3 · An Anticolonial Pollution Science

Every morning when I put on my lab coat, I have decisions to make. How will we do science today? How will we work against scientific premises that separate humans from Nature, that envision natural relations as universal, and that assume access to Indigenous Land, especially when so much of our scientific training has primed us to reproduce these things? These are not theoretical questions—they are practical questions, questions of method-and-ethics (hyphenated because they are the same thing). Critique is important[1] but it can only take you so far when you are a practitioner trying to do work in a good way.

In *Molecular Feminisms*, Deboleena Roy (diaspora Indian)[2] recounts how her commitments to the laboratory presented "challenges of actually trying to apply feminist epistemologies and methodologies at the level of practices at the lab bench."[3] Roy chose to "address some big questions that both feminist scientists and scientist feminists may have in common. How do we continue with science after the critiques of science? How do we work toward biology that we desire? How are we to encounter matter? How can we bring questions of context with us when we do encounter this matter? How can we reconfig-

1 For an argument about the necessary place of critique beside action, see Hale, "Activist Research v. Cultural Critique."

2 See the introduction, footnote 10, for more on these designations. In short: rather than leaving (usually) white and settler authors unmarked as the unexceptional norm that does not have to introduce itself, I mark everyone with either how they introduce themselves in their texts or as unmarked if they do not introduce themselves based on their L/land relations or relationships to privilege. You might start to notice a pattern . . .

3 Roy, *Molecular Feminisms*, 11.

ure the relationship between the scientific knower and what is to become the known?"[4] Likewise, feminist scientist Banu Subramaniam (Indian)[5] asks how to bring about the goal of feminist science studies to "develop an experimental practice and method that does not overdetermine or prefigure its conclusions" and instead makes room for "imagination and gusto," reflexivity and reconstruction, in experimental biology.[6]

Roy and others show that a commitment to doing science in a feminist way places critique in a unique relationship to scientific method. As feminist geographers Nadine Schuurman (unmarked) and Geraldine Pratt (unmarked) write,

> "How" critique is expressed, as well as what its objectives are, is critical to achieving changes in any research area. We start from the position that many of the critiques of Geographic Information Systems (GIS) have aimed to demonstrate what is "wrong" with this subdiscipline of geography rather than engaging critically with the technology. Critics have judged the processes and outcomes of GIS as problematic without grounding their criticism in the practices of the technology. This follows a pattern of external critique in which the investigator has little at stake in the outcome. External critiques . . . tend to be concerned with epistemological assumptions and social repercussions, while internal critiques have focused on the technical. But there is a further difference. Internal critiques have a stake in the future of the technology while external ones tend not to. . . . We argue for a form of critique that transcends this binary by tackling enframing assumptions while remaining invested in the subject. To be constructive, critique must care for the subject.[7]

Care for the subject of critique is part of feminist methodologies.[8]

The most useful definition of care I've heard was articulated by CLEAR

4 Roy, *Molecular Feminisms*, 12.

5 The method of introducing people gets meta with this one: the section *Ghost Stories for Darwin* where Subramaniam introduces herself in various ways is about how she was taught to "encode cultural difference within the language of meritocracy" and understand racialization, gendering, and heteronormativity as part of scientific subjecthood and the tensions of having to/not/un-identify with aspects of that subjecthood. I did say these identifications are an imperfect method. How you introduce yourself changes with your audiences and this practice makes that static. Subramaniam, *Ghost Stories for Darwin*, 174 and 171–79.

6 Subramaniam, *Ghost Stories for Darwin*, 4, 5.

7 Schuurman and Pratt, "Care of the Subject," 291.

8 TallBear, "Standing with and Speaking as Faith." More on this is in the introduction.

member Emily Simmonds (Métis) during a lab meeting.[9] We were talking about killing animals for science and how to kill in a good way. Simmonds spoke of care as an affective relation whose leading ethic is to create attachments within infrastructures of inequity. These attachments are best described as obligations. What I like about this working definition is that it allows things like genocidal residential schools to be about care. Missionary care was often well intentioned, part of the "save the man, kill the Indian" Christian and settler state logics of colonial paternalism and annihilation.[10] They certainly made (violently) affective relations that made (blistering) attachments in infrastructures of (colonial, genocidal) inequity that the schools understood as their (Christian) obligation. From the position of conquest (of people, Land, and souls), genocidal care is an obligation. As feminist scholars Aryn Martin (unmarked), Natasha Myers (settler), and Ana Viseu (unmarked) point out, "Practices of care are always shot through with asymmetrical power relations. . . . Care organizes, classifies, and disciplines bodies. Colonial regimes show us precisely how care can become a means of governance."[11] Care is not inherently good.[12] It is an uneven relation and can contribute to and/or mitigate unevenness.

This is a crucial framing for attempting to change dominant science[13] while wearing a lab coat. All science has L/land relations, as discussed in the previous chapters. Some of these relations are colonial and we have to maneuver within them: there is no blank slate to start from.

9 One of the many things Simmonds researches is how uranium economies produce and amplify colonial geographies, primarily through concepts of consent, colonial infrastructures, toxic sovereignties, and the biopolitics of settler colonialism. She thinks about care a lot. During the lab meeting where she articulated her working definition of care, we were talking about our animal respect protocols. Since we deal with dead animals, and often kill animals, many of the definitions of care from feminist STS were not working for us. This meeting occurred in 2018. This definition builds on much existing work in feminist STS, which foregrounds power, obligation, responsibility, and ethics in care, in particular: Murphy, "Unsettling Care"; A. Martin, Myers, and Viseu, "Politics of Care in Technoscience"; Puig de la Bellacasa, "Matters of Care in Technoscience"; Schrader, "Responding to *Pfiesteria piscicida* (the Fish Killer)."

10 Grande, *Red Pedagogy*.

11 A. Martin, Myers, and Viseu, "Politics of Care in Technoscience," 628. While all authors are unmarked in this text, Myers introduces herself and her critical standpoint as "a settler living and working on stolen Indigenous lands" in Evans, "Becoming Sensor in the Planthropocene."

12 Murphy, "Unsettling Care"; Ureta, "Caring for Waste."

13 See footnote 77 in the introduction on why I use the term *dominant science* instead of *Western science*.

I remember doing my first plastic ingestion study on dovekies, not as a CLEAR member, but training under ornithologists. Over two hundred dovekies had been wrecked in a storm, meaning they died as a group, likely after being blown into a cliff and then drowning in the water below. At first, I thought the tiny, red, narrow fragments I found in their bellies might be plastics (what else is that red in nature?!), but then I saw the larger branched structure they'd come from—some kind of seaweed. I learned to hold judgment on unfamiliar things until I went through more dovekie guts and thus more of the environment they lived and ate in. Those clear "plastic" films? Bits of shrimp exoskeletons. I could learn about underwater landscapes I'd never been to through the dovekies' gizzards. Plastics were part of those landscapes. Especially green fishing line.

The warm feelings I had from learning about underwater landscapes stopped short when suddenly it occurred to me to ask: how did we get these birds? Did [our collaborator] just take them? Did we get permission? Accessing landscapes, underwater or otherwise, suddenly seemed shitty.[14]

Civic Laboratory for Environmental Action Research (CLEAR) is the land-based, feminist, and anticolonial environmental science lab I direct with between five and twenty-five collaborators. In CLEAR, we mostly count plastics. These plastics are often in the gastrointestinal tracts of animals caught for food, but we also sample plastics in water, in sediments, in ice and snow, and on shorelines. Many pollution scientists create counts that make thresholds seem like properties of Nature; 15 units of pollution are fine but 16 is too many (see chapter 1). But there are also ways to count that further an "epistemology where the relationship with something is more important than the thing itself. Inherent in this concept is the recognition that this person, object or idea may have different relationships with someone or something else."[15] The rest of

14 The lab stories that run throughout this chapter as well as other parts of the book are from various members of CLEAR, including myself. All stories are shared with permission.

The permission to obtain dovekies is tricky when it comes to the area around St. John's where the birds were recovered. Normally you would get permission from the Indigenous groups whose Land the birds died on, but the Beothuk were completely murdered by white settlers during the conquest of the island of Newfoundland. No one speaks on behalf of the Beothuk, so permission can never be granted. This inability to follow basic protocol in the face of genocide is a problem, and frankly one of the goals and achievements of genocide.

15 Wilson, *Research Is Ceremony*, 73.

FIGURE 3.1. Contents of a dovekie's gizzard and proventriculus (area between the crop and gizzard) under a microscope. Note the branched structure on the lower right. To horrified scientists seeing the state of the stage: yes, this was a scavenged microscope, and no, we were not using it to identify microfibers (though there are at least two in this image). This was early days. Photo by Max Liboiron.

this chapter shows how this can happen in a marine laboratory that is well ensconced in dominant and Western science while also conducting anticolonial science.

> *I've been working as an apprentice with a group of ornithologists, picking plastics out of the bellies of starved dovekies. We process more than one hundred birds, but one dovekie surprises us: D-156 (our 156th dovekie). I call over the biology student working with me to witness the number of plastics I am pulling out . . . 7, 8, 9 . . . ! Until now, about a third of the birds have ingested plastics, but only 1 to 3 plastics on average. . . . 32, 33, 34! . . . We pull out 50 plastics. Oddly, many are burned. We talk about D-156 for days. Maybe she got into a campfire and ate up its ashes. Maybe she got separated and then united with her flock. Maybe she was the only one who chose to eat items that weren't food when she was starving. When it comes time to analyze the data, the rest of the research team call her an outlier and talk about leaving D-156 out of the study, both because of her high number of ingested plastics, but*

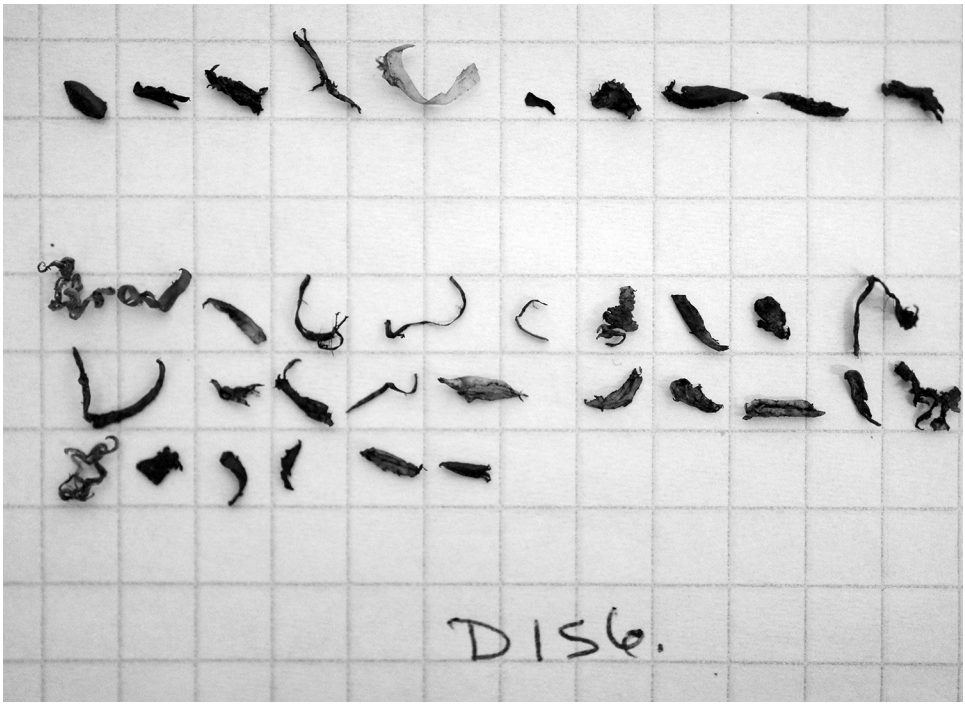

FIGURE 3.2. Some of the fifty plastics ingested by D-156. It is odd how they are all similar sizes and shapes. They likely came from the same place, and while we have many theories about what that place might have been (cruise ship garburator/incinerator, fishing-camp fire), there is no way to know. Photo by Max Liboiron.

also because of the odd burned plastics she ingested. I argue that D-156 is an extreme but quintessential example of plastic ingestion and while she had a different eating pattern than her flock, she was still very much part of that flock and its collective behaviours. D-156 stays in the final paper but is called an outlier.[16] *The burned plastics are mentioned in the paper but are separated from D-156 and her high plastic count so they stand alone, in aggregate and without context. D-156 isn't even named. Now that I run my own lab, we wouldn't have called her an outlier and likely would have given her more of a holistic portrait. Maybe like the one you just read.*

16 Avery-Gomm et al., "Study of Wrecked Dovekies (*Alle alle*) in the Western North Atlantic."

Making and Doing Anticolonial Science

The existence of D-156 presented us with a series of questions: Do we include the outlier, or not? Why? What kind of world do we describe either way, and to what ends? If we choose to include it, how? Do we use the statistical definition of an outlier, which depends on a normal curve, or do we note that D-156 was different? I'd never thought of outliers in this way before, though I was a feminist the whole time. Through our handling of dead birds, little red organic or plastic bits, specimen bags, tweezers, and the statistics of outliers, we find that we must be accountable to these things and their worlds in ways that don't always show themselves when we are theorizing at our desks and handling keyboards and books. Thinking at desks is still a way of doing, of course.[17] But when your hands are in someone's guts unanticipated issues tend to present themselves.

How?

Understanding accountability in practice *through* practice is a core strength of "making and doing" as a methodology in science and technology studies (STS), "a mode of scholarship that involves attending not only to what the scholar makes and does but also to how the scholar and the scholarship get made and done in the process."[18] The question of how is CLEAR's main concern. Scientists count plastics in animal guts with some regularity—*how* will we do it? Statistics happen every day—*how* will we do ours? And *how* will they be in good L/land relations? *How* will we do science in an anticolonial way, rather than merely with anticolonial intent?

This question of *how* is common in STS, which often asks how, exactly, is knowledge made? How does laboratory knowledge come to be? Through what inscriptions, conversations, or bumps against the machine? I don't mean this kind of *how*.[19]

For CLEAR, we mean to ask *how* the way Vanessa Watts (Anishinaabe and

17 See chapter 2, right around the text with footnote 110, where an Elder is talking about his computer as a relation, as a thing with spirit that we collaborate with rather than control and use.

18 Downey and Zuiderent-Jerak, "Making and Doing," 225.

19 The genre of study called "laboratory life" or "laboratory studies" was popularized by the French STS scholar Bruno Latour (unmarked), who is also really into nonhumans like door hinges. I'm pretty sure CLEAR's focus on *how* is not what Latour means when he follows scientists around for their how. Latour and Woolgar, *Laboratory Life*.

While I draw on these kinds of studies, I also depart from them in significant ways by foregrounding obligation, and specifically obligation to L/land as the primary frame for

Haudenosaunee) means it. She talks about the way dominant settler understandings of agency and worldmaking practices remove the *how* and *why* out of the *what*. The what is left empty, readied for inscription. . . . The man-made [*sic*] distinction between what and how/why is not an innocent one"[20] because it leaves the discovery of the how in the human domain. This is true even in what are called "multispecies" and nonhuman encounters in academia, "meaning that, although the dirt/soil has been granted entrance into the human web of action, it is still relegated to a mere unwitting player in the game of human understandings."[21] Like a pet, always loved but certainly in deficit. These are Nature relations that maintain separation, rather than Anishinaabe and Haudenosaunee Land relations (see chapter 1). Damn, I love that article.

How as Accountability

We mean *how* the way Shawn Wilson (Cree) means it when he says "the shared aspect of an Indigenous ontology and epistemology is relationality (relationships do not merely shape reality, they are reality). The shared aspect of an Indigenous axiology [ethics] and methodology [doing] is accountability to relationships."[22] Here, *how* is not a process. Careful. This is the tricky bit. *How* is a genre of relationality based in obligation.[23] As educator Dwayne Donald (Cree) explains, "This form of relationality is . . . an ethical stance that requires attentiveness to the responsibilities that come with a declaration of being in relation."[24] In a cosmology based on relationality-as-accountability, Wilson reminds us that "right or wrong; validity; statistically significant; worthy or un-

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scientific how. There are laboratory ethnographies by outsiders more aligned with this approach, such as Helmreich, *Alien Ocean*.

20 Watts, "Indigenous Place-Thought," 24; emphasis in original.

21 Watts, "Indigenous Place-Thought," 30.

22 Wilson, *Research Is Ceremony*, 7.

23 Some Indigenous reviewers (thank you!) have asked me, why do you always say obligation instead of responsibility? As I understand it, responsibility is a choice (you can take responsibility, or not), whereas obligation precedes you and is not a choice (you are obliged even if you don't take responsibility). For a mixed audience, I choose the heavier hand. If responsibility is in your or your Elders' vernacular, go for it. Terms like *accountability*, *obligation*, and *responsibility* have been heavily co-opted and will have different baggage for different folks. The way I understand obligation is that it is another way of saying gratitude, and gratitude is your gift to the world (water, relatives, food, sunlight, or Land for short) that gives you more than you can ever return. But I could be wrong.

24 Donald, "Indigenous Métissage," 535. Also see Donald, Glanfield, and Sterenberg, "Living Ethically."

worthy; value judgements lose their meaning. What is more important and meaningful is fulfilling a role and obligations in the research relationship—that is, being accountable to your relations."[25] This does not mean that relations exist and you are accountable to them through your actions, but rather that things are constituted by these relations (as articulated in much science and technology studies) and that accountability is the way to describe that constitution (which is common in many Indigenous theories).

When I think about the *how* of our science, I think about something my mentor and Elder Rick Chavolla (Kumeyaay) recalls his mother saying, "taking a chocolate bar out of your back pocket is a prayer." It's not that she loved chocolate in a holy way. (I think) she is saying that everything you do is a prayer, where prayer shows and reinforces our obligations and gratitude to Land. CLEAR member Edward Allen (Kablunangajuk) explains it another way: "Ceremony is about teaching and learning, and it reinforces and perpetuates what is meaningful to us. Ceremony can be prescriptive or a regular part of the maintenance of our well-being. With the danger of oversimplifying it, ceremony is an enactment of our values, guiding principles, and our prayers. Our prayers are the acknowledgment of what is sacred, and what is sacred is how we are connected to everything else"[26] . . . including back pockets and chocolate bars, Excel sheets and lab benches. This is what we mean by the *how* of science. We mean making and doing ceremony in science.

The other part of *how* is its undoing. As la paperson writes, "'How?' is a question you ask if you are concerned with the mechanisms, not just the motives, of colonization. Instead of settler colonialism as an ideology, or as a history, you might consider settler colonialism as a set of technologies—a frame that could help you to forecast colonial next operations and to plot decolonial directions."[27] As chapter 1 illustrated, scientists don't have to be racist or intentionally imperial to reproduce and enforce colonial land relations that use Land as a Resource, flattening and hoarding its relations for colonial goals while maintaining the violent erasure of Indigenous relations and bodies; Streeter and Phelps simply made some measurements that showed how rivers can assimilate pollution. So, too, with anticolonialism. It can also be understood as a set of technologies, or even protocols, that make different Land relations. Because colonialism is ongoing and must be maintained, these mechanisms are a crucial way to think about anticolonial work. They are at the core of CLEAR's theory of change.

25 Wilson, *Research Is Ceremony*, 77.

26 Edward Allen, personal communication, August 17, 2016.

27 paperson, *A Third University Is Possible*, 5.

Protocol

To centre *how*, CLEAR focuses on L/land relations at the scale of protocol. Yes, we think about (and survive) genocide, missing and murdered Indigenous women and girls, and land theft, but when you're standing at the bench with a beaker in your hand, those questions are hard to bring to earth. Protocol helps with this. When I say protocol, I use its double meaning in both science and ceremony to mean "the manner in which one approaches each and every element in our space"[28] as a manifestation of our values, survival, and goals, as axiology-in-practice. In a scientific laboratory, protocols are the scripts you follow to keep your controls controlled, your science replicable, and your findings valid. Step 1: Tie back your hair and put on gloves to avoid contamination. Step 2: Rinse the outside of the specimen bag in water before placing it in the sieve. Protocol also refers to guidelines for conduct during ceremony: bring the hosting Elder tobacco (loose cigarette tobacco will do, but leaf tobacco is better) in a red cloth bundle for the paarantii kaayash ooshchi;[29] present it in your open left hand and let the Elder take it from you. In both science and ceremony, protocols reinforce and perpetuate what is meaningful and right in an activity.[30]

Protocol can manifest in small ways. In one of CLEAR's protocols, for instance, we do not wear earbuds or headphones when we dissect fish, since they are L/land and it's rude to tune out your relations. Sometimes protocol manifests in more notable ways, like redirecting hundreds of thousands of dollars of federal grant monies to Indigenous-led research instead of settler-led research on Indigenous Land.

Feminist scholar Helen Longino (unmarked) proposes that "we focus on science as practice rather than content, as process rather than product, hence, not on feminist science, but on doing sciences as a feminist."[31] So, too, with anticolonial science, where we focus on doing science with an orientation to good L/land relations. The thing about protocols is that they are orienting technologies, pointing us toward certain futures that are good and right and true, rather than merely describing a series of actions or processes. The following protocol is excerpted from CLEAR's lab book:

28 Kealiʻikanakaʻoleohaililani, "Hawaii Environmental Kinship," 77.

29 Question: Hey, why don't you italicize the Michif? Answer: Because you italicize foreign languages and that would be English, not Indigenous languages. Italicizing a whole book minus these lines would be annoying. But I did think about it.

30 Whyte, Brewer, and Johnson, "Weaving Indigenous Science"; TallBear, "Standing with and Speaking as Faith."

31 Longino, "Can There Be a Feminist Science?" 52.

Processing the stomach:

1 Do not wear earbuds to listen to music while processing, as this separates you from the animal, who deserves your full attention and respect. You can play music from a speaker, and singing is particularly welcome.
2 Take a moment to think about the samples and where they came from.
3 Fill in the spreadsheet with the fish code (ex. PH13, NCCED18–01), today's date, the location the fish was caught, size, and sex if it is not already filled in. This will require you to look at the sample collection sheets or other documentation. Fill in your name, the date on the contamination control, and how you are feeling.[32]
4 Before opening each gut, wash your hands, backwash the sieve, and wipe down the tools, microscope lens & plate, and Petri dishes you will use. This will mitigate (not eliminate!) microfibers that have settled on tools through atmospheric deposition.
5 Stack the wide-grid sieve (if processing big guts) on top of the 5mm sieve on top of the 0.425mm sieve in the sink. The top sieve will catch the larger items and make visual inspection of the finer sieves easier. [Teaching moment: notice it says "finer" instead of "smaller" sieve? In science, it is important to get descriptions of relative quantities correct, so that size is not conflated with mass, mesh size, duration, etc. since they mean different things, have different relations.]

Even before we touch the fish guts, there are already several moments of orientation in these few moments of protocol: think about the fish, the land, and your relation to them. You don't have to be kin with the fish (though some of us are), but neither should you be thinking of the fish primarily as a specimen or scientific object. While the protocol asks a lab member to consider the fish or rinse the sieve, the lab member is also expected to think of other ways to respect the fish and reduce contamination—to become attuned to these relations and com-

32 Adding feelings to our data entry is a relatively new protocol for CLEAR and came about when we read *Data Feminism*, which highlights how data is often disembodied. Not only does our data entry and work attempt to highlight fish bodies but also the bodies of those doing the data entry. While we're not quite sure what we're going to do with this data, I've found it to be a source of surprise and generosity when I'm going through lab data and I see students are happy, struggling, or bored. It helps me take care of lab members (including reminding them to go home when they're sick) and helps us figure out where our practice and protocols are bogging down. D'Ignazio and Klein, *Data Feminism*.

port themselves accordingly, extending the protocol into new spaces to uphold the spirit of the script.

Whatever the scientific or ceremonial paradigm, protocols are enactments of our values and guiding principles, and they instruct us in how to reproduce what is good, whether that good is objectivity (sigh[33]) or good L/land relations, whether you're a settler with land relations or an Indigenous person with Land relations or something else. Sometimes protocols are prescriptive, and sometimes they are about the maintenance of everyday life, but they are always orienting you toward a particular horizon and away from others. They are reproductive technologies (see chapter 1).

Indigenous Sciences Are Different Than Anticolonial Sciences

"But I'm a settler! I can't do back-pocket chocolate-bar prayers! That's appropriation!" Good eye. Love you. I have been using Indigenous studies and science and technology studies scholarship from Indigenous writers to talk about a different orientation to science. By doing so, I've somewhat mushed together anticolonial science and Indigenous science though they are two different things.

Indigenous Sciences

Indigenous sciences are done by Indigenous peoples, full stop: "Native science is a metaphor for a wide range of tribal processes of perceiving, thinking, acting, and 'coming to know' that have evolved through [our collective] experience with the natural world."[34] Sometimes Indigenous sciences use methods, tools, theories, and frameworks developed out of Western and other non-Indigenous sciences, like the work of Robin Wall Kimmerer (Potawatomi).[35] Sometimes not. Sometimes they involve settler scientists. Sometimes not. Sometimes it is called Traditional Knowledge. Sometimes not. These decisions are an expression of Indigenous sovereignty over Indigenous ways of producing knowledge on Indigenous Lands, by Indigenous peoples.[36]

CLEAR does not claim to do Indigenous science, not least because most of

33 For a primer on how objectivity is a value-based concept that changes over time as Western societal values change, see Daston, "Objectivity versus Truth."

34 Cajete, *Native Science*, 2.

35 Kimmerer, *Braiding Sweetgrass*.

36 For more, see Geniusz, *Our Knowledge Is Not Primitive*; Kimmerer, *Braiding Sweetgrass*; Kawagley, *Yupiaq Worldview*; Kawagley, Norris-Tull, and Norris-Tull, "Indigenous

our members are white settlers. While some of our Inuit, Métis, and First Nations members certainly draw on Traditional Knowledge or local knowledge and certainly work from their worldviews and even with their families, communities, and homelands, we do not give this to academia.[37] Stacey Ann Langwick (unmarked) writes about a similar refusal within an NGO in Tanzania, where health clinics do not move their medical practices to Indigenous science even if practitioners' identities and knowledges might allow them to do so. She writes about how dawa lishe, a medical practice, "is not a return to, or even a nostalgia for, traditional African healing. It is, however, a refusal to forget in the present that African healing has long addressed humans and their environments together. . . . This is not a nostalgia for tradition but a call for memory, for a remembering that relations between plants, people, and place have not always been as they are, that they were reorganized through colonialism and continue to be stabilized through" colonial acts, such as Science.[38] This is not how CLEAR works, but it does point to how there are a variety of ways to do anticolonial science without essentialization or appropriation of Indigenous knowledges.

Worldview of Yupiaq Culture"; Knudtson and Suzuki, *Wisdom of the Elders*; and Dene Nation and Assembly of First Nations, "We Have Always Been Here."

Some argue that there is significant overlap between Indigenous and Western science and that they can be integrated, while others work to keep them uniquely separate, even if in collaboration. This is not an argument I will engage with here, except to say that—regardless of the possibility of overlap—academia is rarely an ideal place for Indigenous knowledge, or at least not the academia that I know and work within. It remains hostile to other ways of knowing, except as a source of cultural capital, curiosity, and value for extraction. It remains a Resource relation. This is the context in which I don my lab coat, and it is crucial not to lose sight of that context.

37 As discussed in chapter 1, the emerging drive in academia to capture, incorporate, use, and eat up Traditional Knowledge as a Resource is often another expression of colonialism and the settler and colonial entitlement to Indigenous Land (now with more knowledge!). This trend is why CLEAR *does not* claim to engage in Traditional Knowledge (TK) or Traditional Ecological Knowledge (TEK) collection or use. For more critiques of bringing TK and TEK into the academy and how doing so can reinforce colonial, academic knowledge systems even when that may not be the goal, see McGregor, "Traditional Ecological Knowledge"; Reo, "Importance of Belief Systems in Traditional Ecological Knowledge Initiatives"; Nadasdy, "Politics of TEK"; and Nadasdy, "Anti-Politics of TEK."

For Indigenous readers well versed in these topics looking for a little more nuance, I recommend Duarte et al., "'Of Course, Data Can Never Fully Represent Reality.'"

38 Langwick, "Politics of Habitability," 417, 421.

Navigating this line can be tricky. Of course, Indigenous lab members solve scientific problems in ways that align with traditional teachings and values. For example, after a CLEAR meeting where we discussed how we might discard fish guts in a good way after we had analysed them for plastics, people talked with their fishing families. This is Edward Allen's story:

> *I asked my Elder about "sharing" animal guts. After several moments he shared a memory starting in his childhood. It was my memory as well, and undoubtedly the same memory his Elder kept. When I was young, I was told to take what remains over to feed the dogs, or the birds in the summer months, and these other ones to another place so that the mice might enjoy them. Some were left to be reclaimed by the waters and all that lived below them, and some to go into the ground. As the memory travels through the generations, the only difference was how much there was to take. There was no such thing as waste. All was consumed by us, the animals we shared the land with, or the land itself. Everything is in movement. Even things that were still were gone by morning. Spreading what remains around ensured that they were shared efficiently, and that no remains were piled to the point of contamination. And while the delicacies found in entrails have been forbidden to me because of PCBs and other things from away, the remains still have purpose in the larger whole. They are part of sila and keep me, my Elder, and my Elder's Elder buoyant.*[39]

Edward's conversation with his Elder informed one small part of what is now a regular CLEAR practice: we return fish and other animal guts to the water when our part with them is done. We call this "gut repatriation," but its protocol is not written in the lab book.

Indigenous practices, while they certainly are part of how things happen in CLEAR, are not a shared knowledge system in the lab. As Laurelyn Whitt (unmarked) writes,

> a knowledge system can be defined in terms of four characteristics: epistemology, a theory of knowledge giving an account of what counts as knowledge and how we know what we know; transmission, dealing

39 This story was originally shared in a different version in a lab meeting that is not for public consumption. This written version was prepared for M. Liboiron et al., "Doing Ethics with Cod."

> with how knowledge is conveyed or acquired, with how it is learned and taught; power, both external (how knowledge communities relate to other knowledge communities) and internal (how members of a given knowledge community relate to one another); and innovation, how what counts as knowledge may be changed or modified. The systemic nature of knowledge is due to the reciprocal influence of these four characteristics upon one another: how we know, how we learn and teach, how we innovate, and how power figures in this are linked.[40]

It is not that Indigenous sciences constitute one type of thing, and that anticolonial sciences, Eurocentric or Western sciences, and other sciences constitute entirely different sorts of things. Parts of their different knowledge systems overlap.[41] Yet Indigenous sciences have fundamentally different obligations and structures of accountability than other sciences. For instance, CLEAR is not accountable to Edward's Elder, but Edward is, including on the issue of whether and how he shares his Elder's knowledge in the lab. I don't get access to Edward's Elder to ask whether I can share his story in this book: I ask Edward, who asks his Elder. Protocol helps us see our different orientations, different obligations. This is why there is an annoying split in writing out L/land relations in this chapter; some lab members are engaging in good Land relations according to traditional Indigenous teachings, instructions, and obligations, and some are engaging in good land relations as environmentalists, ecologists, ecofeminists, and Nature lovers. Sometimes those obligations overlap, and sometimes they are at odds.

When I think about maneuvering the sometimes overlapping and often-aligned but separate relationships and obligations between Indigenous sciences and dominant sciences in CLEAR (a.k.a. caring), I often think of the two-row wampum. The two-row wampum is a governing document made out of shells (wampum) that illustrates how settlers and Indigenous groups will coexist on separate but parallel paths heading in the same direction.

Of course, the paths are never separate: not in genocide, not in care, and not in anticolonial nor Indigenous sciences. Kim TallBear (Sisseton-Wahpeton Oyate)

40 Whitt, *Science, Colonialism, and Indigenous Peoples*, 31.

41 And not always in a good way. This overlap is a way to describe why Eurocentric sciences find it so easy to appropriate Traditional Knowledge—even if they do not understand that traditional knowledge is a way of knowing rather than what Indigenous people know, scientists can still extract what Indigenous people know, and call it Traditional Knowledge data. But there are also good ways to overlap, such as what Elder Albert Marshall calls Two-Eyed Seeing. See Bartlett, Marshall, and Marshall, "Two-Eyed Seeing and Other Lessons."

writes about how "the difficulties faced by the Native American bioscientists I interviewed cannot be understood within a dichotomy of 'traditional knowledge' versus 'science.' Rather, they can be better understood within a notion of 'harmony' versus the will to know. . . . Almost all travel home periodically, and do not necessarily have trouble reconciling ceremonial practices, or immaterial, 'spiritual' beliefs with the materialist explanations of science. These scientists seem comfortable themselves with having two different knowledge forms at hand to meet their different needs."[42] Here, difference is not the same as mutual exclusion.

These maneuverings work both ways. Not only are Indigenous scientists working to harmonize knowledge systems; so, too, are settler scientists working with aspects of Indigenous protocol. This story is by CLEAR lab manager Kaitlyn Hawkins (settler), who participated in her first gut repatriation ceremony[43] when we were done processing samples. While Indigenous members of CLEAR can burn sage, lay down tobacco, and raise up prayers during the ceremony in Indigenous ways, we also don't expect appropriation of those things. There are other ways to get it right:

> *While touching the guts when returning them to the ocean, we didn't wear gloves out of respect for the animal. I thought at first it would be extremely disgusting, getting blood and guts and some nasty fishy smells all over my hands. Surprisingly though, I didn't mind at all once I started. Don't get me wrong, some of the guts were incredibly messy and extremely smelly, but there was this sort of calm and gratefulness that came over me during the repatriation. I don't recall even smelling the guts (and I know they smelled bad from when I was packing them into coolers earlier in the day). It was just me and the guts and a feeling of peace and gratitude for what the guts had contributed to us.*
>
> *Often while working on guts in the lab, especially when I'm at the lab alone, I'll have a moment where I'll speak to the guts (and the animal that these guts came out of) and do my own kind of appreciation speech for the sacrifice that these animals had made for us (as both a source of food and for science). It felt very fitting that I was then a part of the repatriation, almost as if I were saying my goodbyes to these animals that I had grown intimate with (in a sense) from my work in the lab.*

42 TallBear, "Indigenous Bioscientists," 183.

43 Some (usually Indigenous) audiences have asked about the ceremonialization of this protocol. This protocol does ceremony more in the way that taking a chocolate bar out of your back pocket is a prayer than something more formal. Rick Chavolla (Kumeyaay), CLEAR's (and my) Elder advisor, helped us figure out how to return guts to the Land the first time we did it.

To be honest, I was nervous and wasn't sure what to expect before the repatriation. I wasn't sure that I really knew what I was supposed to be doing and how I was supposed to act. Those feelings quickly passed once we began, and I just sort of understood what it was that I was supposed to be doing and how to act. It's hard to describe in words how I felt, but I felt at peace with returning these guts back to the land. I felt like we were doing the right thing by honouring them this way rather than just tossing them in the trash like a man from the wharf had suggested when he first saw us putting the guts in the water. It felt respectful, like it was the right and the best thing that we could do for the animals. It left me with an incredible sense of calm.

Once we had finished returning our guts to the land, we took a quick hike up the Sugarloaf Trail so we could get away from some of the hustle and bustle of the wharf and have a quiet moment. While standing on a cliff and looking out over the harbour and the ocean, we saw several humpback whales swimming in the distance. This was the perfect ending to the repatriation, showing us the circle of life and how everything in the ocean is connected. It further added to my feeling of calm and strengthened that we had done the right thing by returning the guts to the land. I am so glad I was able to experience and be a part of the repatriation!

One of the things that makes Kaitlyn Hawkins an extraordinary lab manager for CLEAR is her ability to make space for others, from whatever position they are starting from. In this quote and in many other ways, she exemplifies what Kim TallBear calls "standing with," where knowledge is co-constituted "in concert with the acts and claims of those who I inquire among,"[44] whether that is other lab members or fishes. Thank you, Kaitlyn.

Anticolonial Sciences

Anticolonial sciences, even when they run parallel to or overlap with Indigenous sciences and practices, make space for settler and other scientists as well as allies in unexpected places. The university's protocol for disposing of animal tissue, like fish guts, is to incinerate them as biohazardous waste. CLEAR had to get permission to deviate from this regulated practice. When I emailed the biosafety group at the university, I was ready to fight—I was requesting something counter to policy, to practice, even to regulation. They emailed back a one-sentence reply that said to go ahead, repatriate those guts. I was so surprised I nearly forgot to think of them as allies. Finding allies in unexpected places,

44 TallBear, "Standing with and Speaking as Faith," 5.

recognizing the many ways that "colonial schools become disloyal to colonialism,"[45] and understanding that power is not a monolithic wall to throw your soft body against are all important parts of an anticolonial science.

As is the case for Indigenous sciences, there are many different types of anticolonial sciences, and there are overlaps between anticolonial sciences and what we call Science(s), colonialism(s), resistance(s), and L/land.[46] None are monolithic or stable, but rather changing, moving, patchy, incomplete, plural, and diverse.[47] Often I hear scholars and activists alike talking as if capitalism (or patriarchy or racism, but mostly capitalism) is a solid monolith that we must dash our soft bodies against, to little avail. But that characterization gives capitalism and colonialism more power than they merit by erasing not only their diversity, but also the patchiness, the unevenness, and the failures of those systems to fully reproduce themselves.[48] It erases the other kinds of economies and L/land relations that happen within, alongside, and in spite of capitalism, the university, and colonialism. So let's not.

Even within dominant science, there are many anticolonial sciences: queer science,[49] abolitionist science,[50] Zapatista science,[51] feminist science,[52] anarchist science,[53] slow science,[54] anticapitalist and communitarian science,[55] and sci-

45 paperson, *A Third University Is Possible*, xvi.

46 The refusal to separate out who is in a land relation and who is in a Land relation, especially as these relations shift and overlap, is why the annoying L/land will appear for the rest of this chapter. It's ugly but it's truer.

47 For a similar discussion of capitalism, and how giving capitalism a monolithic architecture misses already-existing resistances against it, see Gibson-Graham, "End of Capitalism (as We Knew It)"; Peck, "Explaining (with) Neoliberalism"; and Neville and Coulthard, "Transformative Water Relations."

48 Thank you, Josh Lepawsky (settler), for your input about this problem in academic conversations. This also builds on the work of J. K. Gibson-Graham and la paperson. To extend this, if capitalism, the university, etc. are hard monoliths and all we can do is dash our bodies upon them, then the only form of activism is to become a bloody body. There is a greater diversity of activism. David and Goliath is a stupid model for change.

49 E.g., Mortimer-Sandilands and Erickson, *Queer Ecologies*; van Anders, "Van Anders Lab."

50 E.g., Rusert, *Fugitive Science*.

51 Duncan, "Zapatistas Reimagine Science as Tool of Resistance."

52 E.g., van Anders, "Van Anders Lab."

53 E.g., Thorpe and Welsh, "Beyond Primitivism."

54 E.g., Stengers, "Another Science."

55 E.g., Bencze and Alsop, "Anti-Capitalist/Pro-Communitarian Science and Technology Education."

ences from below,[56] among others.[57] So why not just say we're doing intersectional feminist and queer science, then? First, queer, feminist, and other sciences are not monolithic or stable either—some expressions of these sciences can be colonial in their entitlement to Land.[58] Foregrounding colonialism avoids the implication that queer or feminist orientations and obligations are automatically and simultaneously anticolonial orientations and obligations. An anticolonial science does not conflate and collapse different forms of oppression and resistance into one category.[59]

This specificity is also why we do not say CLEAR does decolonial science. Eve Tuck (Unangax) and K. Wayne Yang (diasporic settler of colour) write, "Decolonization, which we assert is a distinct project from other civil and human rights–based social justice projects, is far too often subsumed into the directives of these projects [talking about social justice, critical methodologies, or approaches which decentre settler perspectives], with no regard for how decolonization wants something different than those forms of justice."[60] Unlike anticolonialism, which can take many forms, "decolonization specifically requires the repatriation of Indigenous land and life. Decolonization is not a metonym

56 Harding, *Sciences from Below*.

57 There are many labs out there doing research with an orientation to good land relations. Here are just a few: the Technoscience Research Unit, Political Conocimiento Development Tools Lab, The Data Warriors Lab (forthcoming), Collaboratory for Indigenous Data Governance, Forensic Architecture Organization, Apology Lab, Global Witness Lab, the Mother's Radiation Lab—Tarachine, Dine No Nukes, Sitka Tribe of Alaska Environmental Research Lab, Indigenous Community Based–Health Research Lab: Morning Star Lodge, Te Koronga, Indigenous Futures, Fab Lab Palestine, Hyphen Labs: NeuroSpeculative AfroFeminism, Decolonial Sustainability Lab, UHURU Black Liberation Lab, Indigenous STS–Indigenous Peoples in Genomics Canada (SING Canada), INDIGI LABS, DREC (Digital Research Ethics Collaboratory), Ida Wells Lab, Onman Collective, Black Farmers Collective, Corp Watch, Black Mesa Water Coalition, Ngā Pae o te Māramatanga New Zealand's Māori Centre of Research Excellence (CoRE), Liberation Lab, and Feminist Approach to Technology (FAT) lab . . . among so, so many others. If you run a lab that works from anticolonial and other good land relations, please introduce yourself to me!

58 See the introduction for discussions of environmentalist and anticapitalist alignments with colonialism.

59 This is a key argument in Tuck and Yang, "Decolonization Is Not a Metaphor." I *highly* recommend reading it if you've ever claimed to decolonize something, or even if you are just attracted to the idea. Another good nuance is the second part of chapter 1 in Tiffany Lethabo King's *The Black Shoals*.

60 Tuck and Yang, "Decolonization Is Not a Metaphor," 2, 3.

for social justice,"[61] though I also acknowledge that different colonialisms will have different decolonialisms and anticolonialisms. Does CLEAR do decolonial work? Do we repatriate Land and Life? Sometimes/perhaps, but I don't think that is for public consumption. By my understanding, most of what CLEAR does is not decolonial.

Anticolonial sciences are characterized by *how* they do not reproduce settler and colonial entitlement to Land and Indigenous cultures, concepts, knowledges, and life.[62] They are not "about rescuing settler normalcy, about rescuing a settler future."[63] There are a lot of ways to do anticolonial science. For example, in "Being a Scientist Means Taking Sides," biologist Mary O'Brien (unmarked) contends, "There are infinite questions that you could ask about the universe, but as only one scientist, you must necessarily choose to ask only certain questions. Asking certain questions means not asking other questions, and this decision has implications for society, for the environment, and for the future. The decision to ask any question, therefore, is necessarily a value-laden, social, political decision as well as a scientific decision."[64] While this argument is ideal for teaching people about how values are inherent in the supposedly neutral, objective, and culture-free domain of dominant science, I found O'Brien's work while seeking scientific critiques of assimilative capacity (see chapter 1). As a professional biologist, she writes against the ubiquity of risk assessment as a dominant scientific framework to describe harm. In so doing, O'Brien implicitly argues against an entitlement to Land as a sink for pollution:

> By diligently preparing and analyzing data for risk assessments . . . scientists are participating in the process of assimilative capacity assessments and policymaking rather than alternatives assessments. Assimilative capacity assessments ask, How much dioxin is safe in the milk of an infant's mother? How much hazardous waste can be burned without raising the cancer risk to nearby residents by more than one in a million, or one in a hundred thousand, or perhaps one in ten thousand? . . . One could ask instead, What alternatives do we have to the industrial use of chlorine,

61 Tuck and Yang, "Decolonization Is Not a Metaphor," 21.

62 I used to say "lifeworlds" but I really mean bare life, as Tiffany Lethabo King reminds us: "Genocide—and the making of the Native body as less than human, or flesh—remains the focus and distinguishing feature of settler colonialism that is worth defining and analytically parsing for readers." King, *Black Shoals*, 56. Repatriate Land and *Life*.

63 Tuck and Yang, "Decolonization Is Not a Metaphor," 35.

64 O'Brien, "Being a Scientist Means Taking Sides," 706. This is an excellent teaching text if you are working with young scientists and engineers.

> which results in the placement of dioxin in an unborn embryo's tissues? What alternatives are available to reduce toxics use and generation of hazardous wastes and eliminate the making of cement by burning solvents and other toxics? What social and production alternatives do we have to cutting the last of our ancient forests? What is the least habitat we can take away from a species in trouble? . . . I contend that, in general, to ask risk-assessment questions rather than alternatives-assessment questions is to contribute to the currently dominant, but suicidal, assimilative capacity approach and practices of our society. Many industry associations adopt the assimilative-capacity approach, because the questions asked support extractive and polluting activities.[65]

O'Brien does not have to talk about Land, Indigenous peoples, or even justice to practice dominant science with anticolonial elements. As discussed earlier, "to be subject to anti-Indian technologies does not require you to be an Indigenous person."[66] Colonialism and its pollution affect a wide range of peoples. So, too, can a wide range of peoples engage with anticolonial technologies like the ones O'Brien discusses.

To be clear, anticolonial sciences are not just technical tweaks to dominant science. Anticolonial sciences function more like infrastructures, underlying "the ways knowledge-making can install material supports into the world—such as buildings, bureaucracies, standards, forms, [instruments], funding flows, affective orientations, and power relations."[67] I am proposing anticolonial sciences as knowledge systems, sometimes arrayed with, sometimes adjacent to, and sometimes explicitly against the knowledge systems of dominant science.

Because knowledge systems are based on reciprocal influences of how we know, what we learn and teach, how we change, and how power works, CLEAR does not operate by tweaking protocols (though we do that, too). We don't add a bit of land theory here, and work to be a little less elitist over there. Instead, we aim to transform every moment of every aspect of our research, from how we pay people, to sampling methods, to peer review, into good relations with L/land and against dominant scientific relations with L/land based in separation, universalism, maximum use, unfettered access, standing reserve, and proofs of harm (among other things). Leonie Pihama (Māori) reinforces this way of being and doing, linked to research and everyday life:

65 O'Brien, "Being a Scientist Means Taking Sides," 706.
66 paperson, *A Third University Is Possible*, 11.
67 Murphy, *Economization of Life*, 6.

> It seems that every day I get a request to meet or talk with organisations about how to "do" Kaupapa Māori Research Methodology. Starting point is that you don't "do" Kaupapa Māori. You live Kaupapa Māori. You live tikanga. You live te reo. You live as fully Māori as you can. You strive for rangatiratanga for our people. You seek to transform injustice and colonial oppression in all its forms. You live aroha, manaakitanga, kaitiakitanga. You honour mana, tapu, noa. You uplift & affirm mana wahine, mana tane, mana Tangata, mana atua, mana Whenua. Then we can start talking about what Kaupapa Māori Theory and Methodology really looks like.[68]

Compromise and Obligation

Compromise

Regardless of the specifics of your approach, doing anticolonial science within a dominant scientific context is simultaneously a commitment to dominant science and a divestment from it, which makes it uniquely compromised. Compromise is not about being caught with your pants down, and it is not a mistake or a failure—it is the condition for activism in a fucked-up field. Research and activism, scientific or otherwise, never happen on a blank slate. As a result, we are always caught up in the contradictions, injustices, and structures that already exist, that we have already identified as violent and in need of change.

During her activist research in Bhopal, India, after one of the largest industrial chemical disasters in history, STS scholar Kim Fortun (unmarked) reflects: "Idealized portraits of advocacy represent a certainty that is resolutely at odds with how environmental problems materialize on the ground, in continuing negotiations over what is real, what is past, and what is to come. Described in ideal terms, the advocate is never seen enmeshed in discrepancies, ambiguities,

68 Pihama, "It Seems That Every Day . . ." Are anticolonial sciences knowledge systems or methodologies? I don't really care. They are a commitment and an orientation, and they play out at multiple scales simultaneously, which means they do not focus on the scale of technical tweaks like adding more Indigenous people to the lab, to the readings, or as data collectors (since inclusion or diversifying empire does not change anything about structures, infrastructures, power relations, or L/land relations). Knowledge systems and methodologies are understood in different ways by different disciplines and groups, but they both look at scales that cover epistemology rather than just knowledge, ethics instead of just ethics review forms, and assumptions rather than truths.

and paradox. Nor is he seen trying to force fit the world into available political ideologies. . . . Idioms for ethics without full knowledge remain undeveloped."[69]

Compromise means maneuvering the "discrepancies, ambiguities, and paradox" of doing anticolonial science in a dominant scientific field, "trying to force fit the world into available political ideologies." Charles Hale (settler) argues that any act of resistance is "partly implicated in the very systems of oppression they set out to oppose,"[70] inadvertently reproducing parts of the system while challenging or changing others. There is no recourse to purity, where anticolonial scientific activism and resistance is outside of, free of, or separate from the colonial systems we seek to oppose.

In chapter 1, I mentioned that CLEAR no longer uses chemicals that require hazardous waste disposal, because hazardous waste disposal assumes access to Land as a sink. This restriction includes not using KOH, which in turn limits our ability to study bivalves, crustaceans, and other invertebrates for plastic ingestion since you need KOH to dissolve their shells. But recently, Liz Pijogge (Inuk), my main research partner in Nunatsiavut, said that she wants us to investigate mussels and whelks for plastics because they are key parts of traditional food webs. The compass that allows us to pick through this conflicted terrain is a commitment to good L/land relations and a commitment against reproducing colonialism. We don't have an answer yet, but we have a way forward.

It's a lot of work. In *Research Is Ceremony*, Shawn Wilson (Cree) writes:

> Like myself, other Indigenous scholars have in the past tried to use the dominant research paradigms. We have tried to adapt dominant system research tools by including our perspective into their views. We have tried to include our cultures, traditional protocols and practices into the research process through adapting and adopting suitable methods. The problem with that is that we can never really remove the tools from their underlying beliefs. Since these beliefs are not always compatible with our own, we will always face problems in trying to adapt dominant system tools to our use.[71]

69 Fortun, *Advocacy after Bhopal*, 52. Thank you, Kim Fortun, for the work you have done and continue to do. Your willingness to share ideas and ask questions with others, to learn from others (including your juniors), to stand up to others (including your seniors) has impressed me during our interactions. Thank you.

70 Hale, "Activist Research v. Cultural Critique," 98.

71 Wilson, *Research Is Ceremony*, 13. Also see Lorde, *Master's Tools*.

One response to this incommensurability is to move to Indigenous science, with its own knowledge systems. But what if you are rooted in and committed to dominant research paradigms?

Zoe Todd's (Métis) work is often about this in-between space (also about fish). Her work, as well as that of many other Indigenous scholars in academia, "attend[s] to the space between and across a) the Euro-Western legal-ethical paradigms that build and maintain the academy-as-fort (or colonial outpost), fixing it within imaginaries of land as property and data as financial/intellectual transaction, and b) Indigenous legal orders and philosophies which enmesh us in *living* and *ongoing* relationships to one another, to land, to the more-than-human, and which fundamentally challenge the authority of Euro-Western academies which operate within unceded, unsurrendered and *sentient* lands and Indigenous territories in North America."[72] The question is (and for many of us, always is): how do we do our research in this space between?[73] The answer will play out differently for settlers, and for different kinds of settlers and non-Indigenous people that aren't settlers, than for Indigenous scientists (and different kinds of Indigenous scientists!).

Obligation

Compromise is what happens when you have obligations to incommensurabilities. Incommensurability means things do not share a common ground for judgment or comparison; that is, "projects that simply cannot speak to one another, cannot be aligned or allied."[74] Anticolonialism within dominant science. Diversity work in a racist institution.[75] Humility in a tenure application. All are impossible bedfellows that are nonetheless crucial to pursue and indeed happen, yet should never be smoothed over or conflated in that pursuit. Tuck and Yang write, "An ethic of incommensurability . . . recognizes what is distinct"[76]

72 Todd, "From Fish Lives to Fish Law"; emphasis in original. A note on unceded land: Loretta Ross (Bimaashi Migizi), treaty commissioner of Manitoba, has explained that even treaty Land is unceded, for the Land was never available to be ceded to begin with. To give up ownership of Land is a colonial possibility, not one rooted in most Indigenous concepts of Land. Ross, "Treaties, Reconciliation, and Me."

73 This is not a new question. See, e.g., Fine, "Working the Hyphens"; Donald, "Indigenous Métissage"; Wilson, *Research Is Ceremony*; paperson, "Ghetto Land Pedagogy"; paperson, *A Third University Is Possible*; Moten and Harney, *Undercommons*; and Todd, "Refracting Colonialism in Canada."

74 Tuck and Yang, "Decolonization Is Not a Metaphor," 28.

75 Ahmed, *On Being Included*.

76 Tuck and Yang, "Decolonization Is Not a Metaphor," 28.

and what cannot be joined even if allied. In an anticolonial science, for example, "an ethic of incommensurability means relinquishing settler futurity, abandoning the hope that settlers may one day be commensurable to Native peoples."[77] At the same time, "We argue that the opportunities for solidarity lie in what is incommensurable rather than what is common across these efforts."[78] An ethics of working with and through incommensurable values, futures, and knowledge systems "brings these areas into conversation, without papering over the differences, but also without maintaining false dichotomies."[79]

I understand a commitment to anticolonial science as one rooted in incommensurabilities that nevertheless moves forward with, in, and around impossible bedfellows. Rather than erasing or smoothing difference, or claiming that something is incomprehensible because it does not align with what makes sense on my/our/your logics, or reaching resolution or consensus, I understand an ethic of incommensurability as one that digs into difference and maintains that difference while also trying to stay in good relations.

Admittedly, an ethic of incommensurability within anticolonial science is hard to wrap my head around. But only in theory. On the ground, it is easier because my obligations are clear. In the last chapter, I talked about how scale is a way to describe which relationships matter within a given context (e.g., gravity and capillary action exist for both elephants and viruses, but gravity matters more to elephants and governs their movements, while capillary action matters more to viruses and governs their movements). For obligation in the anticolonial science that CLEAR engages in (and I would guess for most forms of obligation), the relationships that matter are not between yourself and the system, but with the collective and systems. Obligations do not exist and are not enacted in atomized and individualized one-on-one relationships but in a diversity of relationships where some relations matter more than others.

> *I'm here because I'm a scientist and I need fish guts, plus I love fishing. I'm the guest of my friend and two men I've just met from Nain, the most northern settled town in Labrador, Canada. It's my first time fishing for Arctic char. I'm excited. But when I look around the boat, there is no fish bonker—that wooden stick you use to bonk the fish over the head. Uh oh. How do you kill the fish? I throw out my line so I don't catch anyone. The men are catching char after char, throwing them over their shoulders into the fish boxes and*

77 Tuck and Yang, "Decolonization Is Not a Metaphor," 36.
78 Tuck and Yang, "Decolonization Is Not a Metaphor," 28.
79 Tuck and McKenzie, *Place in Research*, 5.

casting out again without looking back. The fish suffocate. When my friend catches her first fish I ask if I can kill it. She nods. I grip the fish between my knees and I cut its throat, sawing and sawing away. My borrowed knife is dull. The skin is unexpectedly thick. Shit, shit, shit. I'm doing a bad job. The char is bleeding and bleeding all over me, but is still alive. I cut deeper and deeper, past its gills. Still alive. Shit. Past its eyeballs. Its head is nearly off. Still alive. I am covered in blood and flies. I throw the char in the fish bucket, where it bleeds out. Shit. The next time my friend catches a fish I cut deeper and faster. Still not good. She lands a third fish. I feel sick. I am going to have to keep sawing away like a shitty idiot. The boat driver interrupts his casting to pick the fish out of my hands by its tail and whack its head against the side of the boat. Dead. Thank god. I start catching fish and whacking them. Though only mine and my friend's. Turns out you don't slit a char's throat. You have to whack char. I really need to add that to the lab protocol.[80]

The way people in the boat were catching and killing char came from their relations. My (strained, evolving) methods of killing fish by slitting throats and whacking heads came from my obligations to my father, who taught me to catch and kill fish quickly; to my Elder, who taught me about good relations in general (including keeping a sharp knife); to my friend on the boat, who invited me to her home in Nain; to the men on the boat, who invited me onto the boat; and to the fish, who died. I killed my and my friend's fish, but not the men's. That was not my place. One of the men, who was accountable to his guest, showed me how to bonk the fish. The men had other obligations, too, that made them throw the char in the box as fast as they could—they had to fill freezers (theirs and other people's) in a place with acute food insecurity. Perhaps. I was a guest, so this is speculation and none of my business. The point is: different relations make different obligations, which engender different methods. This is not relativism, but a deep specificity based in place and in the relations to which we are accountable.

Community Peer Review

The first time I found plastic in a cod, I was thrilled. I remember seeing the small white plastic on my blue gloved finger, the elation of finally finding a fragment of plastic after looking through nearly a hundred stinky cod guts. Then I suddenly realized what I had done. I had found plastics in *cod*. In *Newfoundland*. Shit.

80 This story also appears in M. Liboiron et al., "Doing Ethics with Cod."

Since the sixteenth century, when colonial fisheries began in earnest on the island of Newfoundland, cod have shaped the socioeconomic structure of the colony and then the province, the colonial geography of where people live, and settlers' ability to sustain themselves.[81] In the 1970s, "the world's best funded, most prestigious, scientific fisheries management system"[82] managed the wild cod populations—a necessity as the province started to prioritize industrial-scale fishing. Spoiler: a change in scale from sustenance to industrial fishing is a change in relations that matter. The government scientists missed this. On July 2, 1992, the settler government declared the cod fishery had collapsed and called a moratorium on cod fishing. An estimated 9,000 to 10,000 fish harvesters and somewhere between 10,000 and 12,400 fish-plant workers lost their income in a province of 580,109 people.[83]

The cod moratorium criminalized sustenance fishing, which was central to ways of life and living in the province. When I walked into my first rural (here: "outport") restaurant in 2014, the only thing hanging on the wall was the newspaper article announcing the 1992 cod moratorium. When we talk about the moratorium in undergraduate classrooms, students who weren't even born in 1992 talk about it as if it's fresh in their memories. When I teach statistics and we're using temporal zones for analysis, students say "1992" is the sharpest temporal marker for any analysis of the island no matter what we are analysing. I don't think I've ever taught a student from the island whose family wasn't directly affected by the cod collapse. Cod matters here, and fisheries science killed cod.

And I just found pollution in a cod, as a scientist.

I remember staring at the little plastic fragment on my finger and thinking, "*How* am I going to handle this?!" What are my obligations? *How* do I not cause harm? Then I thought, "How would I know? I have to ask Newfoundlanders." CLEAR's community peer review process was born in that moment.

If colonialism is a mode of domination where settlers and colonial forces have access to Land for their goals, including the conduct of environmental research, then community peer review is a way to cockblock that entitlement.[84] Like traditional academic peer review, community peer review is a way to ad-

81 Ommer, "After the Moratorium."

82 Bavington, *Managed Annihilation*, 13.

83 Gien, "Land and Sea Connection"; Schrank and Roy, "Newfoundland Fishery and Economy."

84 Don't worry, I looked up *cockblock*, and it really is all one word. Makes sense not to have any extra spaces where things might wiggle through.

FIGURE 3.3. Community members looking at plastic samples as part of community peer review. Photo by Bojan Fürst (settler) from the photographic series *How We Do Science* (2018).

judicate and distribute knowledge that enacts the values of community self-evaluation, ethical procedure, and reliability of results. It is a way to meet obligation, with others, in context. But CLEAR's protocol for community peer review outlines a markedly different view of peers, ethical distribution, quality, and reliability than that of the academy. Yet the procedure of community peer review is quite similar to academic peer review: researchers share work with a community of peers (in this case, local fish harvesters and community members), discuss what they did, why they did it, and what they found, and the reviewers give input to make the work better and either deny or support its publication.[85]

For CLEAR, community peer review is about obligations to Land, including fish, fish harvesters, local ways of knowing, events of the cod moratorium, and more. The colonial assumption of many research practices is that researchers have a right to access Land for data acquisition. But researchers are not entitled to conduct research on someone else's L/land, whether it falls under private title or collective land claims or is part of homelands. Land is always part of a community, whether there are humans present or not. Feminist geographer

85 For a step-by-step, protocol summary of community peer review, see M. Liboiron, Zahara, and Schoot, "Community Peer Review." This document is a preprint and has not been published at the time of this writing.

Doreen Massey (unmarked) has critiqued "a persistent identification of place with 'community.' . . . What gives a place its specificity is not some long internalized history but the fact that it is constructed out of a particular constellation of social relations, meeting and weaving together at a particular locus."[86] We can extend this concept of community to include people who aren't human, materials, landscapes, events, obligations, and other types of relations.

One of the first steps in CLEAR's protocol for doing community peer review is to do your homework to "understand the wider historical and political context of the community."[87] While this can be met in part by "reading texts by Newfoundlanders about Newfoundland, reading local newspapers and Fishermen's Unions' annual reports," it is more important to hire "local graduate students and field technicians [from the community] to be part of the process."[88] Obligations to Land and community without locals are weird and unlikely, even impossible. For CLEAR, homework has helped us determine whether and which fish are part of the community,[89] as well as the legacies of fisheries science and food sovereignty that characterize CLEAR's research contexts and obligations. It also *must* precede any act of "outreach" to speak with community members, since having locals on the research team gets rid of the creepy "out" in "outreach,"[90] as it starts to blur (but never gets rid of!) the lines between the research community and the fishing community, and brings in more robust forms of accountability.

CLEAR's community peer review protocol does a variety of work, such as creating a way to recognize more forms of harm and violence beyond those usually thought about by science professionals or captured in scientific research designs (see chapter 2); making space for narratives about fish, food, and pollution beyond deficit models and damage narratives;[91] making space for guidance, analysis, and collaboration from experts outside of academia; and, perhaps most importantly for anticolonial science, setting the stage so that communities can refuse our research.

86 Massey, "Global Sense of Place."

87 M. Liboiron, Zahara, and Schoot, "Community Peer Review," 9.

88 M. Liboiron, Zahara, and Schoot, "Community Peer Review," 9.

89 Todd, "Fish, Kin and Hope." CLEAR's community peer review protocol is currently anthropocentric and is built for humans. We are working on a protocol that would also include others. Fish and others can communicate and have the ability to refuse, so this method should work more broadly. Stay tuned. See Wadiwel, "Do Fish Resist?"

90 If you've ever been the subject of outreach, you know what I'm talking about. All reachy and getting into your business.

91 Tuck, "Suspending Damage."

The term *refusal* in a research context refers to ethical and methodological considerations about how and whether findings should be shared with and within academia at all, as researchers often encounter information that might be intensely personal, fundamentally contextual, sacred, intended only for certain people, or needs to be earned.[92] Offering refusal is part of ensuring research is accountable to its relations. In refusal, rather than "the terms of accommodation . . . being determined by and in the interests of the hegemonic [more powerful] partner in the relationship"[93] such as academics, fish harvesters and villagers set the terms of how and whether research that impacts their communities should occur, be conducted, and circulate. Practicing refusal keeps community knowledge from being a Resource.

As such, refusal is affirmation and repair more than denial (though it's certainly that, too!). Refusal "is not just a 'no,' but a redirection to ideas otherwise unacknowledged or unquestioned."[94] It can highlight and address the strained relationships between academics and communities,[95] realign research values to local needs, benefits, and protocols, and, of course, bring attention to how the right to research is a colonial concept.[96]

We've been refused before. When CLEAR was conducting community peer review in a small fishing village, someone in attendance asked if we worked with the Department of Fisheries and Oceans (DFO), the federal arm tasked with regulating fisheries. It also happens to be the source of the fisheries science that

92 There is a strong and growing literature on refusal in Indigenous thought that articulates refusal as a methodology, an ethic, a politics, and a right. This work includes but is not limited to Gaztambide-Fernández, "Elite Entanglements"; Coulthard, *Red Skin, White Masks*; Grande, *Red Pedagogy*; Grande, "Refusing the University"; McGranahan, "Theorizing Refusal"; Moffitt, Chetwynd, and Todd, "Interrupting the Northern Research Industry"; A. Simpson, "On Ethnographic Refusal"; Zahara, "Refusal as Research Method in Discard Studies"; A. Simpson, "Consent's Revenge"; Tuck and Yang, "Unbecoming Claims"; Tuck and Yang, "R-Words"; Wadiwel, "Do Fish Resist?"; and A. Simpson, "Revenge of Consent."

93 Coulthard, *Red Skin, White Masks*, 17.

94 Tuck and McKenzie, *Place in Research*, 147.

95 Smith, *Decolonizing Methodologies*.

96 When I've presented the methodology of community peer review to mostly white settler audiences, especially those that work with Indigenous groups, people are discursively on board, but questions tend to stray toward techniques of ensuring research is not refused. That's creepy (see chapter 2 for more on creepiness as settler desire). Giving up the entitlement and perceived right to data is a central—the central!—ethic of anticolonial sciences. You will lose things in anticolonial research that you automatically get as a researcher in colonial modes of research (regardless of your heritage).

led to the 1992 cod collapse. It was clear that if we worked with DFO, we were not welcome.

This example is one of the rare explicit refusals we have encountered in community peer review. For the most part, people are good hosts. They ask us how we are doing and how our families are. They smile and say "welcome." It can be easy to confuse good hosting for consent. One of the crucial aspects of community peer review is that, like consensual sex, refusal can be indicated by something other than a clear "no." We have watched our colleagues' informants welcome them into their communities, feed them, give them places to stay, and then refuse at every other stage of the research by not showing up to interviews, coming late, saying questions or tasks are too complex, saying they don't know the answer to obvious questions, or telling researchers they should talk to so-and-so, who is unavailable because they are on the Land for the next three months, the local sell-out, or dead.[97]

It can be hard to see your obligations, especially when they are counter to your desires. But there are ways to help, with the collective, in context. Part of CLEAR's community peer review protocol is to have several note takers write observational notes during community review meetings (with consent!), writing what attendees did, what they said, how many there were, where they sat, what body language they displayed and if/when this changed, among other observations. These are our clues and cues to refusal. Then we read those cues and clues. Analysis is tricky. During an academic presentation, it's considered quite rude for someone to answer their cell phone. But in some of the small villages we've been in, it's normal. What if a community member says the work sounds important, and we should go do it in a neighbouring village? Is that an invitation to leave, or to extend the research? What if no fish harvesters show up? Is it because you are being refused, or that you didn't do your homework properly and there's a hockey game on that evening? (That's happened.) If you bring fancy tea biscuits to the meeting and no one eats them, are you being refused, or do local tastes run more toward Tim Horton's doughnuts? (That's happened.)

The answer is: if you are not from that place, you don't know.

This is why it is crucial to community peer review to hire local people as full researchers on your team, from the start and with a place in decision making and analysis.[98] There is no other way to do this method. No amount of reading,

97 For more on what refusal can look like, see A. Simpson, "On Ethnographic Refusal," 77.

98 The ideal here would be to hire so many, so often, that the community can do its own research and you make yourself obsolete as an outsider. That's our goal. That way, communities have a real choice to work with us, or not.

asking around, or observing will tell you. This lab story is from Saskatchewanite CLEAR member Alex Zahara (settler):

I was sitting in the back of a truck, surrounded by lab members as we returned to St. John's after our lab's first official public meeting. The meeting was held nearly twenty minutes away in a nearby fishing community, and as a PhD student at Memorial for just under three weeks, the late January evening was one of my first times out of town to visit rural Newfoundland. As the city lights grew bigger, I remember noticing how the snow contrasted so differently against the scattered grey of frozen ponds and the blueish black ocean waves, which I could see whenever we drove up a hill. Like many of the other CLEAR lab members, I'm a come from away (the local term used to describe non-Newfoundlanders) and the landscape was so different from the Canadian Prairies that I was used to.

Lab members explained to me that the public meeting was meant as a way of being accountable to the communities involved in our cod fish study. In practice, I observed that this meant taking on different roles: Max, the lead of the study, presented our findings and responded to most of the audience feedback; Charlie and Emily, who participated in data collection and analysis, stood near displays of sample plastics; and still others, such as myself, handed out surveys, took notes about demographics, recorded audience questions, mood, and responses. As a new lab member, writing notes at the meeting was important for learning about our audience (were they anti-plastic activists or local fishers? maybe overlap between the two?) and to better understand their concerns. As we sat together in the truck, we debriefed on what we learned through our respective tasks.

Being a science lab, perhaps it wasn't surprising that many of our initial observations were quantitative: there were more women than men attending the meeting (surely this was a feminist observation?[99]*), and the group was a near equal mix of both older and younger people. But as we continued driving along, we began pointing out more subtle happenings: Did you also notice that nobody sat in the front row? How about that people's arms were crossed? Did anyone else write down that people were really quiet at the beginning? These moments, however, often contrasted with what people said to us directly: people indicated support of our research findings, and also gave us suggestions for future research. As we approached campus, we quickly brainstormed reasons for this disconnect. And looking back, I think my top-of-the-*

99 LOL.

brain suggestions weren't totally helpful (maybe Newfoundlanders are just shy? Do they not typically like marine scientists?), though not knowing the place, perhaps this was to be expected.

At the time of this writing, our paper on how we conduct community peer review has been rejected by an open-source science journal that has a special section on peer review. The stated reason is that the method is not universally replicable. We're glad they understood the method! Peer review will always change based on the communities of peers doing the reviewing. The rejection itself is the proof.

On the bright side, several of CLEAR's scientific papers have passed both community and academic peer review and have been published. When I give presentations on community peer review, people often ask what would happen if publication were refused. The short answer is: We would follow the instructions of the community. We wouldn't publish. Perhaps the community thinks the knowledge is more properly held by the local fishermen's union than by a scholarly publication. Then that's where we put it. Research does not have to be published to be valid. This also means that community-situated research is risky for graduate students whose thesis might be refused. This method underlines how community-based research is not inherently lovely. It requires ethics that can cause loss, rather than only gain, for researchers. It must be so: otherwise it's a Resource relation.

So far, all of CLEAR's findings that have been approved and improved through community peer review have also been approved for publication (though if they weren't, would I be able to tell you?). We've had parts refused, been directed to new and different research questions, been told some of our analyses are wrong, and one group asked us to tell you: Atlantic cod tested from the island of Newfoundland have a lower plastic ingestion rate than cod tested in Norway.[100] All of these insights and requests have been honoured.

100 Apparently, Norway is one of Newfoundland's main competitors for Atlantic cod. This is the main metric that mattered during one community peer-review meeting. We now always include comparisons of the same commercial species in nearby places in our papers. Nuances like this, rather than total refusals, characterize most of our community peer-review feedback.

Place-Based Sciences

Community peer review is place-based, where "the relationship between an object and where it belongs is not simply fortuitous, or a matter of causal forces, but it is rather intrinsic or internal, a matter of what that thing actually is."[101] Place-based science is not unique to CLEAR. Historian Geert Somsen (unmarked) has written about a broader international movement where "the current emphasis on local contexts is not only opposed to a European picture, but also to the long-standing notion of science as inherently universal. In fact, the localist perspective has developed precisely as a reaction against such universalism: the idea that science is independent of the place where it is practiced (because of the universality of its knowledge or method), and that scientific practitioners are automatically united in a single global pursuit."[102]

An argument for the emplacement of knowledge, including scientific knowledge, has long been made in feminist science studies. One version of this argument is that it is impossible to distinguish an object of study from such tools of observation as microscopes and sensors that collect some data and not others.[103] The standpoint one is observing from, including one's own body, social location, history, and training, among other situating and emplacing factors, also shapes what one sees.[104] These insights about the emplacement of knowledge extend to obligation. If we make the things we observe, then, as Angela Willey (unmarked) asserts, "we become responsible not only for the knowledge we seek but for what exists."[105] This is not to say that place-based knowledge is inherently good. Indeed, colonialism is also a place-based practice. This is to say that place engenders a specific type of relationship with its own set of compromises and obligations that do not assume that universal laws govern L/land relations.

Judgmental Sampling

Some science speak: to count scientifically, you first must organize the world[106] so you can be sure that your count represents the thing you are trying to study. Sampling is one way to do this. Since you usually can't count every single instance

101 Curry, *Digital Places*, 48.

102 Somsen, "History of Universalism," 362.

103 E.g., Barad, *Meeting the Universe Halfway*; Murphy, *Sick Building Syndrome*.

104 E.g., Haraway, "Situated Knowledges"; Harding, *Feminist Standpoint Theory Reader*.

105 Willey, "World of Materialisms," 1008.

106 Counting and measuring make things. As STS scholar Geoff Bowker (unmarked) writes, "The database itself will ultimately shape the world in its image: it will be performative.

of what your study is gathering knowledge about, a sample is a subset of your population[107] of interest. A statistically good sample–population relationship allows you to generalize from your sample to the population. It allows your count to be of the world, writ small. You can never know if your sample is truly representative of the larger population or phenomenon, but sampling methods exist to make this as likely as possible. One popular sampling method is probability sampling. Probability sampling means that there is a known chance (probability) that each individual instance of the thing you are counting could be selected from the wider population of things. It is the gold standard of reducing count bias and ensuring that your count is counting the thing it says it's counting.[108]

CLEAR does not use probability sampling. Instead, we use judgmental sampling, where researchers actively choose what to include in a count. Our samples are biased (in the statistical sense of the term) by design. They emanate from a particular standpoint (usually called "expertise" in the statistical literature). Judgmental sampling is quite common in pollution science. If someone thinks their oil tank is leaking, they don't grid off their entire yard and randomly select some grid points to sample. This approach might miss the tank entirely but would represent the lawn overall quite well. Instead, they sample around the tank, and often only around the tank. In quantitative research design, that is considered a biased sample. And that's fine in science, so long as everyone knows that's how the count is organized.[109]

If we are only saving what we are counting, and if our counts are skewed in many different ways, then we are creating a new world in which those counts become more and more normalized." Bowker, "Biodiversity Datadiversity," 675. I am here drawing on a rich literature on the politics of counting and measuring, including the way counting makes worlds by determining what is worth counting, how things are categorized for counting (and what does and does not make the cut), and how the metrics of counts impact representations of realities. This includes Nelson, *Who Counts?*; Hacking, "Making and Molding of Child Abuse"; Desrosières and Naish, *Politics of Large Numbers*; Pine and Liboiron, "Politics of Measurement and Action"; Scott, *Seeing like a State*; Verran, *Science and an African Logic*; Verran, "Numbers Performing Nature in Quantitative Valuing"; and Porter, *Trust in Numbers*.

107 Populations, as Michelle Murphy reminds us, are political in part because of how they are created via sampling, counting, and other methods. Murphy, *Economization of Life*.

108 Random sampling is the most common version of probabilistic sampling. It's a methodology that holds that any subject in a population has an identical chance of being selected, so the ones you select are representative of the population.

109 The more science I do, the more I am aware that feminist "strong objectivity" à la Harding is already welcomed and even practiced in dominant scientific culture in various ways.

When we conduct plastic ingestion studies to see whether and to what degree a population of animals ingests plastics, CLEAR uses judgmental sampling by collecting the gastrointestinal tracts ("guts," for short) of animals that are caught for food by humans. Our work does not generalize (or seek to generalize) to animals, but only to the wild food portion[110] of the Newfoundland and Labrador human food web. People here don't eat sperm whales, so CLEAR knows nothing about sperm whales. We know a lot about cod, though. A study design using probabilistic sampling to investigate plastic ingestion rates in fishes would trawl (drag net) fish in a region using a random pattern. That study would be counting plastics in fishes[111] in the area. But we stand on wharfs where fish harvesters land their catch and ask for fish guts. "Hello! I'm a scientist at Memorial University. We're looking for plastics in fish. May I have your carcass when you're done, please?"[112] Because of this protocol, we only sample fish that are likely to be caught by lines and jigs.[113] This means we do not have certain types of fish in our samples, including those that are offshore, smart fish that got away once and no longer fall for lures, fish that have already eaten their dinners, or grandmother fish that tend to be wise and hang out at the bottom of the ocean.[114] We tend to sample the nearby, naive, young, hungry fish that local people eat. We sample freezers, not oceans. Thus, we study food, not fishes.

110 Wild food and country food are terms of art in the province (and elsewhere) that mean food you catch or pick yourself.

111 In science, *fishes* refers to many species of fish. *Fish* is singular for an individual fish, or a population of one species of fish. Trawling gets fishes. Sustenance fishing during cod season gets fish.

112 This is one line of a much longer protocol for gathering fish guts from harvesters. Thanks to CLEAR alum Jessica Melvin (settler), this protocol also includes cutting out tongues, cheeks, and britches (ovaries) from the carcasses we get and offering them back to harvesters as a thank-you for gifting us their guts. These parts are edible and even delicacies but are time-consuming to remove. We then keep the guts for ourselves and throw the rest of the carcass back into the water, where crabs and other life feed on it. We bag and tag the guts, take them back to the lab, and freeze them.

113 Jigging involves dropping a heavy line that has hooks along its length (the jig) into the water and jiggling (jigging) it so the hooks move up and down, snagging fish that swim by. The fish are hooked in the side, not the mouth. It is a method designed for fish-filled waters. I prefer line fishing.

114 Fisheries science now knows that grandmother fish—old females who have spawned often—are the key drivers of fish populations, since they lay more eggs and more of their eggs successfully hatch than younger fish. In fact, overfishing grandmother fish using trawls, which net from the bottom of the ocean, is one of the potential explanations for why the cod fishery collapsed in Newfoundland in 1992. Sustenance fish harvesters' tools

FIGURE 3.4. CLEAR members collecting fish guts at St. Philip's Harbour, Newfoundland. Photo by Bojan Fürst (settler) from the photographic series *How We Do Science* (2018).

Sampling for Sovereignty

We use judgmental sampling because our counts generalize to human food webs. We can thus say things about food sovereignty, even though we can say little about oceans in general. While there is high food insecurity in the province, particularly in parts of Labrador,[115] our anticolonial focus is on food sovereignty (Land relations) in addition to food security (access to wild food). While food security is about access to healthy food, food sovereignty is a broader concept about "the right of peoples to healthy and culturally appropriate food produced through ecologically sound and sustainable methods, and their right to define their own food and agriculture systems."[116] Food sovereignty, more than food se-

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are much less likely to hook grandmother fish than industrial bottom trawlers. See Bavington, *Managed Annihilation*.

115 Nunatsiavut Government, "Household Food Security Survey Results Released."

116 Via Campesina, "Food Sovereignty." Via Campesina is an international alliance of organizations of peasant and family farmers, farm workers, Indigenous people, landless

curity, is part of reproductive justice, which includes "how environmental contamination impacts the reproduction of cultural knowledge. . . . At Akwesasne [in southern Ontario], community members report a loss of language and culture around subsistence activities like fishing, which have been largely abandoned because of fears of exposure to contaminants. The generational reproduction of culturally informed interpersonal relationships has been affected as much as physical reproduction. . . . For many indigenous communities, to reproduce culturally informed citizens requires a clean environment."[117]

So, too, in Newfoundland and Labrador. Reproductive justice highlights "the uneven relations and infrastructures that shape what forms of life are supported to persist, thrive, and alter, and what forms of life are destroyed, injured, and constrained,"[118] in this case through traditional food and its contamination.

CLEAR's sampling protocol makes traditional and culturally salient food, rather than strictly fishes, legible as a sink. We ensure the phrase "for human consumption" appears in the titles and keywords of our scientific publications (as well as the name of the place fish were caught).[119] These food webs are not out there in the field, external to either laboratory or daily life. They are our food webs. Some lab members are from Nunatsiavut and NunatuKavut, some are daughters of fish harvesters, and most of us eat local fish (if we eat fish). The lab has a rule about samples: they must be eaten. We do not catch fish for science. We use fish caught for food, and we do science on the leftovers.

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peasants, and rural women and youth. It is one of the leading actors in global food sovereignty movements.

117 Hoover et al., "Indigenous Peoples of North America," 1648. See chapter 1 for more on pollution and the reproduction of Indigenous culture.

118 Murphy, *Economization of Life*, 141–42.

119 M. Liboiron et al., "Low Plastic Ingestion Rate in Atlantic Cod (*Gadus morhua*) from Newfoundland Destined for Human Consumption Collected through Citizen Science Methods"; M. Liboiron et al., "Low Incidence of Plastic Ingestion among Three Fish Species Significant for Human Consumption on the Island of Newfoundland, Canada"; Saturno et al., "Occurrence of Plastics Ingested by Atlantic Cod (*Gadus morhua*) Destined for Human Consumption (Fogo Island, Newfoundland and Labrador)."

Fish and the other animals we sample are, however, more than food. This section lays out the stakes of articulating cod, for example, as food rather than as a scientific object, but there are also stakes in articulating cod as more than food. Cod are also kin, animals, sentient beings, sovereign bodies, grandmothers, predators, and other things.

FIGURE 3.5. CLEAR's freezer with a box marked "food" to differentiate between guts and edible flesh from sampled fish. There is also a bag of cod skins for Grandmother on the left. Photo by Max Liboiron.

Universalism versus Generalization

Place Doesn't Always Travel

Place-based protocols do not lend themselves to the universal view of dominant science. CLEAR's sampling protocol doesn't always work elsewhere. For instance, on the island of Newfoundland we need fish harvesters to gut their catches on the wharfs so that we can collect the hundreds of gastrointestinal tracts we need. In Labrador, my fishing companions tend to gut the fish halfway home on the rocks on the shoreline, throwing the guts to seals. In Nova Scotia, they tend to take their fish home whole and gut them in the kitchen. Offering someone cod britches (ovaries), cheeks, and tongues as a thank-you isn't received as a gift everywhere. Our protocols—our methods of knowledge production—don't necessarily travel. Elder and CLEAR lab advisor Rick Chavolla (Kumeyaay) says,

> There are certain, very fundamental, elements about a colonial knowledge pursuit in general and it certainly applies to science, maybe in a way even more intensely than almost any other field. One is that there is a universality to it. When you discover something scientifically, it applies to anything, anywhere. You can go anywhere in the world and say, "Yes!

> This works! This is what truth is! Truth was here in this place, and truth will be the same someplace else." For us, that's so far from our truth, so far from our knowledge as Indigenous people. We know that for knowledge you *must* understand where you are.[120]

When I first arrived on the island of Newfoundland, I was trained in universal protocols for conducting shoreline microplastic surveys, designed to ensure that scientists can directly compare their findings to one another.[121] The standardized protocol tells you to scoop sand from the top of your quadrat (a little randomly sampled square on the shoreline). But the shorelines here are all rock and ice and snow. They are unscoopable. It is why the island of Newfoundland is called The Rock. Being good sports, we tried using the universal protocol on our rocky coasts but were "unable to procure small microplastics that other literature has demonstrated exists in marine environments"[122] because they either fall through the cracks or are swept back to sea without landing. In short, the universal protocol doesn't work on the island of Newfoundland.[123]

Generalization

If anticolonial sciences eschew universalism in favour of place-based methods, where does that leave the ability for knowledge to work outside of the place of its creation? How do we make a nonuniversal science trustworthy and useful in more than one place? Sometimes it simply does not happen, and that's fine—even good. But usually, even when knowledge is not universal, it is still generalizable. The theory of universalism, where "certain principles, concepts, truths, and values are undeniably valid in all times and places,"[124] tends to overdetermine what generalizable means. Generalizability is about commonality,

120 Richard Chavolla in *Guts*, a documentary directed by Noah Hutton and Taylor Hess. This interview is at 4:23 to 4:51.

121 The universal protocol is here: Lippiatt, Opfer, and Arthur, "Marine Debris Monitoring and Assessment"; EU-TSML (European Union Technical Subgroup on Marine Litter), "Guidance on Monitoring of Marine Litter in European Seas."

122 McWilliams, Liboiron, and Wiersma, "Rocky Shoreline Protocols," 485.

123 The article we published on our failed attempts to use the universal protocol is a strategy to mitigate universalism in science through means that science respects—peer-reviewed publication. Now, I can point to something that shows that universal methods in science do not work, simply and clearly, through proofs and numbers dear to the discipline. For more on how setting precedents in STEM is part of discipline-specific activism, see Gutiérrez and Liboiron, "Strong Animals."

124 Castree, Rogers, and Kitchin, "Universalism."

FIGURE 3.6. I dare you to scoop that. Near Middle Cove, Newfoundland and Labrador. Photo by Max Liboiron.

shared characteristics, and overlap. Things that generalize can still be place-based and have differences, despite similarities.

Tim Choy (unmarked) writes about two moves scholars typically use to deal with the tension between particularism and universalism. One is to subsume the particular into a master narrative, such as the universal We (as discussed in the introduction). The other is to steadfastly refuse the universal, including the project of trying to tie together things that matter at different scales. Choy writes,

> Both responses, whether universalizing or particularizing, seek solid analytic ground; and both find their ground through resort to a "one." This is so whether the one is the unifying one of the "all," or the irreducible particular one refusing subsumption into the general. The conceptual one and the empirical one are a conjoined pair, and both suffer vertigo without firm footing. . . . This might help us to imagine a collective condition that is neither particular nor universal—one governed neither by the "all" nor through the "one nation, one government, one code of laws, one national class-interest, one frontier, and one customs-tariff" that Marx envisioned, nor even the "one planet" of mainstream environmental discourse. Instead, it orients us to the many means, practices, experiences, weather events, and economic relations that co-implicate us at different points as "breathers."[125]

125 Choy, "Air's Substantiations," 11, 12. For more on the various politics of universalism and particularism and how they are mobilized in different ways and simultaneously to different political ends, see Choy, *Ecologies of Comparison*.

He argues that there are ways to think about locality, collectives, and scale that do not "find [their] movement through multiple scales and political forms remarkable in the first place."[126]

Two ways of evaluating whether research is trustworthy and useful in new contexts that attend to multiple scales—that is, the relationships that matter in context—are provocative generalizability and relational validity. Feminist scholar Michelle Fine's (unmarked) concept of provocative generalizability "refers to researchers' attempts to move their findings toward that which is not yet imagined, not yet in practice, not yet in sight. This form of generalizability offers readers an invitation to launch from our findings to what might be, rather than only understanding (or naturalizing) what is."[127] This is an orientation toward an "ought" rather than an "is," a normative orientation. Anticolonial science is an "experimental otherwise"[128] that uses science against scientific values of universalism, separation, domination, and colonization. As such, it is an ideal place for provocative generalizability because it necessitates the creation of new methods and methodologies oriented toward new horizons. It is normative. Getting fish samples from wharfs rather than the ocean and eating our samples allows us not only to talk about food sovereignty, but also to enact it, and thereby allow other researchers to think about how they might also enact food sovereignty, even when our protocols don't exactly work in their place. Publishing papers about how southern "universal" protocols do not work in the north is an invitation for northern-led,[129] place-based methods for shoreline studies that do not require southern landscapes—or scientists.

Another type of generalizability proposed by Tuck and McKenzie is relational validity, which is "based on paradigmatic understandings of the relationality of life."[130] They understand research as a mode of accountability to these relations, an accountability that dominant science has failed: "Ironically, the human induced collapse of ecosystems that has been enabled through non-relational understandings of validity is functioning as a form of the earth 'talking back' in ways that may compel the greater uptake of relational understandings and approaches to legitimacy in research and social life."[131] For example, a sample "disposal" method like CLEAR's that returns guts to the land ac-

126 Choy, "Air's Substantiations," 37.
127 Tuck and McKenzie, *Place in Research*, 229; Fine, "Bearing Witness."
128 Murphy, *Economization of Life*, 105.
129 Moffitt, Chetwynd, and Todd, "Interrupting the Northern Research Industry." Amen.
130 Tuck and McKenzie, *Place in Research*, 157.
131 Tuck and McKenzie, *Place in Research*, 157.

counts for and extends scientists' and fishes' L/land relations and is more valid as an anticolonial method than one that treats all animal tissues as biohazardous waste.

Another way to think about relational validity is how validity is tied to L/land relations and whether or not findings take up the L/land relations that matter in a place. One primary goal of this text has been to centre and nuance land relations in intellectual production so readers can use a form of relational validity in their own work: *how* are your actions and research accountable to L/land relations, both colonial and anticolonial? Do your methods, broadly defined, generalize in a way that aligns with the relationalities that are already in play? I quote Reviewer 2: "The principles [of CLEAR] are replicable even if the [place-based] practices are not. How would scientific practices in the Americas and other colonized regions change if all labs were required to understand what it is to do science in a settler-colonial context—to understand that both the practice of science extends from colonialism and feeds into it?"[132] And how might those changes feed into anticolonial research practices, scientific and otherwise?

Farewell, Good Luck, Generalize

I end on generalization and relational validity both because I think they are hallmarks of anticolonial sciences, but also because you have finished this book and perhaps found parts of it delicious. Perhaps it nourished you. Perhaps you have gobbled up parts and stashed others in the freezer for later. Perhaps it was gross and you spit it out. How might readers relate to this text and its ideas, once we leave the shared page?

Orientations, which come out of obligations, mean that you are facing in a particular direction with a specific horizon of possible action before you. Orientations are the condition of possibility for some futures and not others. Given the diversity of readers and their places, I do not presume to know which direction to point your feet in, but I do know which popular and available orientations reproduce colonial relations to L/land while also sounding like good ideas in academia. If the start of this text was about defamiliarizing and denaturalizing environmental pollution, then the end is about defamiliarizing and denaturalizing reading to make better compromises. What might a reading and citing

132 Reviewer 2, "Reports!," Duke University Press, March 17, 2019. Reviewer 2: Maarsi and much gratitude for these words, but more for keeping me accountable.

practice with an orientation to L/land look like? How do we look out for moves to settler innocence[133] when working across and within difference and how does that change if you are settler, Indigenous, Black, or something else? How do we account for diverse efforts at mitigating colonization from traditions that are not our own, especially if we're Indigenous?

Those weren't rhetorical questions.

This work will look different in different places, which have different relations: "Like colonization, which has shared components and instruments across sites but is uniquely implemented in each setting, decolonization [and anticolonialism] requires unique theories and enactments across sites. Thus, [colonialism] is always historically specific, context specific, and place specific."[134] I hope this book is not used as a Resource, but I do hope the tactic of foregrounding land relations in scientific disciplines to see how they might be "accidentally" colonial and the methodologies of CLEAR's particular anticolonial science generalize relationally and provocatively to your work and obligations. Though I do not have many things figured out, I hope these thoughts have made space for good relations. Maarsi to everyone who made this work possible and as strong as it could be, and to those who will build on it.

That's your cue.

133 You get two conclusions for the price of one. "Conclusion: An ethic of incommensurability, which guides moves that unsettle innocence, stands in contrast to aims of reconciliation, which motivate settler moves to innocence. Reconciliation is about rescuing settler normalcy, about rescuing a settler future. Reconciliation is concerned with questions of what will decolonization look like? What will happen after abolition? What will be the consequences of decolonization for the settler? Incommensurability acknowledges that these questions need not, and perhaps cannot, be answered in order for decolonization to exist as a framework. We want to say, first, that decolonization is not obliged to answer those questions—decolonization is not accountable to settlers, or settler futurity. Decolonization is accountable to Indigenous sovereignty and futurity." Tuck and Yang, "Decolonization Is Not a Metaphor," 35.

134 Tuck and McKenzie, *Place in Research*, 11.