?" I could see how I caught him surprised with my question. His body turning slightly stiff, he replied: "This is a complete heresy". Even though his voice was decisive, I could sense how he seemingly contained more of his opinions on this idea, potentially preventing himself from a more emotional reaction. In a more calm and rationally grounded tone he added that access has already been restricted to the respective area due to its importance for the birdlife and that the financial costs would be exceedingly high. He concluded that the project to install a pending bridge over the Gouessant's estuary would be completely redundant.

The idea of a pending bridge was first mentioned to me by Laure of the Agglomération Saint Brieuc. Fascinated by the idea to connect both sides of the Gouessant estuary by a construction of metal, wood and plastic, Laure imagined this bridge as a catalyst for local tourism and additional protective measure for the estuary's

birdlife. In this conception, the many hikers that arrive on the GR34 would find an easy shortcut to cross the estuary and would further decrease attempts by some to cross the estuary through its mud, rendering both the hiker and the birds in a dangerous situation. Instead, both hikers and tourists can gaze at the birds from a distance and the birds themselves would be left undisturbed.

The bridge is not yet hanging and attracting the many tourists, and it probably never will be, as it lacks popular, communal and financial support. Nevertheless, the mere imaginary conception overshadows its highly unlikely implementation and sparked emotional reactions on both sides, the Agglomération and the Réserve Naturelle. The sole theoretical idea of the pending bridge is emblematic for the late relationship between the two institutions, an engagement constituted by distrust, avoidance, ignorance and frustration. While these frictions are highly localized and appear as isolated and project-specific, they need to be taken out from their material context. Thus, underlying ontological borderlines become apparent through which each institution perceives and engages with the Saint-Brieuc Bay.

The two previous chapters seek to outline how toxic space is made and unmade by various actors, ranging from the institutional actor Agglomération Saint-Brieuc to the Réserve Naturelle and various more-than-human entities. Given the distinct approaches of the respective institutions, the final chapter of this thesis examines the layers of friction, disagreement and emotional upheaval that emerge when different viewpoints and working approaches to the bay are coming together.

The topic of friction has been famously elaborated in Anna Tsing's (2005) book "Frictions: An Ethnography of Global Connection". Based on her fieldwork in Southern Kalimantan and the Meratus Mountains in Indonesia, she claims that global connectivity and global capitalism are not a "well-oiled machine" but are instead comprised by various frictions and contradictions. She defines frictions as the "awkward, unequal, unstable, and creative qualities of interconnection across difference" (4)" and postulates that encounters occurring in such situations are generative for new forms of culture and power. Engaging with friction in their respective anthropological field, Anderson & Cury (2023) equally point out the generative value of friction and how they "serve as a mirror reflecting the complexities and nuances that are often overlooked" (Anderson and Cury 2023, 386). Applying their arguments to a chemoethnographic context, we see how the

arising frictions turn chemicals into “useful linking figures” to dissect the complex arguments and ontologies at play in the Morieux bay (Shapiro and Kirksey 2017, 481).

Building on the argument of the previous chapter of this thesis that toxicity is a contingent concept influenced by the ideological and political perspective of the respective actor, this chapter portrays how hydrogen sulphide and the *algues vertes* become actors in themselves and turn into catalysts for contestation and friction in the Morieux bay.

In what follows, I outline first how these frictions play out in the (non)-cooperation among the two major institutional bodies Agglomération and the Réserve Naturelle. Then, I move away from institutionalised perceptions and highlight the endeavours of certain civil society organisations who aim to discard the Morieux bay of its toxic association. Finally, and in stark contrast, I analyse how an activist group engages with the green algae and how their actions actively reinforce the bay’s toxicity.

Institutional Frictions between Agglomération and Réserve Naturelle

On an early Friday morning, I was sitting in Laure’s office at the outskirts of Saint-Brieuc, impressed by the architectural style of the building. Wooden bars cover its front and the interior felt cosy and comfortable. Laure, the person in charge at the Agglomération Saint-Brieuc for the *algues* removal, sat behind her desk and stared at the screen of her computer. She appeared slightly stressed, accompanied by feelings of despair and fatigue. Recurring heavy breathing, puffing and rolling of her eyes underlined her emotional state. Her reactions appeared in relation to two specific events: the trial of the collection boat in September 2022 and the testing phase of the collection machine BeachTech 5500 in June 2024.

The 22nd of September 2022 marked an important day for Laure and Gustave as they tested for the first time the newly constructed collection boat in the Saint-Brieuc bay. All concerned actors were informed and consented, including the Réserve Naturelle and major political institutions. After first attempts remained unsuccessful due to the specific construction of the boat, the team on board decided to embark with the dinghy into more shallow waters and inspect the quantity of green algae in the open water. Before doing so, they followed the bureaucratic guidelines and called the *préfet*¹⁰ who in turn informed the

¹⁰ State representative and head of Département

Réserve Naturelle about the team's attempt to advance into more shallow waters, potentially reaching into the territory of the Réserve. Their demand was accepted from both sides and they embarked with the small boat and paddled further towards the coast. After some moments, an alarming sound went off. "PIEP-PIEP-PIEP". Laure, who was on the boat recounted to me her state of confusion and soon realised that the sound was originating from devices carried by Réserve Naturelle employees who were situated on the coast. Still under confusion, they returned with the dinghy to the collection boat and when they reached a certain limit, the alarming sound ceased. The Réserve Naturelle issued a complaint at the responsible police station, where Laure and her boss had to give testimonies of the event. According to Laure and Gustave, this specific event and their unexpected consequences was the starting point of the dissociation and breach of trust among the respective institutions.

This incident in September 2022, however, was not singular. In 2024, Laure and Gustave dedicated a considerable amount of energy into the testing of the BeachTech 5500 machine, a small wheeled device that should enable algae removal in areas impassable by the bigger excavator and trailer. This endeavour culminated on June 26, 2024 when they convened mayors of the respective communes and representatives from the Réserve Naturelle and Natura 2000 to practically show them the operational area of the machine. Despite some minor pitfalls, the machine seemed to fulfil its main goal: the collection of *algues vertes*. With a slightly annoyed and frustrated voice, Laure added that the representatives of the Réserve Naturelle and Natura 2000 demanded for a separate environmental evaluation study to assess the impacts of the potential future use of BeachTech on the biodiversity in the bay. Upon telling this, she broke out in an ironic laughter in front of me. According to her, this is ridiculous because they never asked for an environmental evaluation of the much bigger and heavier excavators, tractors and trailers since they drive on the beaches. She perceived their demand as a joke and as an obstacle against the attempts of the Agglomération to remove the *algues vertes*. The major concern of the Réserve Naturelle was the possibility of soil compaction caused by the machines. However, Laure denied their claim and assured them during the testing day that the BeachTech 5500 is extraordinarily light and that the tires are intentionally wider to equally distribute its weight on the soil. Already convinced about BeachTech's environmental compatibility, she is more concerned about the workload such an

environmental evaluation would cause to her. She listed the necessary tasks: the machine would need to be ordered another time to the Saint-Brieuc bay, an independent research institution would need to be hired, money allocated and time would pass until the machine could start to operate. Laure concluded this specific account by asserting her confusion about the demands and workings of the Réserve Naturelle. Not only did her hopes crush but also the hopes of the mayors of the respective communes who also perceived the BeachTech as a viable addition to the current fleet.

During the research stay, I attempted several times to engage with employees of the Réserve Naturelle to obtain their point of view about the specific incidents mentioned by Laure. However, a formal interview never occurred and my engagements with some employees remained rather distant and formal which did not allow me to obtain the information I sought for. On a day at the end of July for example, I went to a museum attached to the building of the Réserve Naturelle where scientific reports of the institution are also publicly displayed. My intention was to directly talk to employees of the Réserve and to inquire about an official meeting and a volunteer possibility. After outlining that I am an anthropologist doing research on green algae in the Morieux bay, they referred me to their website where I would find all necessary information. During another exchange I was forwarded to different emails and phone numbers, but my request was not really dealt with. I managed to partake in a bird counting mission, as outlined in the previous chapter, which was the longest and closest time I could spend with an employee of the Réserve Naturelle. Analysing the different reactions by the Réserve, I do not think that the institution actively tried to avoid me. However, the way how they interacted with me was similar to how private research partners described their engagement with the Réserve which was often characterised by containment and reluctance from the latter side. This was similar to my experiences: containment and a thorough consideration of every word they mentioned to me turned into a common thread whenever I exchanged with certain employees. Even though I passed certain employees on a quite regular basis – such as on beaches, at parking lots or at the beforementioned museum – our exchanges remained highly formal and distant. To me, it felt as if the interest I had for them was not reciprocated from their side to me.

Rubbing two sticks together

The conflicts regarding the trial of the BeachTech machine and the collection boat were not the only ones, further conflicts and disagreements about siltation projects, sand banks and beach closures also occurred. Combining the engagements of the institutions together with my and other research partners interactions with the Réserve, the question remains how this can be explained and grappled with.

Juxtaposing their non-interest in my presence to the way how the institution generally deals with the bay, such as law enforcements, prohibitions and signs as outlined in the previous chapter, their specific approach becomes discernible: protection. It is here where the Réserve Naturelle and the Agglomération Saint Brieuc operate on completely different grounds in and with the bay: whereas the former seeks to protect its birdlife and biodiversity *from* external forces such as human interference, the latter seeks to manage the bay to prevent and contain sanitary risks *for* humans. It becomes clear that their point of reference diverges. Whereas the Réserve Naturelle is concerned mostly about more-than-human life in the bay, the Agglomération has a strong anthropocentric focus. During a walk with Laure through the bay, she put the difference bluntly:

The difficulty is that the beaches, we don't see them from the same manner. For me, they are a working place where there are aggradations and where we have to remove to prevent problems, sanitary problems. And they, they see above all the preservation of the natural environment (Note from field diaries)

Returning to the opening quote by Anna Tsing at the beginning of this chapter which asserts that “rubbing two sticks together produces heat and light” (2005, 5), the question remains what exactly it is that produces this heat between the two institutions engaging with the Morieux bay? The article of Blaser (2009) and the concept “political ontology” he provides, become a useful tool to understand what might be at stake. Formulating his argument in the context of ontological turn proponents such as Eduardo Viveiros de Castro (1998), Blaser reminds that environmental conflicts cannot be only reduced to epistemic differences but need to take into account the different ontological approaches through which actors position themselves. Writing on a conflict about hunting practices and the integration of indigenous knowledge in Paraguay, he asserts that “there are many

kinds of natures” and that conflicts between different actors arise “because the interlocutors are unaware that different worlds are being enacted by each of them” (Blaser 2009, 11). Even though Laure from the Agglomération was well aware about their different working perceptions of the Morieux bay, the key difference between the two institutions might be their “different and asymmetrically connected ontologies” (Blaser 2009, 10). Entire sub-areas of the bay, such as bird breeding zones, the foreshore and the Gouessant estuary are constructed around two utterly different vantage points. While for the Agglomération, the Morieux bay is structured around management approaches such as geomorphological documents, measuring devices and machineries, the Réserve Naturelle centers the bay’s birdlife and biodiversity. Here, toxicity and the algues vertes are both the material and discursive means through which these “two sticks” create heat, ultimately turning into agents for friction and contestation. Both the institutions’ diverging ontological engagement with the bay not only create different vantage points but also different perceptions of toxicity and the danger emanating from green algae.

The Morieux bay as a delta and multispecies site

While I have established that the Réserve Naturelle focuses on the protection of more-than-human entities in the bay, the question remains of how the striking difference of the two institutions’ ontologies comes into being and what causes these frictions. In Chapter 4, I already outlined how the sensual engagements and technoscientific approaches of the Agglomération create the toxic space and a specific ontology through which the institution engages with and makes sense of the Morieux bay. However, the ontological approach through which the Réserve Naturelle engages with the bay has not yet been addressed adequately. Therefore, this subsection elaborates how the manifold more-than-human life in the bay, such as birds, fish and green algae, is tightly connected with and dependent on other entities in the bay, such as the Gouessant river, the sea and the sand.

I argue that this interplay ultimately influences the specific ontology of the Réserve Naturelle and is a major driver for the frictions between the two institutions. In what follows I particularly rely on Fabiana Li’s analysis (2013) who showed that natural entities, such as the Mount Quilish in Peru, can change their associated meaning through the interplay of different practices. Applying this ontological lens to the Morieux bay, I

trace the interplay of entities that turn the Morieux bay into a multispecies site and a more-than-human delta.

On the many walks I did throughout the bay either in solitude or in companion of research partners the statement of a hobby ornithologist from a neighbouring village constantly reverberated “things are moving, and they are moving very fast”. He did not refer to the many arriving and departing birds but to the estuary in its entirety. When we were both standing on a slightly elevated point overlooking the estuary of the Gouessant, he tried to underpin his statement with a concrete example. He pointed to a patch of grassland further up on the slopes where no grass and hedges were growing until some years ago. At the time of our visit, the area was filled with green plants.

This was not the only account of research partners pointing out the manifold changes which occurred in the bay over the last decades and the various entities intermingled within them: the sea, the sand and the Gouessant river. Beside the prominent birds and the green algae, the Morieux bay also harbours a complex assemblage of entities who once altered the bay and still currently shape this multispecies site.

The sea

The sea is one of these major entities. Through its perpetual movements, it carries in sand, algues vertes, shells and driftwood, and sometimes turns into a hazardous upheaval. The Saint Brieuc Bay has the fifth highest amplitude regarding tide movements which yields into a 7000-hectare big foreshore exposed by the sea during low tide. To better grasp this, it is easier to imagine the furthest distance between the fixed shore and the retreated waterfront: at its maximum, this space can reach up to 7 kilometres. This means that a human could walk through this area two times a day, which is usually covered by water containing fish, algues vertes, eggs, etc. The tides occur two times a day in fixed intervals which means that the different prevailing habitats are under constant and rapid change. While the foreshore opens during low tides as a food source for the brant geese and other birds, high tides not only work against gravity by lifting sea water upwards and land inwards, it also carries various fish, such as different eel varieties as far up as the Pont Rolland bridge.

Sand, tourists and nostalgic memories

The sea not only moves green algae, but also high amounts of sand. The sand movement often caused astonishment, stories and feelings of nostalgia among human residents because it highly impacts the geographical and social composition of the bay. Hervé and Rosa, both born, raised and settled in La Grandville during the last 80 years of their life, experienced the village's beach during the 1960s and 1970s. In these decades, the wide, long and sandy beach of La Grandville attracted countless residents from neighbouring villages and tourists coming in from as far as Paris. A grand hotel at the shores of the beach reminds of these glorious times.

At a similar point in time, when tourists planted their parasol, their children playing in the sand and the sea, something else happened just some hundred meters westwards towards Bon Abri. There, as Hervé recalled, the only dunes of the Saint Brieuc Bay have been turned into a sand extraction site for bitumen production and for construction purposes. The quarry, owned by a local duke, was active until the late 1980s and was turned into an illegal dumpsite after its closure where residents buried their trash under the sand. A major change occurred to the dunes in 1998 when the Réserve Naturelle was created. The institution put the dune of Bon Abri under increased attention to protect its biodiversity. Today, the dunes are considered a “biodiversity hotspot” with over 1300 different species residing there even though the rubble under the sand was never removed (Réserve Naturelle 2020, 25).

Siltation and sandbanks

The Morieux bay experienced yet other drastic environmental amendments in form of siltation processes since the 1980s. The enormous amounts of sand that have been brought into the bay by the movements of the tides resulted in an increase of elevation of roughly 3 meters. While this buried the former tourist beach, it also let entire rock formations disappear which were to be found further outside in the bay or on the sides of the beach. There, various residents told me how the famous rock formation *Roc verd* was slowly covered by sand, losing up to three meters in elevation over the last years.

The rise of sand levels up until three meters also drastically changed the entire landscape of the beach and the foreshore. While it did not only bury rock formations, it also created new treasures and ultimately new lifeworlds. The most prominent among is within the little ringed plover's demarcated breeding zone at the beach of St.Maurice.

Today however, the rising sand layers filled the small sand basins and the waterway and turned the space into an enormous sand bank. It is the same sand bank that Laure from the Agglomération Saint-Brieuc called a “trap” and a “degraded zone” because it attracts and stores high amounts of *algues vertes* due to its specific formation. For the Réserve Naturelle and the a specific bird species, the little ringed plover however, this “degraded zone” turned into a calm and secured breeding zone for the bird.

Le Gouessant

Changes to the bay occur on an even more accelerated rate when looking at the Gouessant river and its many branches. Once the river leaves its vast estuary the water ramifies into various branches meandering over the foreshore until they reach the sea. The main branch is demarcated by 1-meter-high shores consisting of sand, mud and occasionally decomposing *algues vertes*. The further this branch moves towards the sea the lower its shores become. The subsequent branches differ in size, depth, width and consistency. Further outside in the bay where the branches of the Gouessant river meet the sea, farmers cultivate mussels on hundreds of vertical wooden sticks. The farmers recounted how quickly the little branches of the Gouessant river can change, especially after high tides or summer storms.

The Gouessant river is essentially the lifeline which connects terrestrial with aquatic lifeworlds. Thus, the river not only creates a moving lifeworld for the manifold array of animals residing in its estuary and enables certain fish to travel inwards, but also serves as the connective medium through which various forms of human debris find its way into the sea. One of the main reasons why the Saint-Brieuc Bay experiences extraordinarily high rates of algae bloom are not only the intensive agricultural practices, but the specific aquatic infrastructure that transports nitrogen, phosphate and remnants of pesticides from the land to the sea. The Gouessant river as the main waterway acts in accordance with the entire conglomeration of groundwater, rain and wells which creates the overall watershed. Nevertheless, it is not just the water, which transports human debris, but it is specifically the leachate – “putrescible and organic material transported by water” – through which Bretagne ´s agro-industrial complexes are connected with the sea (Hird 2013, 107). Thus, the lifeline of the Gouessant is ambiguous. While the river plays and essential role to create certain ecosystems, such as the many bird and fish

species, it equally functions as a toxic polluter carrying chemical remnants that are ultimately responsible for the unprecedented growth of green algae.

From the bay to the delta

The various changes, transformations and interconnections among the many entities in the Morieux bay are remarkable. During a walk with a research partner, he put it neatly: “It is impressive, and it is the sea that does this”. Laure, the employee of the Agglomération Saint-Brieuc asserted in a similar way “It is an area that always moves and evolves”. How can the interplay of the sea, the sand and the Gouessant river be grappled with from a multispecies ethnographic perspective? This constantly changing environment is best understood as a “delta”, as anthropologists working on the social relations of water describe. More specifically, Morita and Jensen (2017), point out that “a delta is a meeting place between land and sea, an inherently intermediary space” (117). The authors further highlight that deltas can inhibit radically different ontologies, they call this “delta ontologies”. Within these ontologies, the authors differentiate between a terrestrial and an amphibious ontology. Here, the former highlights how the force of a river, such as the Gouessant river in the case of the Morieux bay, can alter and shape the land around it. The latter highlights the agentic force of the sea and perceives “deltas as extensions of the sea into land” (Morita and Jensen 2017, 119). Furthermore, when referring to the many processes and actors involved in forming a delta, Franz Krause put it bluntly:

Deltas are characterised by an ever-changing interplay of land and water as a result of flooding, draining, drying and irrigating, sinking, silting, sedimentation, channelling, erosion, and reclamation (Krause 2017, 403).

It is in this delicate interplay of water, people, sediments, plants and animals in which human and more-than-human lives emerge. In reverse, these forms of life cannot be understood as separate from the various processes occurring in the bay. More importantly however, these more-than-human assemblages form the radically different ontology through which the Réserve Naturelle predominantly perceives and engages with the Morieux bay. Consequently, frictions between the Agglomération and the Réserve Naturelle emerge because both institutions prioritize different multispecies assemblages.

Counter narratives from civil society: from un-toxic to super-toxic

The second section of this final chapter continues the discussion emerging at the end of the previous chapter, namely the question for whom the green algae are toxic in the end. The foci point of this question in the last chapter was mostly on more-than-human actors and I asserted that the green algae's toxicity is contingent because the emanation of toxic gas creates living space for birds and other beings. This section takes the question a step further and shows that toxicity is also perceived as a contingent matter among several human residents who engage with the Morieux bay. Instead of additional liveability, the specific research partners were concerned that the designated toxicity of the Morieux bay would make it negatively perceived from the outside. This subsection provides several examples of how certain residents actively contest this toxic space discursively and try to cast off the bay's reputation as one of the most concerned green algae bays of France.

A situation with a research partner during a walk next to the shores of the Gouessant river is emblematic. While he was making me aware of the enormous bird life on the river's shore, he uttered to me "We speak of toxic algae, but in fact they are not toxic, they can be eaten". I remained a bit surprised, but he kept going on and pointed to a layer of mud in the river valley. With fascination, he asked me what I would see there. Staring at the greyish mud-layer and not really knowing what to see there, I shrugged my shoulders and replied that I hope to never be stuck there. Dissatisfied with my answer, he exclaimed that this mud-layer is full of life because it contains eggs, bacteria, compost and many more entities. He went on laying bare his fundamental disagreement with the comic book "Algues Vertes: Histoire Interdite" by Inès Léraud which comments on the Gouessant estuary that "all forms of life have disappeared in this putrid environment (Léraud and Van Hove 2019, 112). The mud-layer needs to be taken as a metaphor for the entire Morieux bay. For him, the area, including the Gouessant river, is full of life disregarding the ongoing algae proliferation. After some moments of silence, he added conclusively: "the wild boars don't die here any longer".

While the person's standpoints were quite clear and convincing, other research participants were a bit more hesitant but equally attempted to put in question the toxicity of the Morieux bay. Their point of critique was not in regard to the Gouessant river however, but about the permanent monitoring stations, described in chapter 4, responsible for hydrogen sulphide and other toxic gas detection. Their installation in the Morieux bay was

relatively recent, at the beach of St.Maurice in May 2022 and in La Grandville in May 2024 (Air Breizh, n.d.). Three research participants residing in or around La Grandville felt utterly misrepresented. First, the monitoring stations were put at specific locations at the beaches with constant accumulation of toxic gas. Thus, the device would detect a chronic exposure of gas even though the emission is highly located and does not pose any risk for the humans residing in La Grandville. Secondly, the residents also felt overrepresented in comparison to other green algae bays in Bretagne: While seven of these measuring devices are located in the Saint Brieuc bay, only ten are distributed over the other seven designated green algae bays in Bretagne. Overall, the three residents argued individually that the toxicity of the Morieux bay is overrepresented and distorts how life in and around La Grandville actually is. For them, La Grandville and the Morieux bay harbours life and harmony despite green algae proliferation.

This foci point was developed further by a civil society association of the village who got established in 2017. Some members – different to the three residents mentioned above – told me about a similar objective: they want to question the toxicity of the space and highlight the liveability of the area despite its algae proliferation. Comparing the green algae with the pest, they observed that media coverage about the Hillion peninsula always had a negative undertone inquiring how people could still live in this toxic-laden environment. In contrast, the association organises public gatherings, beach walks and joint meals to not only foster village conviviality but to especially discard this “damage-centered lense” of media outlets (Murphy 2017, 496).

Another civil society initiative, which already ceased to exist, was framed around art-works, public sculptures and demonstrations, equally based in La Grandville and Hillion. During a walk with one of the residents mentioned above who was also a former active member, she outlined that the goal was to give a different perspective to the bay and to show that there are not only green algae. While we were standing on an elevated point overlooking the Morieux bay from La Grandville, she recounted how they once traversed the entire foreshore with a group of young and old people to underpin that the green algae do not prohibit this endeavour. One of their biggest events was the installation of tetrahedral sculptures that the association together with an artist placed on the foreshore in front of La Grandville. The action was authorised and the art pieces remained there for a duration of six months, constantly floating with the incoming and outgoing

tides. Describing this installation with an undertone of nostalgia, the former organizer then went on explaining that the Réserve Naturelle intervened because the sculptures would disturb the birdlife in the bay. As a consequence, the sculptures were disassembled and removed.

The arts of unnoticing¹¹

Even though these examples suggest that residents widely cared about green algae proliferation these initiatives and opinions remained exceptions. Thus, during the research stay I often pondered on the question why very few residents seem to care about the green algae or actively pursue actions to prevent them. Beside the various actions above that actively attempted to undo or unmake the toxicity of the Morieux bay, I often heard phrases such as “it is not too bad to live here”; “we actually don’t notice the smell of rotten eggs anymore” or “it used to be much worse”. Once I asked a resident of La Grandville what she thinks about health consequences to her body due to chronic exposition to hydrogen sulphide. Living in a house located very close to a beach where toxic decay occurs on a quite frequent level, I expected that she would have at least inquired this question to herself once. Instead, she reacted quite surprised about my question and confessed that she never thought about it. Similarly, my hosts in St.Maurice told me several times that they do not notice the recurring strong scent of hydrogen sulphide anymore.

Another research partner, a farmer who lives a bit further away from the next beach access, described the reactions of residents by the French word “omerta”. The Cambridge dictionary describes omertà as an agreed upon “set of rules” or “code of silence” among a group regarding specific information that is not shared with people outside the group. The investigative journalist Nicolas Legendre even applied the term in the subtitle of his book “Silence dans les champs. Système agro-industriel: violence et omerta” (Legendre 2023). He claims that the rise of agro-industrial companies and industrial agriculture in Bretagne since the 1960s produced a climate of silencing, violence, negligence – and omertà about its deadly and toxic consequences. Applying anthropological scrutiny to what research partners told me, I do not think that they felt threatened by the agro-industrial complex, but rather applied specific practices through which life in a

¹¹ Lou (2022)

“permanently polluted world” becomes bearable, feasible and comfortable (Liboiron et al. 2018).

In their work on petrochemical pollution in a district of the southern Chinese city Guangzhou, Loretta Ieng Tak Lou (2022) introduced the concept “the arts of unnoticing” after researching how residents perceive and engage with chronic contamination. More specifically, the concept illuminates “how people justify living in certain environments and living with certain adversities” (Lou 2022, 581). The specificity that Lou noticed was the high levels of indifference among residents towards the imminent and ubiquitous pollution deriving from petrochemical plants – a danger that most of their interlocutors were aware of. Instead of apathetic and fatalist reactions however, this ignorance was fundamentally necessary to retrieve agency and make life bearable. As the author points out with a reference to Nicholas Shapiro’s work on domestic formaldehyde “like learning to become sensitive to environmental change, becoming unaffected too requires work” (Shapiro 2015, 374 in Lou 2022, 583).

The approaches and projects of the two civil society associations in La Grandville and on its foreshore need to be equally understood from this vantage point. The art projects and community gatherings are deliberate actions to cast off the bay’s toxicity by unnoticing its chronic contamination, even though residents were well aware of the green algae problematic. In the context of the resident who lives close to toxic decay and never interrogated the consequences on her state of health, or the other examples I provided, Lou (2022) reminds us with a reference to the work of Bryan Tilt that “exposure to environmental risks does not necessarily translate into heightened risk perception” (Tilt 2006, 123–24; in Lou 2022, 585). As it was the case with residents and construction workers in Lou’s research (2022) who ceased to recognize the strong smells of the petrochemical plants, the strong odor of hydrogen sulphide in the Morieux bay equally became hardly noticeable anymore for residents.

Despite the strong relevance of Lou’s concept of the “art of unnoticing” (2022), it is important to bear in mind that this unnoticing in the Morieux bay occurs amidst contestation and friction. All the outlined ethnographic examples have a common baseline to contest the association of the area as toxic, thus creating a counter-narrative to how media outlets or also the Agglomération Saint Briec portray and engage with the bay. Furthermore, as the next subsection highlights, the “art of unnoticing” in the Morieux

bay are not the only approach through which residents engage with the *algues vertes*, adding yet another layer of friction, both discursively and materially.

Toxicity as the means to arrive at an end

The attempts of these two civil society associations and the remarks of some research partners to actively undo and contest the toxicity of the Morieux bay stands in stark contrast to the *modus operandi* of the most prominent activist group in the area.

The group “Halte aux marées vertes” (HAMV) [Stop the green tides] was founded in September 2000 in La Grandville with their initial goal to fight against the green algae proliferation in the Saint Brieuc bay. From their founding moment on, they discerned the specific agricultural methods in Bretagne as the main cause for the algae production and therefore demand for an amendment of the agricultural sector to turn it more sustainable. Accordingly, they organised rallies, demonstrations, sensibilization walks on beaches and press conferences to highlight not only the toxic consequences of the green algae, but to especially outline the specific agricultural context in which they proliferate. Despite their strong reputation around its founding moment in 2000, their membership numbers declined over the years and during a talk with an organizer in summer 2024, they confessed that their events are scarcely attended. They mentioned a feeling of resignation accompanied by a conviction that the status quo would be unchangeable among residents around the Morieux bay and used this as an explanation for their decline in membership. This subsection seeks to highlight the reasons behind their declining reputation and support by examining their approach to the *algues vertes* and the toxicity of the Morieux bay.

The monitoring stations epitomize their differential approach: whereas three residents complained about the overrepresentation of the Morieux bay due to the results of the device, the activist group played a decisive role in their installation. One of their founding members claimed that he suffers health consequences from his chronic exposures to hydrogen sulphide because his house was near the beach of La Grandville. Accordingly, HAMV urged political representatives to install monitoring devices to document and demonstrate that the bay is exposed to chronic toxic gas emissions. After the death of the joggeur in the Gouessant estuary in 2016 members of the association descended on the next day to the specific location where the person died. Equipped with

breathing masks, ropes and hydrogen sulphide measuring devices, they documented gas levels reaching up to 380 ppm – rates proven to be lethal for humans (HCSP 2021).

Here, HAMV engage in “evidence-based activism” to not only tackle institutions from the outside but to actively engage in the production and dissemination of knowledge to achieve political change (Rabeharisoa et al. 2014). HAMV produces credential knowledge in form of hydrogen sulphide rates or by demanding more monitoring stations and combines them with experiential knowledge from one of their founding members. According to the authors, evidence-based activism can produce ambiguity between activists, experts and ordinary people because the focus on scientific evidence instead of political means such as demonstrations can lead to processes of depoliticization and alienation especially among those who identified with the struggle. This, however, is not the case in the Morieux bay and with the approach of HAMV because they never experienced a lot of public support in the first place. Instead, the demand for and production of evidence-based data reinforce the toxicity of the space – something that other residents actively try to unmake and unnotice. By referring to the main founding member of the activist group, one resident summarized it neatly: “We don’t like him, because he really made publicity, counter-publicity for the area, he appeared in the press, always criticizing and criticizing”.

In his book “Life in Oil” Michael Cepek (2018) equally mentions how oil as a topic of environmental destruction caused lines of friction and disagreements among the Cofán people in the petroleum fields of Ecuador. He described these frictions as “the fights oil was causing (Cepek 2018, 214). Among the respective actors in the Morieux bay, the green algae were equally a main driver for conflict. As it was the case among the Cofán in Ecuador, the conflicts in the Morieux bay also soon turned personal and often neglected the main topic of dispute: the oil or the green algae. The idea of belonging was also added to the conflicts surrounding the green algae. Several members of the activist group HAMV did not have a long historical affiliation with the Morieux bay and were often born in Paris, lived there for some time, or returned back to Bretagne after considerable amounts of absence. As it was the case among the Cofán, ethnic belonging also played a decisive role in the disagreements and some were accused of not being truly Cofán. In the Morieux bay these lines of frictions were not purely ethnic but rather regional and based on center – periphery hierarchies.

Interestingly, I find that the respective goals of the civil society organizations and the activist group HAMV are not so dissimilar. Both want to unmake the toxicity of the bay. However, the means to arrive at this end are strikingly different. The civil society organizations engage in actions and arguments that discursively and immediately detoxify the space to highlight the bay's liveability amidst toxic proliferation. The activist group in contrast strongly insists and reinforces the toxicity of the space in the first place only to arrive at a reduction of green algae and consequent toxicity at a later stage.

Green algae as drivers for friction

The final chapter of this thesis highlights of toxicity can become a driver for friction and contestation. First, the two main institutional bodies, the Agglomération and the Réserve Naturelle, operate and engage with the bay on two divergent ontological grounds. Their respectively different "political ontologies" (Blaser 2009) determine what beings in the bay are considered to be important and noteworthy, resulting in conflicts, containment and various forms of non-cooperation. The second major line of disagreement runs between two distinct groups of residents. On the one hand there are civil society associations and different residents who actively seek to cast off the bay's toxicity because they want to show that life beyond damage, strong smells and algae proliferation is easily possible. On the other hand, the activist group "Halte aux marées vertes" seeks to contain the arrival of green algae but for doing so, they first highlight and insist that toxicity is ubiquitous in the area. As opposed to the two institutional bodies, I argue that the line of disagreement between these civil societal actors are not based on political ontological lines but rather on the question of how a good life is possible.

In all of these ethnographic examples however, toxicity is not a neutral and agreed-upon term and state of being. Instead, the different actors have their different approaches. The Agglomération actively engages with it, the Réserve avoids and downplays it, the civil society organisations try to cast it off and the activist group reinforces it. Here, toxicity is not only contingent but also builds the ground for friction among the various above-mentioned actors.

Conclusion

This thesis presented various actors who engage with the *algues vertes* in the Morieux bay of Bretagne/France. The major scientific assumption on which the ethnographic research and the thesis was based is Fabienne Li's observation that "entities in the world are not fixed or constant" (Li 2013, 400). Instead, these entities, disregarding whether they are mountains or other geographical areas, need to be constantly remade and reenacted. I approached the Morieux bay from a similar vantage point and asked myself what practices the different actors apply to enact and stabilise the bay. Adding the green algae and the toxicity they emanate through the production of the gas hydrogen sulphide to the analysis, I tried to inquire and answer following research question:

How do different actors contribute to the making and unmaking of toxic space in the Morieux Bay?

In Chapter 4 "The production of toxic space" I outlined the practices through which the Agglomération Saint Briec produces this toxic space. The basis for how the institution perceives and determines the Morieux bay is a geomorphological document that highlights the areas where green algae reside and hydrogen sulphide is released. Thus, some sections of the beaches in the bay are divided and categorized as potential hazardous zones. The areas where the Agglomération can intervene to diminish the health risks are further marked. Permanently installed measuring devices on five beaches in the Saint Briec Bay indicate hydrogen sulphide levels in the respective areas. If a monitoring station passes 1 ppm (parts per million) the beach is closed through a communal order. This also occurred at the beaches St. Guimond and Hôtellerie in summer 2024. There, the toxic space was highly discernible because iron fences and warning signs visibly and materially demarcated the specific beach section where toxicity was considered hazardous. When I accompanied the employees of the Agglomération, different approaches and practices emerged to determine toxicity and decide where the toxic space becomes most hazardous. Instead of relying on quantitative data derived by the permanently installed monitoring stations or the personal hydrogen sulphide detectors, the Agglomération predominantly relied on an array of sensual and "bodily knowledge" to determine the toxic and hazardous areas of the beaches (Shapiro 2015, 370). The

employees put focus on pre-emptive sensing of harm by diligently observing where green algae move in the sea, inspecting the wind directions and examining the visual appearances of piled up algae. If they would only rely on the quantitative data provided by the monitoring stations, the institution's actions to remove decomposing piles of green algae would be too late. Thus, they need to sense harm long before it arrives (Auyero and Swistun 2010). After they determined the specific areas filled with potentially hazardous green algae, they remove them mechanically with excavators and tractors. They also envision or already apply other practices through which the toxic space is unmade or harm prevented before it arrives. These practices include amendments of rivers and riverbeds, siltation projects or the application of new collection machinery.

The consequent Chapter 5 approached the main research question from a multispecies lens by focusing on the perspective of the many birds residing in the Morieux bay and the Réserve Naturelle. Here however, the focus of the research question slightly changed from the creation of toxic space to the creation of natural space. This shift of vantage point resulted from ethnographic insights due to the prevalence of various more-than-human entities. The Réserve Naturelle engaged with this human and more-than-human assemblage through various different practices that create and reinforce the natural space. Through yellow buoys and various information signs they demarcate the territory under their jurisdiction. Within this space, the institution can enforce laws that prohibit certain activities such as putting up parasols, kite surfing or bringing dogs without a leash. Through the signs and sensibilization tours, employees and volunteers of the Réserve Naturelle inform beach visitors about the specificities of the controlled area and the sensitive biodiversity it harbours.

Through the perspective of the brant geese, a duck variety that the Réserve Naturelle attributes increased conservation importance, this chapter asserts that the green algae do not only pose toxic threats but also serve as providers of life. In the case of the brant geese, the algae serve as the main nutrition source for the birds. Here, the interrelated and dependent actions of the birds and the *algues vertes* can be described as “mutualistic alliances” (Chao 2021). In such multispecies situations, each species sustains the life of the other due to their strong interdependence. As Sophie Chao (2021) pointed out, these alliances often create and sustain space where the survival of the involved more-than-human entities is guaranteed. For the brant geese, the green algae

create living space due to their nutritional value. In turn, the importance the Réserve Naturelle attributed to the ducks prevents the institution from partaking in further actions to reduce the proliferation of green algae. Thus, the brant geese indirectly benefit the prevalence of green algae in the Morieux bay.

Chapter 6 “Frictions, contestations and counter-narratives” showed how diverging perspectives turn the Morieux bay into a contested territory. Here, the *algues vertes* become agents for frictions and contestations and stimulate articulations of counter-narratives about toxicity. The differing approaches of the two major institutions – the Agglomération and the Réserve Naturelle – form the major conflict in the Morieux bay. These disagreements are often not expressed through direct engagement but are rather characterized by non-cooperation, distrust and containment. The research showed that these conflictual standpoints are not due to personal reasons but are instead due to differing “political ontologies” through which the actions of the two institutions in the bay differ (Blaser 2009). Blaser (2009, 11) reminds that “bringing into being the entities that make up a particular world or ontology” often lead to conflicts between different actors. The previous Chapter 4 and 5 have outlined how the particular worlds or ontologies of the two institutions form. The ontology of the Agglomération is built on and primarily focuses on the toxicity that the green algae emanate. In contrast, the Réserve Naturelle predominantly creates and engages with the more-than-human life in the bay and rather perceives the Morieux bay as a multispecies site. As a consequence, the two institutions prioritize different entities in the Morieux bay. Whereas the Agglomération seeks to protect humans, the Réserve Naturelle seeks to protect the more-than-human life. The second major line of friction that I encountered during my research was among different groups of the local civil society. Various research partners from ordinary residents to civil society associations longed for a Morieux bay that is associated with anything else than the green algae. According to them, the decades of green algae proliferation have been overemphasized by media outlets and in turn created an image of the bay which does not represent reality. For them, the Morieux bay is full of life. In contrast, the activist group “Halte aux marées vertes” deliberately reinforces the toxic association of the Morieux bay and emphasizes the toxicity of the green algae. Through this strategy the activists seek to increase public awareness about the main causes of algae proliferation to amend agricultural practices and societal consumption behaviours. The approaches of the civil

society associations and the activist group are in stark contrast to each other and caused considerable disagreements among its members. These contestations and frictions are not singular. In their comic book, Inès Léraud highlighted the human and more-than-human casualties often lead to disputes and fights (Léraud and Van Hove 2019). In contrast to the disagreements between the two major institutions in the bay, the frictions among civil society actors are often based on personal and regional grievances before they become political and ontological.

Where does the multiplicity of toxicity lead to?

Besides examining how toxic and natural space is created and how diverging ontologies and opinions turn the green algae into actors for friction, the research highlighted one fundamental aspect of toxicity: its contingent characteristic. The Agglomération for example, focuses on the state of decomposition in which the algae produce the gas hydrogen sulphide. However, this gas is not equally toxic for the different beings that reside in the Morieux bay. Whereas several humans, dogs and wild boards suffocated, almost all the birds and the fish in the bay can survive the gas or partner up with them through mutualistic alliances. Additionally, as I highlighted in Chapter 6, even toxicity does not mean the same to all humans involved: the disagreements about the Morieux bay as a toxic space between the civil society associations and the activist group best illustrate this.

Commenting on his research about oil pollution among the Cofán in Ecuador, Michael Cepek noted that “life in oil may be deadly, but it is also a subtle, ambivalent and contradictory condition” (Cepek 2018, 9). While this is clearly applicable to the Morieux bay, it is important to emphasize that the green algae and their toxicity are much more than only ambivalent and contradictory. The green algae and the hydrogen sulphide are not a single entity or a single chemical (Adams 2023, 37). They are active and animate and, most importantly, are turning into a multiplicity of actors when “partnering in different ways with different things” (Adams 2023, 37). When they decompose and partner with humans, they are lethal. When they are still green, they are life providers for various birds in the bay, and when they are disseminating over the various beaches in the bay, they spark friction and contestation. Thus, the algues vertes and their accompanying toxicity need to be equally understood as “a kind of swirl” as Vincanne Adams describes

the herbicide glyphosate (Adams 2023). In this swirl, the green algae are a multitude of actors in an uncertain chemically and industrially altered environment.

However, the multiplicity of toxicity raises important questions beyond this research. When toxicity is highly contingent and is formed by “ontological multiplicity” (Adams 2023), how can toxicity be grappled with and made sense of in a world in which chemical compounds permeate all forms of life? Drawing on the findings of this research and putting the question in other words, does the concept of “toxicity”, or “toxic”, still carries any meaning when different actors engage and perceive chemical molecules through different thresholds?

At this point, it is helpful to dive deeper into some of the criticisms regarding one of the major theoretical assumptions of this thesis, the ontological “multinaturalism” put forward by Viveiros de Castro (1998). Vigh and Sausdal (2014) for example, argue that the ontological turns overemphasis on ontological radical alterity, often neglects the political reality that inhabits different worlds. In other words, by asserting that many natures and ontologies exist, proponents of the ontological turn risk to relativize between them. If we take a colonial ontology that is based on the eradication of land and life and juxtapose it to an indigenous ontology, is the inherent violence of the former then not sugarcoated behind just another ontological understanding of nature? (Todd 2016).

Moving back to chemoethnography, the concept “ontological multiplicity” applied by Vincanne Adams in their work (2023) on the herbicide glyphosate describes the multiple realities this chemical compound can take. In most instances, it causes cancer in human bodies, but it can equally act as an anti-corrosive on metal surfaces. While Adams’ work (2023) cannot be put in the anthropological category of the ontological turn as the author does not argue that multiple natural worlds exist, they still describe the multiple forms glyphosate takes and the worlds it inhabits. Clearly, this does justice to the specific ethnographic reality Adams accounts for. Nevertheless, it could also run the risk of overstressing and revitalising the toxic properties of the herbicide. In a similar approach, Alex Nading ponders on the “toxic world” and suggests that the “future of a toxic anthropology (...) lies in slowing down and working through the mess” (2020, 219).

Again, I critically ask if chemoethnographers can allow themselves to ponder on the multiple realities of toxicity? In a “permanently polluted world” can chemoethnography allow itself to be slowly “working through the mess” (Nading 2020,

219) and potentially not take a political stance? I remain doubtful. Other chemoethnographers, such as Max Liboiron rightfully reminds that “pollution is colonialism (Liboiron 2021). In other words, chemical pollution is inherently characterised by high degrees of violence exposed on humans and more-than-human corpses. Still, the question remains if chemoethnography should take a political position when they work amidst chemically altered worlds? Put in other words, does chemoethnography carry responsibility beyond creatively examining new assemblages between human and more-than-human lives? As the discipline of anthropology and its approaches are highly diverse, answers to these questions might also not be univocal.

Before I embarked on my research stay in the Morieux bay, I was committed to what Charles Hale (2006) coined “activist research”. This form of ethnographic research is based on a political alignment between the researcher and an organized group in a political struggle, often also entailing that the former provides qualitative insights to the latter. Accordingly, I reached out to the activist group “Halte aux marées vertes” (discussed in Chapter 6) prior to the research to offer them a more active role in my research process. However, during the research I became aware that the toxic reality in the Morieux bay is much more diverse. In other words, focusing predominantly on how the activist group works to diminish the toxicity of green algae would have fundamentally obstructed how other actors engage with toxicity.

After some time in the research process, the question arose whether chemoethnography after all can be politically aligned to a group in struggle? In one of the founding articles of chemoethnography, Shapiro and Kirksey (2017) suggested that one of the major focus points of this newly formed anthropological subdiscipline is to examine the emerging new social forms between humans, more-than-humans and chemical compounds amidst chronic pollution. To pursue this ethnographic proposition, political alignment with an activist group might not be the best approach for this. Nevertheless, there is no single motivation for chemoethnography. Anthropology overall is a manifold discipline. On their work on PFOA contamination in Vermont and New York for example, David Bond (2021) applied an highly engaged form of chemoethnography and organised free classes for residents to inform about the toxicity of this permanent chemical compound.

Thus, in an attempt to answer these important questions posed in this section and generally sparked by this research, I argue that chemoethnography can be an important tool for tracing the fundamental power imbalances caused by colonialism and late industrialism which result in ubiquitous chemical pollution in the first place. However, when chemoethnographic research seeks to position itself politically and take an active role in existing political struggles to contain chemical contamination, researchers might find themselves in awkward and ambiguous positions. In a “permanently polluted world” (Liboiron et al., 2018), toxicity is often utterly complex and remains intangible. Thus, if the chemoethnographer struggles against one toxic aspect, this approach might obstruct another aspect of toxicity.

This argumentation should not stumble into the trap of a “toxic” cultural relativism that would argue that all forms of toxicity are valid. However, the findings of the research in the Morieux bay highlight that toxicity entails much more than organizing against it. While the Agglomération undertakes any “bricoleur”-like attempts to reduce the toxicity of the green algae, the livelihood of the brant geese is threatened. However, the discipline of anthropology is well-equipped to attend to the complexities of the social world. Thus, I argue that chemoethnography is able to explore the emerging chemosocial human and more-than-human assemblages while also laying out the violent systemic structures that lead to ubiquitous chemical pollution in the first place. Often, the first step for solving problems is to acknowledge uncomfortable truths.

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