

Encountering leatherbacks in multispecies knot of time

Michelle Bastian

michelle.bastian@ed.ac.uk

Exploring what it might mean to write in a time of extinctions, Deborah Bird Rose proposes that one must take seriously the way that "living beings call and respond; ethics are situated in bodies, in time, in place and necessarily, in encounter" (2013, 6). To write about extinction ethically, she suggests, is not to write in the abstract, but to understand how the confluence of forces making up this process might connect with the "present temporalities, localities, and relationalities of our actual lives" (ibid). In what follows, I offer my own attempt to take these words to heart and to write in response. My focus is the threatened extinction of the leatherback turtle, and how to understand this as something more than a crisis happening in a wide blue elsewhere.

Of course one of the difficulties of attempting this is that leatherbacks rarely enter into the great majority of people's lives with any directness. When I first encountered them it was as a potential object of research. I had heard of them, but just barely, and I had certainly never seen one. It seemed that in all

Bastian, Michelle. “Encountering Leatherbacks in Multispecies Knots of Time”
This is the pre-publication version of a chapter in van Dooren, T., D. Bird Rose, M. Chrulew (eds) *Extinction Studies: Stories of Time, Death and Generations* New York: Columbia University Press, 2017.

likelihood I never would, unless I somehow managed a trip to Costa Rica, or Trinidad, or Florida. So, as you will read for yourself shortly, building connections that might embed leatherbacks and myself in “shared, or partially shared, lifeworlds” as Rose suggests (2013, 5), ended up taking a circuitous route via clocks, filing cabinets, conference deadlines, journal articles, fellow commuters, YouTube videos and a walk along Edinburgh’s Water of Leith. While most of these elements will become clearer as this chapter unfolds, an explanation for why clocks appear in this list is in order.

I’ve come to be fascinated by what it is that clocks do, and particularly what they *might* do (Bastian 2012; Bastian forthcoming). Long detested as the device that surveils, enforces, admonishes, ignores and reduces, the clock nonetheless offers a fascinating window into some of the ways that processes of connection are facilitated and managed. By offering a mesh that encompasses the globe — in the form of Co-ordinated Universal Time (UTC) — clocks suggest that everything is, in principle, able to be connected with everything else. They promise that we are all together in the same moment, in the same ticking of the second hand. Increasing accuracy has been crucial to this process. Temperature, humidity, movement, sudden shocks, gravitational effects, electromagnetic effects and more call materials to respond, and when they do the clocks made from them become less accurate and less reliable. And so the process of creating this mesh of connection has been marked by the search for materials and devices that are less and

Bastian, Michelle. "Encountering Leatherbacks in Multispecies Knots of Time"
This is the pre-publication version of a chapter in van Dooren, T., D. Bird Rose, M. Chrulew (eds) *Extinction Studies: Stories of Time, Death and Generations* New York: Columbia University Press, 2017.

less likely to respond to the environmental conditions around them (Bastian 2014; Mann 2014).

Telling time in a time of extinctions poses different problems. A point highlighted by Rose (2012) in her account of the ethics of multispecies temporality. Focusing on sequence and synchrony, rather than accuracy and universality, she tells a story of the co-evolved relationships between flying foxes and eucalyptus trees. Rose describes the way that synchronies between species — where flowering eucalypts offer sustenance to the migrating foxes, who in turn pollinate the trees — sustain each of them through sequences of generational time. Neither sequence nor synchrony happen automatically but are embodied achievements. The flying foxes and the trees must find each other, and at the right times. As Thom van Dooren writes, sequences depend upon "real embodied generations - ancestors and descendants - in rich but imperfect relationships of inheritance, nourishment, and care" (2014a, 27-29). Neither do synchronies and sequences occur in isolation, rather multitudes of them bring together food and fed, pollinator and pollinated, traveller and medium travelled. In the case of flying foxes and forests, however, as both of their populations decrease these "multispecies knots of time" are fraying, threatening the functional extinction that precedes the actual (Rose 2012, 138). As this collection shows, these are only one set of knots among many. Rose's proposal then is that, with the loss of these relationships in a time of extinctions, time itself is being unmade.

Bastian, Michelle. "Encountering Leatherbacks in Multispecies Knots of Time"
This is the pre-publication version of a chapter in van Dooren, T., D. Bird Rose, M.
Chrlew (eds) *Extinction Studies: Stories of Time, Death and Generations* New
York: Columbia University Press, 2017.

What then of the clocks that so often chart our way through
relationality? Why summon them here to guide us into a story
of turtles? Only a hunch and a hope that they might one day
work differently. All clocks are not the same after all. Within
research on circadian rhythms, for example, the environmental
conditions that promote responses from body clocks do not
threaten time's accuracy as they do for their namesakes.¹
Instead elements of daily life which affect embodied time, such
as light, temperature, eating, and socialising, are known as
zeitgebers or 'time givers' (Pittendrigh 1981). For these clocks
time cannot exist in isolation but is given in relationship. Here
accuracy is not about keeping to a regular disinterested beat,
but adjusting to the shifting cycles that make life possible. At
the heart of this chapter, then, is the question of what happens
when the experiences of leatherbacks are drawn into everyday
experiences and further, once there, what kind of 'time givers'
might they prove to be?

4

Tuesday, 8th February 2005

8:01pm

My partner and I have just moved to Sydney and have been in
our new flat for only four days. The four years of my Ph.D.
stretch out unknown before me. We are just arriving home from
getting the groceries and we pause on the side entry to look out

¹ Though also see Kevin Birth's critique (2014) of the way the metaphor of
the clock has led to misunderstandings of how these body 'clocks' work.

Bastian, Michelle. "Encountering Leatherbacks in Multispecies Knots of Time"
This is the pre-publication version of a chapter in van Dooren, T., D. Bird Rose, M.
Chrulew (eds) *Extinction Studies: Stories of Time, Death and Generations* New
York: Columbia University Press, 2017.

over Coogee Beach. It is a new moon and the ocean is dark. We wonder, like we always will, what might be happening out there, over the water.

Nine years later I find out. Trying to retrace where I was on that date at that time, I shuffle through filing cabinets, flip through appointment diaries, and consult old rental agreements, as well as weekday and moon phase calculators.² Playing the game of 'where were you when this happened?', I collude with the clock and its promise of an all-encompassing time. It offers me a retroactive synchrony that connects that place with another, allowing a leatherback to weave its way into my life.

5

Because at the same moment that we are standing there, out over that water, on the other side of the Pacific, on another beach, leatherback turtles are hauling themselves up onto land (Shillinger et al. 2010, 222).

Over in Playa Grande, Costa Rica, it is 3.01am. The local time is different but the darkness of the ocean remains, the new moon shared across the globe long before international time keeping agreements. Since October female leatherbacks have been congregating offshore, making multiple trips to the beach to nest. Laying between October and February links their reproductive cycles to the cycles of the ocean, with large seasonal eddies helping to pull hatchlings out to sea when they

² Specifically <http://www.timeanddate.com/date/weekday.html> and <http://www.moonpage.com/index.html>

Bastian, Michelle. "Encountering Leatherbacks in Multispecies Knots of Time"
This is the pre-publication version of a chapter in van Dooren, T., D. Bird Rose, M.
Chrulew (eds) *Extinction Studies: Stories of Time, Death and Generations* New
York: Columbia University Press, 2017.

eventually venture forth (Shillinger et al. 2012, 1).³ Like my partner and I, the turtles have also been watching the moon, often preferring to wait for a dark night like tonight before making the risky trip onto land.

Aware of these cycles and hoping to play some role in their continuation, human researchers have congregated on the beach. They are responding to the threat of the leatherback's imminent extinction. This threat had been announced five (long) years ago (Spotila et al. 2000). And this particular population of Eastern Pacific leatherbacks has declined by up to 90% in twenty (short) years (Shillinger et al. 2010, 215). In other places they have disappeared entirely. As Spotila et al. note, "leatherbacks had disappeared from India before 1930, declined to near zero in Sri Lanka by 1994, and fallen from thousands to two in Malaysia by 1994" (2000, 529). On Playa Grande there is still hope that the population will recover. This beach is one of their key nesting sites and has been designated as a national marine park since 1991. Egg-harvesting has been reduced and hatcheries have been created to save threatened nests.

But a focus on the short life stages spent on land can only do so much. The intensification of open sea fisheries in the eastern Pacific, including the use of longlines and gill-nets, has had a swift and massive impact. Drawn to the same productive upwellings out to sea, a new synchrony between turtles and

³ Research also suggests that the hatchlings do their own forms of synchronising, calling to each other while still within their shells in order to coordinate their crawl to the ocean (Ferrara et al. 2014).

Bastian, Michelle. "Encountering Leatherbacks in Multispecies Knots of Time"
This is the pre-publication version of a chapter in van Dooren, T., D. Bird Rose, M. Chrulow (eds) *Extinction Studies: Stories of Time, Death and Generations* New York: Columbia University Press, 2017.

humans, one in search of swordfish and the other, jellyfish, has created the conditions for the extinction of a species. Roland Brañas, a local fisherman from Chile, remembers that "before ever using nets, leatherbacks were extremely odd, some fishermen perhaps couldn't even tell them apart from other sea turtles" (Arauz 1999, 14). During the late 80s and early 90s, however, he estimated that each boat in his area would catch around 30 leatherbacks a year. As early as the mid- to late- 90s, Brañas no longer heard of them and the leatherback had again become rare (Arauz 1999, 14-15). Overall estimates suggest that fisheries "killed at least 1,500 female leatherbacks per year in the Pacific during the 1990s" (Spotila et al. 2000, 530). Both before and after, an encounter with a leatherback at sea was a curiosity, but while in one moment this rarity supported the continuation of life, in the other it signalled a decimation.

7

And so up on the beach researchers are attaching satellite trackers to the leatherbacks. The hope is that if they can track where the turtles go once they finish nesting, perhaps they can help undo this deadly sharing of time. Inspired by the TurtleWatch programme, which has helped longline fishers in Hawai'i avoid dangerous interactions with loggerhead turtles,⁴ the researchers here plan their own 'clocks;' ones which draw upon growing knowledge of how turtles move and their ways of reading the ocean as they search out their prey (Shillinger et al. 2008, 1414). If they can discover a pattern they will be able to suggest "dynamic time-area closures" be put in place in the

⁴ See <http://www.pifsc.noaa.gov/eod/turtlewatch.php>

Bastian, Michelle. “Encountering Leatherbacks in Multispecies Knots of Time” This is the pre-publication version of a chapter in van Dooren, T., D. Bird Rose, M. Chrlew (eds) *Extinction Studies: Stories of Time, Death and Generations* New York: Columbia University Press, 2017.

south-eastern Pacific like as those used by the Hawaiian TurtleWatch, where the boundaries of conservation zones are set, and re-set, based on current conditions and their likelihood of attracting turtles, rather than static geographical borders (Shillinger et al. 2008, 1409).⁵

Importantly, for Schillinger and co., this time-telling device is not being built in the service of connecting across distance, but rather to separate out human from turtle. Their turtle watch fosters *asynchrony*, using specific, embodied understandings of time to deliberately disconnect (Shillinger et al. 2011, 286; see also Benson and Ramohia 2011). As Brañas’ story suggests, the knots of time that support life may also need to be read in reverse – for the patterns of de-synchrony, dis-coordination and disconnection which may have been just as important for sustaining generational sequences of leatherbacks and others as the synchronies that Rose highlights.

8

When the time is right the tagging begins and so far this season four turtles have been added to the project’s growing list of tracked animals. Tonight there are two more: PTT ID 56268 and PTT ID 56280 (Shillinger et al. 2010, 222).⁶ PTT ID 56280 was first identified in the 1994/1995 season and has been seen back at Playa Grande four times since then. This year she first hauled

⁵ Since writing this paper, the Hawaiian TurtleWatch programme has itself been extended to cover leatherback interactions as well (Howell et al. 2015).

⁶ PTT stands for Platform Transmitter Terminals, which are used with the Argos tracking and monitoring system see (Benson 2012) for a discussion of the system’s development.

Bastian, Michelle. "Encountering Leatherbacks in Multispecies Knots of Time"
This is the pre-publication version of a chapter in van Dooren, T., D. Bird Rose, M.
Chrulew (eds) *Extinction Studies: Stories of Time, Death and Generations* New
York: Columbia University Press, 2017.

up on the night of the 17th of January and her last return will be
the 1st of March when she will end her time of inter-nesting
and head back to her foraging grounds. As she travels her tag
will send intermittent data to the Argos GPS tracking system,
with the researchers following closely all the while.

In the months and years after her tagging, turtle PTT ID 56280
starts to stand out in the analyses of this particular data set. I
first came across her in July 2012, learning something of the
poetry buried in the strict form of scientific papers. While all
the other turtles from Playa Grande headed out into the Pacific
towards the Galapagos Islands, Shillinger et al. reported that "a
single turtle in this study (tag ID 56280, tagged during 2005)
occupied exclusively nearshore foraging habitats along the
coast of Central America throughout the entirety of its tracking
duration (562 d)" (2008, 1411). Such a matter-of-fact tone, yet in
the midst of all the graphs and statistics, her journey insisted on
telling its own story. Its implications rushed out and ahead and
around. Why was she the only one? What had happened to all
the others? How many might there once have been? Did she
notice their absence?

I am not the only one to wonder. I trace hypotheses through
other papers that mention her. Given the large numbers of
leatherbacks caught in fisheries off Peru and Chile, turtle PTT
ID 56280 might represent one of the few remaining 'coastal'
leatherbacks from a population that is on the very edge of

Bastian, Michelle. "Encountering Leatherbacks in Multispecies Knots of Time"
This is the pre-publication version of a chapter in van Dooren, T., D. Bird Rose, M. Chrulew (eds) *Extinction Studies: Stories of Time, Death and Generations* New York: Columbia University Press, 2017.

localised extinction (Saba et al. 2008, 657). Given the diversity of migration paths utilised by other leatherback populations, it seems unusual that eastern Pacific leatherbacks would have only one (Shillinger et al. 2008, 1411). Indeed, these coastal leatherbacks might have been one of the most successful populations in the Eastern Pacific, with their foraging areas being more productive and, importantly, more predictable than the open seas of the south-eastern Pacific (Saba et al. 2008, 657). Eating well requires a particular confluence of temporalities. Being able to predict when and where food will arrive allows a more efficient use of your own resources. PTT 56280 herself was one of the largest tagged in this particular data set, she had larger than average clutches and reached areas where she could forage much sooner than other tracked turtles (Bailey et al. 2012, 7).

10

Even so, when a particular population has dropped by 90% or more in such a short time, and there have been little to no systematic records kept, how can such speculations be answered? As Karen Bjorndal and Alan Bolten argue, "many sea turtle populations of today are ghosts...of past populations" (2003, 16). Who knows how many ghosts might be accompanying PTT 56280 on her solitary journey? Excitement over 'soaring' numbers of nesting sites in Puerto Rico, where more than 1,700 were seen in the first half of the 2014 season (EFE 2014), pales in comparison to stories of thousands of nests in a single night on Playa Grande. But anecdotes like these are few, often forgotten or misremembered, and they don't

Bastian, Michelle. "Encountering Leatherbacks in Multispecies Knots of Time"
This is the pre-publication version of a chapter in van Dooren, T., D. Bird Rose, M.
Chrlew (eds) *Extinction Studies: Stories of Time, Death and Generations* New
York: Columbia University Press, 2017.

translate easily into the particular language of scientific practice
(Pauly 1995).

In an ocean thick with hauntings, what kind of clock could set things to right? Shillinger and co. hope that their complex of asynchronies will, supporting new forms of reckoning in this time of leatherback extirpations. If they can get it running, their clock promises to remove (some) dangers for (some) Eastern Pacific turtles. But to do so their research must be translated into politically viable objectives. The press release that does some of this translation work shows complexities already being smoothed over. In it, the unusual (and improbable) discovery that Eastern Pacific leatherbacks (or at least those who remain) "consistently follow a relatively narrow corridor out into the sea, past the Galapagos Islands and across the equator to an area in the South Pacific" is heralded as "the key to the leatherbacks' salvation" (Stanford University 2008, §2). As the title of the research paper describing this discovery suggests, "persistent leatherback turtle migrations present opportunities for conservation" (Shillinger et al. 2008).

What a relief to find a consistency within the context of so much loss, a stillness inside the chaos. PTT 56280 appears as an interesting oddity and the implications of her existence are left to future studies. Here and now the promise of a dependable and limited migration corridor is pragmatically given priority. It offers the kind of time that is most needed for knitting together the range of national and international bodies that

Bastian, Michelle. "Encountering Leatherbacks in Multispecies Knots of Time"
This is the pre-publication version of a chapter in van Dooren, T., D. Bird Rose, M.
Chrulew (eds) *Extinction Studies: Stories of Time, Death and Generations* New
York: Columbia University Press, 2017.

might support its continuation. Easier to negotiate with the
time of the living, perhaps, than with the time of ghosts.

Yet the ghosts refuse to be banished. I hear them quite close by.
The steady tick that offers (on occasion) a sense of safety, of
predictability and calculability, has been transposed into an
eerie clattering.

Tuesday, 9th July 2013

2:17am

I am far from home, cold, tired and anxious. My PhD is long
finished and home is now on the other side of the world in
Edinburgh. There it is 5:17pm. Once again the clock connects
me, weaving distant others into the present. Knowing the time I
can guess that my partner will be getting home from work
soon. Other homes in Edinburgh will be filling up with
returning occupants. Putting down their bags, making a hot
drink, thinking "what shall we have for tea?"

I have found my way back to Sydney, but to a time that is out of
synch. I sit at my desk, still awake. Almost everyone else is fast
asleep. The traffic has lulled, and the birds are quiet. A clock
ticks, steady when I listen out for it, but when my attention
breaks and I focus back on my screen it seems to move faster.
Suddenly it is 2:54am.

Tick, tick, tick.

Bastian, Michelle. "Encountering Leatherbacks in Multispecies Knots of Time"
This is the pre-publication version of a chapter in van Dooren, T., D. Bird Rose, M.
Chrulaw (eds) *Extinction Studies: Stories of Time, Death and Generations* New
York: Columbia University Press, 2017.

Hurry up, hurry up, hurry up.

You'll be late, you won't have any sleep, you don't have time.

I have travelled here to talk about leatherbacks at a conference on Animal Studies, but I still haven't written my paper and I'm presenting tomorrow. All the times when I could have done something, could have acted, could have been one of those well-timed and responsible academics, weigh heavily. The consistent and persistent version of myself is yet to be realised and, as usual, I have procrastinated and put it all off.

I think back to earlier in the evening, when I spent that extra half hour at the opening of the conference exhibition.⁷ Or the half hour afterwards waiting at my favourite vegetarian place for steamed dumplings. After I'd spent twenty minutes deciding what to get, enjoying the luxury of so many options.

Despite my pleas, the clock is implacable and won't return the time I've lost.

I am not alone in this time though. Others will still be awake, working on their presentations. All of us shrugging our shoulders at the gallery, colluding with each other to put it off a little longer. "It'll get written sometime." Now here we are, in this time outside of time, a synchrony of untimeliness.

Still the clock ticks.

⁷ See <http://intraactionart.com/>

Bastian, Michelle. "Encountering Leatherbacks in Multispecies Knots of Time"
This is the pre-publication version of a chapter in van Dooren, T., D. Bird Rose, M.
Chrulew (eds) *Extinction Studies: Stories of Time, Death and Generations* New
York: Columbia University Press, 2017.

Tick, tick, tick.

In a session yesterday, we wondered over the meaning of a magpie's song, but we never doubt the meaningfulness of this monotonous tick. Too early, too late, so bored, can't wait. The clock sings to us in its own way. It tells us stories of late trains, of exams, of cinema screenings, of job interviews, of grant deadlines (not a millisecond after 4pm).

We are told there is only one clock time, a rigid mechanical process that is "unaffected by context and seasons" (Adam 1998, 70). Your watch might be two minutes faster than mine, but that is not because it is like the magpie, calling us to see it as a unique, creative creature. It is simply because it is wrong. It has the wrong time.

14

But they once said that pied butcher birds only sung by instinct. Not convinced, a musician and researcher has spent years listened attentively to their song (Taylor 2008). The uneconomic practice of simply spending-time-with produces the 'sharp ear' that could move beyond hearing only mimicry and repetition (Taylor 2013). Individuals become distinct, and their song now rings clearly as the voice of a unique being exploring its world.

Maybe we haven't been listening to clocks attentively enough either. Maybe we've just been poring over their bones, clacking them together - clack, clack, clack - and thinking that we know

Bastian, Michelle. "Encountering Leatherbacks in Multispecies Knots of Time"
This is the pre-publication version of a chapter in van Dooren, T., D. Bird Rose, M.
Chrlew (eds) *Extinction Studies: Stories of Time, Death and Generations* New
York: Columbia University Press, 2017.

all there is to know about time and the rhythms that bind
beings together.

Our clocks promise they can keep us coordinated, that if we
plan sensibly, all will take place as it should. The lure of
persistent consistency still guiding understandings of how best
to act and respond in the face of existential threats. But what if,
in this time of extinctions, our hours are muddled, our dates
disoriented, our counting confused?

I hold the clock's bones in my hands, wondering how they
might work differently. Time is not what it once was and all
around rhythms are shifting and transforming.

It's now 3:41am.

The bones have started growing flesh.⁸

The cold pre-dawn has me lying on the carpet soaking up the
radiant heat from the underfloor system. I am reading scientific
articles, as precise and dry as ever. Despite the authors' best
intentions, I evade the long-lines of scientific rationalism.
Instead, the dark carpet in my room morphs into black sand. I
am on another beach, Tortuguero, on Costa Rica's Atlantic
coast. In this place the time is 'peak leatherback nesting season'
(Verísimoa et al. 2012).

⁸ This metaphor is inspired by Deborah Bird Rose's interest in "add[ing]
flesh to the relatively abstracted analysis of kinds of time and patterns that
connect" (2012, 128).

Bastian, Michelle. "Encountering Leatherbacks in Multispecies Knots of Time"
This is the pre-publication version of a chapter in van Dooren, T., D. Bird Rose, M. Chrulew (eds) *Extinction Studies: Stories of Time, Death and Generations* New York: Columbia University Press, 2017.

A jaguar ventures out of the cover of trees. She too is under the close eye of human researchers, tagged and tracked, as part of attempting to halt the fast downward trend of jaguar populations across the Americas (Carrillo, Fuller, and Saenz 2009). Tonight she is hungry and is seeking unusual prey – sea turtles. Until recently she had not needed to hunt this well-protected quarry. The forest was large and held many options for her. She could take peccaries, monkeys, agouti, or many different kinds of birds or fish. But the forest grows smaller and so do her choices.

Then, if you had asked her the time, she might have told you about following white-lipped peccaries from uplands to coastal forest to swamps, as the wet season turned to the dry (Carrillo, Saenz, and Fuller 2002). Or of hunting mornings and late afternoons when the peccaries were out foraging for their food, both peccary and jaguar resting during the mid-day heat (Carrillo, Fuller, and Saenz 2009). But with their numbers dwindling she has become attentive to a new rhythm. This clock does not signal through the shifting scents of ripening fruits, but via the sound of bodies, dragging themselves out of the ocean.

Ever the opportunist, she has begun to forge new relationships of predator and prey. To do this she has also had to forge a new time. She has noticed that the turtles arrive with the new moon and adjusts her sleep to coordinate with them (Carrillo, Fuller, and Saenz 2009, 565). Synchrony is made flesh in her desire to

Bastian, Michelle. "Encountering Leatherbacks in Multispecies Knots of Time"
This is the pre-publication version of a chapter in van Dooren, T., D. Bird Rose, M.
Chrulew (eds) *Extinction Studies: Stories of Time, Death and Generations* New
York: Columbia University Press, 2017.

sustain her own life. The beach now holds jaguar and turtle in a
fraught and fragile shared moment.

Usually she finds green turtles digging out their nests. But she
is early, the time not quite yet 'peak green turtle nesting
season.' Tonight, something huge and unexpected has hauled
itself out of the water. Not looking very much at all like the
others, she is still able to attack the leatherback's vulnerable
flippers and neck. Perhaps next year she will show a cub how to
take advantage of the unprotected flesh, who, in her turn, might
bring cubs to feed on this becoming-familiar prey. A new
synchrony in the present extending out towards new futures.

17

I later read that this is indeed what researchers in Tortuguero
have found, suggesting that the taking and sharing of turtle
carcasses may be "the result of a locally learned behavior,
passed down several generations, which [has] now become
prevalent across the jaguars living in the area" (Guilder et al.
2015, 71). Encroaching agricultural activities, including banana
and pineapple plantations, as well as illegal hunting in the
national park, have pressed jaguars into finding new food
sources.

But learning to kill a turtle also involves learning its
temporalities and spatialities, being in the right place at the
right time, hoping for prey that is both available and reliably so
(Arroyo-Arce, Guilder, and Salom-Pérez 2014, 1455). Like my
clock, the new moon promises the jaguar that if she keeps to the

Bastian, Michelle. "Encountering Leatherbacks in Multispecies Knots of Time"
This is the pre-publication version of a chapter in van Dooren, T., D. Bird Rose, M.
Chrulew (eds) *Extinction Studies: Stories of Time, Death and Generations* New
York: Columbia University Press, 2017.

right rhythms all will take place as it should. But how many turtles will survive and return next year? How much habitat will she have left? And what are conservationists to do when one endangered species starts eating another (Veríssimo et al. 2012)? While there is evidence that, unlike the Eastern Pacific leatherbacks, the turtles tied to these Atlantic coasts are increasing in number (e.g. Stewart et al. 2010), the Tortuguero population is still decreasing (Gordon and Harrison 2012).

Created year after year, synchronies become a sequence through generational time. Or at least they used to. Since the last great extinction event the tangle and weave of embodied time has grown increasingly ornate and precise, but here in the midst of another such event time is becoming threadbare. The forests, the peccaries, the jaguars, the leatherbacks – all are under threat. They will shift and adapt, seeking out gaps and openings that might remake the rhythms that support their lives.

And so time ends and time begins, different consequences rippling out for each of those bound up in the knot.

During the peak green turtle season, jaguars often leave much of the carcass untouched. Abundance means they don't need to take the time to laboriously claw out the hard to access meat (Guilder et al. 2015). Not seeing the point in letting the turtle meat rot, local people propose to the park management that they be given rights to the fresh carcasses (Campbell 2007, 322).

Bastian, Michelle. "Encountering Leatherbacks in Multispecies Knots of Time"
This is the pre-publication version of a chapter in van Dooren, T., D. Bird Rose, M.
Chrlew (eds) *Extinction Studies: Stories of Time, Death and Generations* New
York: Columbia University Press, 2017.

Unlike the jaguar they draw on centuries-long histories of eating sea turtles, including leatherback. But this request is denied. In a time of extinction a human encounter with a turtle is not supposed to be about food, but about tourism and research. Nesting season closes public beaches for locals, but opens them for foreign visitors taking advantage of gaps in their own time to "see the turtles" (Campbell and Smith 2005, 179). The new temporalities that press the jaguar and turtle into connection, disrupt and disconnect others.

Journal articles are scattered all around me now, here on the warm carpet. I reach for one at random and am swept out even further, all the way to the other side of the Atlantic (Witt et al. 2007). With the time now 'jellyfish season' the leatherbacks have shifted from prey to predator. They have been searching out the optimum conditions for jellyfish blooms. Conservation scientists are slowly piecing together the multiple factors each turtle attends to in order to be in the right place at the right time. Underlying search rules begin piling up: 'Ekman upwellings,' chlorophyll-a levels, sea surface temperature, eddies, swells, choppiness and currents.⁹ Unlike our own context-insulated clocks, leatherbacks' modes of coordination trace intersections between a range of dynamic environmental conditions.¹⁰ Constructing clocks of their own, but so different to the one ticking here in my room.

⁹ See Bailey, Benson, et al. 2012; Benson and Ramohia 2011; James et al. 2005; Hays 2008; Heaslip et al. 2012 and Witt et al. 2007.

¹⁰ I'm thinking here of Kevin Birth's use of the term triangulation where time is reckoned by "relating the intersection of different timing or cyclical

Once the blooms are found they can settle into methodically eating their prey, the sheer abundance of jellyfish allowing them almost to graze (Heaslip et al. 2012, 6). Like the jaguar their daily rhythms track those of their prey, rising to the surface at night and sinking down during the day (Witt et al. 2007, 237). While the jaguar's body has not yet invented an efficient way of getting into a large turtle's carapace, the leatherback's has had the time it needed to find solutions to its own problems. Jelly after jelly gets pulled into its spiny throat. Known for its immense size, a leatherback is nonetheless capable of eating its own body weight in a day.

The turtles are off the coast of Ireland, feasting on blooms of barrel jellyfish ten square kilometres wide (Houghton et al. 2006). Until the publication of Houghton et al.'s paper these consistent aggregations of jellyfish in the northeast Atlantic were unknown to science (2006, 1967). Indeed in the articles scattered around me, marine biologists and ecologists have been lamenting how little is known about jellyfish: when they bloom, how, why or where. Until very recently, there has been no funding for research and no interest from policy-makers in learning more about them.¹¹ They are a form of life humans seem to feel no need to synchronise with. Leatherbacks, on the other hand, draw on sequences 110 million years long, knowing

phenomena" similar to the "navigational practice of locating one's position in space by reference to three or more known locations (2014, 318).

¹¹ e.g. Doyle et al. 2008; Hay 2006; Houghton et al. 2006; Richardson et al. 2009. See Gibbons and Richardson 2013 for a more recent overview.

where to be, and when, in order to create the beneficial
synchronies that make futures.

Unlike the jaguar, however, the fear is not that the leatherback's
prey is decreasing, but that they might be exploding
exponentially.¹² Many of the human activities that have
contributed to the swift reduction in leatherback populations
might, perversely, be turning the oceans into a perfect habitat
for jellyfish (Purcell, Uye, and Lo 2007). Where once there were
stories of fish being so abundant that, during salmon runs,
rivers might contain more fish than water (e.g. Roberts 2007 45-
57), now jellyfish are shutting down tourist resorts, killing fish
farms and blocking intake valves for nuclear power plants (e.g.
Danigelis 2013). Clearing them from the Orot Rabin coal-fired
power station in Israel in 2011 required diggers and shipping
containers (Kwek 2011). As with fears of the rise of superweeds
on land, abundance is not absent but appears to be abruptly
shifting form.

Human fears don't always coincide with those of leatherbacks
though. Their nesting cycles are determined by the availability
of prey. Only after meeting their own needs do they start
storing away energy for the intensive work of egg-production
and travelling to nesting beaches. The time between visits is
thus different in different places. While Eastern Pacifics take an

¹² See Richardson et al. 2009 for example. More recent literature questions
this, suggesting that while there have been increases in localised blooms,
there is insufficient research to tell whether there are global trends towards
population increase (Condon et al. 2013)

Bastian, Michelle. "Encountering Leatherbacks in Multispecies Knots of Time"
This is the pre-publication version of a chapter in van Dooren, T., D. Bird Rose, M. Chrlew (eds) *Extinction Studies: Stories of Time, Death and Generations* New York: Columbia University Press, 2017.

average of 3-4 years to return, the Atlantics only take an average of two years (Stewart et al. 2010, 272). These different rhythms are thought to reflect the varying levels of unpredictability each face. The "more consistent foraging environment in the Atlantic basin," and thus the shorter time between nestings, may be one reason why the population there has a more positive outlook for recovery (ibid.). Increased jellyfish blooms might remake these cycles and transform the rhythms of leatherbacks' lives. Being able to build their energy reserves more quickly could allow more frequent returns to nesting beaches and larger clutches (ibid). Oceans filled with hauntings might replenish themselves, even yet.

22

Still, it is hard for conservation researchers to know. Data on jellyfish is patchy and often anecdotal. Their eerie physicality, so incorporeal that they are shredded by sampling nets, so massive they can capsize research boats, combines with their unpredictable and polymorphous life-cycles to discourage researchers from taking them up as objects of study (Schrope 2012). Lacking the time, money, methods and inclination, western science has shied away from learning what makes jellyfish tick.

Putting off the task of addressing the difficult questions animals pose is not unique to conservation (Buchanan 2007), but not making the time threatens to break time. In both scientific articles (e.g. Richardson et al. 2009) and the popular press (e.g. Gershwin 2013) the rise of jellyfish threatens to unmake time's

Bastian, Michelle. "Encountering Leatherbacks in Multispecies Knots of Time"
This is the pre-publication version of a chapter in van Dooren, T., D. Bird Rose, M. Chrulew (eds) *Extinction Studies: Stories of Time, Death and Generations* New York: Columbia University Press, 2017.

supposed dependability and calculability. The fear is that jellyfish might become so dominant that a regime shift could replace fish with jellyfish as "an alternative stable state in marine ecosystems" (Richardson et al. 2009, 313). Relinquishing its implacable forward movement, time (whose time?) threatens to stall and begin to run in reverse, looping the Anthropocene back around into the Cambrian (Richardson et al. 2009, 317).¹³ But it's hard to tell. Jellyfish are not included in the models, and simulations can't be run (Richardson et al. 2009, 320).

Unaware of human imaginings, jellyfish bodies react to the cascades of transformations altering the seas. They are not bound to our clacking bones, with their repeated incantation that everything will continue as it has ever done. Instead they have heard the perfect harmony sung by intertwining rhythms – overfishing, eutrophication, climate change, translocation of invasive species and sea bed destruction (e.g. Purcell 2012). They respond, move, bloom, die and wait, already reflecting back the times before anyone knew to look.

How long does it take to learn how to tell time differently? To evolve the sharp senses that are able to tune into multiple, contradictory rhythms, here, now, in our time of extinctions?

A quick glance at a clock face does not suffice. Jaguars learn to tell time with turtles over years and generations. Can we even

¹³ See Schrader 2012 for a critique of the use of these sorts of temporal moves in scientific research.

Bastian, Michelle. "Encountering Leatherbacks in Multispecies Knots of Time"
This is the pre-publication version of a chapter in van Dooren, T., D. Bird Rose, M.
Chrulew (eds) *Extinction Studies: Stories of Time, Death and Generations* New
York: Columbia University Press, 2017.

imagine how long it took leatherbacks to tell time with jellyfish?

We'll probably never know, these processes are shrouded in deep time and only occasionally read through inscriptions on rocks. We are, however, able to witness a new relationship forming knots in the time of leatherbacks, a 'geological moment' happening right before our eyes.

In 1968 an autopsy conducted on a leatherback gives the first recorded instance of plastics being found in the animal's gastrointestinal tract (Mrosovsky, Ryan, and James 2009, 288), offering a tentative date for the beginning of their fraught relationship. Since then just over 35% of leatherback autopsies have revealed plastics in their guts and, of these, they were the likely cause of death in around 9% of cases (Mrosovsky, Ryan, and James 2009, 288). Plastic might only kill a few outright, but this new relationship adds another indeterminate cadence to the lives of leatherbacks.

Trapped in their intestines, plastics slow the absorption of nutrients. The hope for increased nestings as a result of increased jellyfish populations is now tempered by an opposing rhythm. Abundance of a food source is no help if the ability to digest it is reduced (Mrosovsky, Ryan, and James 2009, 288). Here then is a new impediment that must somehow be coordinated with. Yet another fraught and fragile shared moment being created in a time of extinctions. How far into the future it will extend can't yet be said. As Alan Weisman writes, "plastics

Bastian, Michelle. "Encountering Leatherbacks in Multispecies Knots of Time"
This is the pre-publication version of a chapter in van Dooren, T., D. Bird Rose, M. Chrulew (eds) *Extinction Studies: Stories of Time, Death and Generations* New York: Columbia University Press, 2017.

haven't been around long enough yet for us to know how long they are going to be around for" (Weisman 2007, n.p.).

Ask why leatherbacks eat plastic and the obvious response seems to be that the floating, bilious plastic bags have simply been mistaken for jellyfish. But ask *when* leatherbacks eat plastic and the story becomes more complicated, and more interesting. One suggestion from research done in the Gulf of Gascony is that as their jellyfish prey decreases, leatherback's intake of plastic increases (Duguy, Moriniere, and Meunier 2000). In an abundance of jellyfish there is not much reason to risk trying this strange new variety of prey. But hunger shifts time, and once steady, predictable relationships give way to uncertain futures.

25

Continued life depends on risk-taking, on changing and adapting. The jaguar knows this and so too do leatherbacks. Would leatherbacks be here today if their own ancestors hadn't taken a risk and found ways of forging a beneficial relationship with toxin-laden jellyfish? By doing so, they were able to gift to their descendants a niche coveted by few other creatures (see Mrosovsky, Ryan, and James 2009, 287). Faced with their own new and unusual prey the leatherback's body is again being pushed to find novel solutions. And so, hungry and more open to forging new relationships, the leatherback takes a chance and bites.

Bastian, Michelle. "Encountering Leatherbacks in Multispecies Knots of Time"
This is the pre-publication version of a chapter in van Dooren, T., D. Bird Rose, M.
Chrlew (eds) *Extinction Studies: Stories of Time, Death and Generations* New
York: Columbia University Press, 2017.

Monday, 10th March 2014

9:20am

I am in Edinburgh, trying to write about leatherbacks again, but for the second time in a week the flesh of my palm is burning. This morning, on my way into work, a van came so close to my bike that I only had to reach out slightly to hit it in warning. I reacted so quickly that there was no time for thought, only feeling – threat, fragility, anger, self-righteousness. Knowledge of my right to be on the road turned visceral, demanding space and demanding respect. While the taxi that I lashed out at a couple of days ago moved aside, today the driver and his passenger only look at me blankly. Rather than delay their journey slightly, they are intent on getting through the space I am taking up and being on their way. They move even closer and I fall back, a slower traveller's demand for space and time overwhelmed by the demands of others.

26

Delay weaves its way through much of the research on leatherback conservation. The example of the torturous passage of U.S. legislation on turtle excluder devices, which reduce the numbers drowning in fishing nets, is one I've written about before (Bastian 2012, 44-45). General admonishments to avoid these untimely uses of time, and to work quickly and efficiently, seem to forget that these positives also cast the shadow of their negative image. After all the delay for the turtles was justified by shrimpers' own seeming efficiencies. And today in the traffic the focal point provided by the

Bastian, Michelle. "Encountering Leatherbacks in Multispecies Knots of Time"
This is the pre-publication version of a chapter in van Dooren, T., D. Bird Rose, M.
Chrulow (eds) *Extinction Studies: Stories of Time, Death and Generations* New
York: Columbia University Press, 2017.

conjunction of destination, traffic movements and desired
arrival time obscures everything else. Time narrows and the
expansive flow that might accommodate others is funnelled
away by the rush of battling through all that hinders you.

Take the risk, I tell myself, follow your own time, do it
differently somehow. And so, trying to avoid the focus that
loses perspective, I start out each day with a reminder to go at
my own pace. It becomes a mantra, 'go at your own pace, go at
your own pace'. But still I feel everyone's time pressing in on
me. It starts to become me and suddenly I'm chasing my own
deadlines, arbitrary though they are, and the living beings
around me become obstacles instead of fellow travellers.

27

Pedestrians scurry across the road in front of me, knowing
better than I do that they won't be given time to inhabit this
space with others. Try as I might I lose the expansiveness I
promised I'd hold onto and my burning palm reminds me just
how far it slipped away. My time is not my own, it is given to
me, absorbed by me and offered back to the world through me.

Sitting here now at work I'm distracted, and my hand hurts, so
I'm flicking around the internet, trying to find a way of
summoning up a connection. YouTube offers me the perfect
link bait – leatherback rescues. Quite amenably, I bite and am
reeled in.

Jumping from Newfoundland to Florida to Grenada I watch
people scrambling to help the tangled and the stranded. Fear

Bastian, Michelle. "Encountering Leatherbacks in Multispecies Knots of Time"
This is the pre-publication version of a chapter in van Dooren, T., D. Bird Rose, M. Chrulew (eds) *Extinction Studies: Stories of Time, Death and Generations* New York: Columbia University Press, 2017.

and concern lapping against each other as they try to figure out how to return this large strange creature safely back to the oceans (e.g. Vincent 2013; alinapphotography 2012). Groups of passersby collect around the scene — plans and destinations forgotten as the drama unfolds. Rusty knives, tarps and ropes are pressed into action and eventually the turtle is freed. Kind shouts follow — “get going buddy” — and, not quite ready to end the moment of connection and concern, those filming continue to scan the water hoping to see it safely on its way. Eventually, in boats and on beaches, those who stopped to help are released back into their own lives and times.

Turning back to my pile of articles I read of another video, although in this one the turtle is an obstacle to time, rather than the opening to a new one. Randell Arauz has been collecting stories of leatherbacks along the Pacific coastline of South America. His report lists the numbers of leatherbacks killed by longlines and gill nets and records attitudes towards interactions with leatherbacks, seeking to understand when a turtle is saved and when it isn't. He mentions a film that shows a fisherman dealing with a leatherback caught in the lines. The fisherman raises his machete to cut off a flipper so he can retrieve the hooks “in an easier and faster fashion, before being stopped” (Arauz 1999, 25). Given that many turtles captured by longlines may be found alive, Arauz sees in this moment the possibility for learning to tell time differently. Careful attention could reduce the numbers of turtles who die from the injuries sustained during gear removal (ibid). Thus while Arauz

Bastian, Michelle. "Encountering Leatherbacks in Multispecies Knots of Time"
This is the pre-publication version of a chapter in van Dooren, T., D. Bird Rose, M. Chrulew (eds) *Extinction Studies: Stories of Time, Death and Generations* New York: Columbia University Press, 2017.

suggests many are responsible for stopping the decline of turtle numbers he writes that it is fishers "who will have the ultimate responsibility during fishing operations at high-seas, of saving that turtle on the hook!" (Arauz 1999, 26).

While Shillinger and co. hope for a disconnection, Arauz invests in the moment of connection as the time when conservation might do some of its most crucial work. The steady tick of predictability and calculability that echoed through the planned turtle watch becomes a background note. Instead Arauz turns toward the same tick that chivvied me into action early on a Sydney morning. Under a watchful gaze, those who are out of synch are insistently reminded to adjust, catch up, keep to time. So many of us then chase the lie that all that is needed for proper coordination is for the individual to appropriately calibrate themselves with the correct forms of time (see Sharma 2014, 138).

But can taking the time to recalibrate to a time of care be done alone? As Maria Puig de la Bellacasa suggests (2012, 198), acts of care are embedded in interdependent worlds, and those expected to care may often be labouring under conditions of exploitation and domination. The tourist on the beach wedging the tarp under the stranded turtle and the fisher out at sea are enmeshed in very different webs of time, with different rhythms, expectations, futures and pasts, pressing in on each of them in different ways. Adjusting to a time in which fishers can be "patient enough to release hooked turtles, untangle them, or

Bastian, Michelle. "Encountering Leatherbacks in Multispecies Knots of Time" This is the pre-publication version of a chapter in van Dooren, T., D. Bird Rose, M. Chrulew (eds) *Extinction Studies: Stories of Time, Death and Generations* New York: Columbia University Press, 2017.

use techniques to safely release hooked turtles" may involve more tangles than just those accessible to the fishers alone (Arauz 1999, 25). As Sarah Sharma argues, time is not "singularly yours or mine for the taking but [is] uncompromisingly tethered and collective" (2014, 150).

A jaguar's time is tethered to its shifting prey, a turtle's to the amount of plastic in its gut, just two threads among many. These stories suggest that learning to tell time differently is both a collective risk and a collective task, though not in the same way for everyone. After all, it's easy to focus on the single-minded fisherman wielding his machete, but this tracing of connections with leatherbacks will also bring me face-to-face with the narrowings of time fostered by my own trade...

30

A fisherman is complaining about the lack of response from researchers. He has returned at least thirty tags to a research project in Costa Rica and has never had a reply. Arauz delicately describes the fisherman's reaction as 'discouragement' over this lack of interest (1999, 21). Originally from Costa Rica, where he participated in an environmental education programme, he is now involved in long-line fishing in Ecuador. He has taken this education to heart and tries to take care of any turtles he encounters. But his efforts to help support the continuation of shared futures between turtles and humans are met with a foggy uncertainty.

Bastian, Michelle. "Encountering Leatherbacks in Multispecies Knots of Time"
This is the pre-publication version of a chapter in van Dooren, T., D. Bird Rose, M. Chrulew (eds) *Extinction Studies: Stories of Time, Death and Generations* New York: Columbia University Press, 2017.

In my now unsteady pile of research papers and reports, I follow this thread all the way to Canada, where fishers there too have received no feedback on tags, and no follow up after "spending hours hauling a full-size whale to shore" for researchers to study (Martin and James 2005, 114).

Conservationists trying to do things differently find that employers and funders are insensible the multiple, contradictory rhythms involved in building ongoing communities of concern. They face the continuing challenge of "convincing funding agencies that are conditioned to support traditional research that funding 'softer' aspects of a conservation programme, like community outreach is supporting science" (Martin 113, see also Delgado 96). Cutting time back to its bones may seem to support staying consistently on target, but it leaves the remnants of the careful responses of others trailing in its wake.

Not everywhere though. Other threads of time belie the clock's claim that one time can encompass all. Kathleen Martin and her colleagues are involved in the Nova Scotia Leatherback Turtle Working Group (NSLTWG), which works closely with local fishers on conservation projects (Martin and James 2005). Many are no longer able to hunt for the swordfish that have become increasingly rare and so the years of cultivating particular embodiments are turned to other uses. Forging new futures they now go out 'turtling,' working with conservation scientists to learn more about the behaviour of leatherbacks in Canadian waters. As Martin writes "the ability to spot leatherback turtles

Bastian, Michelle. "Encountering Leatherbacks in Multispecies Knots of Time" This is the pre-publication version of a chapter in van Dooren, T., D. Bird Rose, M. Chrlew (eds) *Extinction Studies: Stories of Time, Death and Generations* New York: Columbia University Press, 2017.

at sea requires observational abilities that only those who have fished on the ocean for years can cultivate" (Martin and James 2005, 113). Indeed, like the jellyfish of the northeast Atlantic, until the fishers of the NSLTWG turned their swordfish-trained eyes to turtle spotting their presence in those waters had never been scientifically proven.

By working closely with local volunteers and seeking to build trust amongst communities whose interests are not always aligned, Martin and her colleagues make time for careful relationship. But this time carries consequences — productivity, status, peer recognition are all put at risk (see also Campbell 2005). For the fishers, however, breaking professional codes by being involved in voluntary conservation work is to risk suspicion, social exclusion, even death (see Delgado and Nichols 2005, 99). For both of them it involves falling out of the complex, but also enfolding, rhythms that bind communities together. But the same risk is not shared by everyone, and the greater risk cannot always be paid back or balanced out. As Martin writes, in relation to the fishers they work with, "there is no way to 'repay' the cultural risk entailed in this kind of action" (Martin and James 2005, 115fn1).

Discussing the violence entwined with care in conservation, van Dooren writes that it is always important to ask "what am I really caring for, why, and at what cost to whom?" (van Dooren 2014b). Likewise Sharma reminds us to ask "what new forms of vulnerability are necessitated by the production of temporal

Bastian, Michelle. "Encountering Leatherbacks in Multispecies Knots of Time"
This is the pre-publication version of a chapter in van Dooren, T., D. Bird Rose, M.
Chrulew (eds) *Extinction Studies: Stories of Time, Death and Generations* New
York: Columbia University Press, 2017.

novelties...?" (2014, 150). What were those bones I worried over,
sitting there on the carpet in a faraway Sydney? How many
other lives were entangled with them while I sat there,
intoxicated by the way they seemed to hail me alone?

Monday, 4th August 2014

4:21pm

The writing that started with such anxiety, after being put off
for too long, is nearing completion. Layers of deadlines for
conferences and seminars, drafts and redrafts, comments and
criticisms have worked it all into a kind of coherence.

Throughout it all leatherbacks have surfaced in unexpected
places, opening up shared worlds in which the calculability of
time is disrupted, its seemingly implacable forward movement
turned on its head and admonishments to work faster, be more
consistent, and more focused are not able to provide the time
needed to solve the problems at hand. Rather than connecting
with "present temporalities, localities and relationalities" the
time given by leatherbacks has rendered them unfamiliar.

Sifting through news items reporting on others' encounters
traces a similar response. Stories of sightings, rescues and
nestings, all accompanied by astonishment that such a creature
should appear *here*. There were the "completely baffled"
experts trying to work out how a dog walker could find fresh
leatherback eggs on a beach in Jersey, part of the Channel
Islands (BBC News Jersey 2013). And wildlife watchers off the

Bastian, Michelle. "Encountering Leatherbacks in Multispecies Knots of Time"
This is the pre-publication version of a chapter in van Dooren, T., D. Bird Rose, M. Chrulew (eds) *Extinction Studies: Stories of Time, Death and Generations* New York: Columbia University Press, 2017.

coast of Cornwall talking about the "enormous privilege" of seeing one so close to land (Lester 2013). A turtle has even been sighted hauling up on England's Blackpool beach (Cooke 2010). Closer to my old home in Australia, so far removed (or so I thought) from leatherback haunts, a dead turtle, probably killed by a boat strike, had drifted ashore near Byron Bay and it was "believed to be the first time in 17 years this breed of turtle has been seen on the East Coast" (Kinninment 2013, n.p.). Another was seen alive in Melbourne's Port Philip Bay (Florance 2014). Sharing my confusion were reporters in Balatan in the Philippines who wondered why an animal "only seen in the Atlantic waters in Europe" would be found tangled in local fishing gear (Sales 2013, n.p.).

34

To encounter a leatherback, then, might actually mean having one's sense of place and time disoriented. As Kathleen Martin attests, "you really feel like you're being blessed by the primeval, you know, this is an animal who has been around for 150 million years — since the T. rex was on Earth, leatherbacks have been with us — it's such a privilege to see that and have that sense of being tied into a world that is so much older than you are, and so much bigger, and just more mysterious" (CBC News 2014, n.p.). Envoys from the last great extinction event, a leatherback encounter may offer a moment that bones cannot touch, a moment that squawks and shuffles and captivates.

But my ticking clock won't give up easily. It's now 11:28pm and I'm on the brink of falling back into the untimeliness that

Bastian, Michelle. "Encountering Leatherbacks in Multispecies Knots of Time"
This is the pre-publication version of a chapter in van Dooren, T., D. Bird Rose, M.
Chrulew (eds) *Extinction Studies: Stories of Time, Death and Generations* New
York: Columbia University Press, 2017.

started all of this. There are so many tangles, knots and threads
that I'm not sure which ones I should track down, tidy up or cut
away.

I need some fresh air. So I quietly unlock the front door and
step outside. The street lights give everything an orange glow
and I can faint sounds of traffic still on the roads. The Water of
Leith is close by and I start to follow it along as it runs through
Edinburgh suburbs. Along and along in the cool darkness.
When I get to Inverleith Park I leave the river and follow the
roads straight down to Granton Harbour and here I stop,
looking out over the water.

35

I look for them, but don't see any yet. But I might.

Leatherbacks have been here recently.¹⁴

While I wait I pull out the clock's bones from my pockets.

It's time to let them go,

so I lay them carefully on the surface of the water.

For a moment they just float there,

but, after a little while,

they start to grow into each other, stretching flesh and

sprouting wings

before heaving up out of the water and soaring lazily out to sea.

¹⁴ See this map of UK leatherback sightings
https://data.nbn.org.uk/Taxa/NBNSYS0000188646/Grid_Map

Bastian, Michelle. "Encountering Leatherbacks in Multispecies Knots of Time"
This is the pre-publication version of a chapter in van Dooren, T., D. Bird Rose, M.
Chrlew (eds) *Extinction Studies: Stories of Time, Death and Generations* New
York: Columbia University Press, 2017.

Bibliography

- Adam, Barbara. 1998. *Timescapes of Modernity: The environment & invisible hazards*. London and New York: Routledge.
- alinapphotography. 2012. Part 2 of 7 - Leatherback Mama Turtle Rescue in Highland Beach, FL. YouTube.
- Arauz, Randall. 1999. Description of the Eastern Pacific High-Seas Longline and Coastal Gillnet Swordfish Fisheries of South America, Including Sea Turtle Interactions, and Management Recommendations.: Sea Turtle Restoration Project
Turtle Island Restoration Network.
- Arroyo-Arce, Stephanny, James Guilder, and Roberto Salom-Pérez. 2014. "Habitat features influencing jaguar *Panthera onca* (Carnivora: Felidae) occupancy in Tortuguero National Park, Costa Rica." *International Journal of Tropical Biology and Conservation* 62 (4):1449-1458.
- Bailey, Helen, Scott R. Benson, George L. Shillinger, Steven J. Bograd, Peter H. Dutton, Scott A. Eckert, Stephen J. Morreale, Frank V. Paladino, Tomoharu Eguchi, David G. Foley, Barbara A. Block, Rotney Piedra, Creusa Hitipeuw, Ricardo F. Tapilatu, and James R. Spotila. 2012. "Identification of distinct movement patterns in Pacific leatherback turtle populations influenced by ocean conditions." *Ecological Applications* 22 (3):735-747. doi: 10.1890/11-0633.
- Bailey, Helen, Sabrina Fossette, Steven J. Bograd, George L. Shillinger, Alan M. Swithenbank, Jean-Yves Georges,

Bastian, Michelle. "Encountering Leatherbacks in Multispecies Knots of Time" This is the pre-publication version of a chapter in van Dooren, T., D. Bird Rose, M. Chrulew (eds) *Extinction Studies: Stories of Time, Death and Generations* New York: Columbia University Press, 2017.

Philippe Gaspar, K. H. Patrik Strömberg, Frank V.

Paladino, James R. Spotila, Barbara A. Block, and

Graeme C. Hays. 2012. "Movement Patterns for a Critically Endangered Species, the Leatherback Turtle (*Dermochelys coriacea*), Linked to Foraging Success and Population Status." *PLoS ONE* 7 (5):e36401.

Bastian, Michelle. 2012. "Fatally Confused: Telling the time in the Midst of Ecological Crises." *Environmental Philosophy* 9 (1):23-48.

Bastian, Michelle. 2014. "Time." In *Migration: The COMPAS Anthology*, edited by B. Anderson and Michael Keith. Oxford: COMPAS.

Bastian, Michelle. forthcoming. "Liberating Clocks: Rethinking the transformative potential of 'clock time'" *new formations: A journal of culture, theory and politics*.

37

BBC News Jersey. 2013. "Jersey resident 'finds rare leatherback turtle egg on beach'." Last Modified 11 June 2013 Accessed 4th August 2014.
<http://www.bbc.co.uk/news/world-europe-jersey-22853538>.

Benson, Etienne. 2012. "One infrastructure, many global visions: The commercialization and diversification of Argos, a satellite-based environmental surveillance system." *Social Studies of Science* 42 (6):843-868. doi: 10.1177/0306312712457851.

Benson, S. R., T. Eguchi, D. G. Foley, K. A. Forney, H. Bailey, C. Hitipeuw, B. P. Samber, R. F. Tapilatu, V. Rei, P., and J. Pita Ramohia, and P. H. Dutton. 2011. "Large-scale

Bastian, Michelle. "Encountering Leatherbacks in Multispecies Knots of Time"
This is the pre-publication version of a chapter in van Dooren, T., D. Bird Rose, M.
Chrulew (eds) *Extinction Studies: Stories of Time, Death and Generations* New
York: Columbia University Press, 2017.

movements and high-use areas of western Pacific
leatherback turtles, *Dermochelys coriacea*." *Ecosphere* 2
(7):art84. doi: 10.1890/ES11-00053.1.

Birth, Kevin K. 2014. "Non-Clocklike Features of Psychological
Timing and Alternatives to the Clock Metaphor " *Timing
& Time Perception* 2 (3):312 – 324. doi: 10.1163/22134468-
00002029.

Bjorndal, Karen A., and Alan B Bolten. 2003. "From Ghosts to
Key Species: Restoring Sea Turtle Populations to Fulfill
their Ecological Roles." *Marine Turtle Newsletter* 100:16 -
21.

Buchanan, Brett. 2007. "The Time of the Animal." *PhaenEx* 2 (2
):61-80.

Campbell, L.M., and C. Smith. 2005. "Volunteering for Sea
Turtles? Characteristics and Motives of Volunteers
Working with the Caribbean Conservation Corporation
in Tortuguero, Costa Rica." *MAST: Maritime Studies* 4
(1):169-193.

Campbell, Lisa M. 2005. "Overcoming Obstacles to
Interdisciplinary Research." *Conservation Biology* 19
(2):574-577. doi: 10.1111/j.1523-1739.2005.00058.x.

Campbell, Lisa M. 2007. "Local Conservation Practice and
Global Discourse: A Political Ecology of Sea Turtle
Conservation." *Annals of the Association of American
Geographers* 97 (2):313-334.

Carrillo, Eduardo, Todd K. Fuller, and Joel C. Saenz. 2009.
"Jaguar (*Panthera onca*) hunting activity: effects of prey

Bastian, Michelle. "Encountering Leatherbacks in Multispecies Knots of Time" This is the pre-publication version of a chapter in van Dooren, T., D. Bird Rose, M. Chrlew (eds) *Extinction Studies: Stories of Time, Death and Generations* New York: Columbia University Press, 2017.

distribution and availability." *Journal of Tropical Ecology* 25 (05):563-567. doi: doi:10.1017/S0266467409990137.

Carrillo, Eduardo, Joel C. Saenz, and Todd K. Fuller. 2002.

"Movements and activities of white-lipped peccaries in Corcovado National Park, Costa Rica." *Biological Conservation* 108 (3):317-324. doi: [http://dx.doi.org/10.1016/S0006-3207\(02\)00118-0](http://dx.doi.org/10.1016/S0006-3207(02)00118-0).

CBC News. 2014. "Endangered leatherback turtle speared by swordfish survives." Last Modified 19 June, 2014 Accessed 4 August 2014.

<http://www.cbc.ca/news/canada/nova-scotia/endangered-leatherback-turtle-speared-by-swordfish-survives-1.2680768>.

Condon, Robert H., Carlos M. Duarte, Kylie A. Pitt, Kelly L. Robinson, Cathy H. Lucas, Kelly R. Sutherland, Hermes W. Mianzan, Molly Bogeberg, Jennifer E. Purcell, Mary Beth Decker, Shin-ichi Uye, Laurence P. Madin, Richard D. Brodeur, Steven H. D. Haddock, Alenka Malej, Gregory D. Parry, Elena Eriksen, Javier Quiñones, Marcelo Acha, Michel Harvey, James M. Arthur, and William M. Graham. 2013. "Recurrent jellyfish blooms are a consequence of global oscillations." *Proceedings of the National Academy of Sciences* 110 (3):1000-1005. doi: 10.1073/pnas.1210920110.

Cooke, Jeremy. 2010. "Giant leatherback turtle visits beach near Blackpool." Last Modified 10 June 2010 Accessed 4 August 2014. <http://www.bbc.co.uk/news/10289590>.

Bastian, Michelle. "Encountering Leatherbacks in Multispecies Knots of Time" This is the pre-publication version of a chapter in van Dooren, T., D. Bird Rose, M. Chrlew (eds) *Extinction Studies: Stories of Time, Death and Generations* New York: Columbia University Press, 2017.

Danigelis, Alyssa. 2013. "Jellyfish Shut Down Swedish Nuclear Reactor." Last Modified 2nd October 2013 Accessed 31st July 2014. <http://news.discovery.com/animals/jellyfish-shut-down-swedish-nuclear-reactor-131002.htm>.

Delgado, S., and W.J. Nichols. 2005. "Saving Sea Turtles from the Ground Up: Awakening Sea Turtle Conservation in North-Western Mexico." *MAST: Maritime Studies* 4 (1):89-104.

Doyle, Thomas K., Henk De Haas, Don Cotton, Boris Dorschel, Valerie Cummins, Jonathan D. R. Houghton, John Davenport, and Graeme C. Hays. 2008. "Widespread occurrence of the jellyfish *Pelagia noctiluca* in Irish coastal and shelf waters." *Journal of Plankton Research* 30 (8):963-968. doi: 10.1093/plankt/fbn052.

40

Duguay, R., P. Moriniere, and A. Meunier. 2000. "L'ingestion des déchets flottants par la tortue luth *Dermochelys coriacea* (Vandelli, 1761) dans le golfe de Gascogne." *Annales de la Société des Sciences Naturelles de la Charente-Maritimes* 8 (9):1035–1038.

EFE. 2014. "Number of leatherback turtle nests on Puerto Rico beaches soars." *Fox News Latino*, 21st June <http://latino.foxnews.com/latino/news/2014/06/21/number-leatherback-turtle-nests-on-puerto-rico-beaches-soars/>.

Ferrara, Camila R., Richard C. Vogt, Martha R. Harfush, Renata S. Sousa-Lima, Ernesto Albavera, and Alejandro Tavera. 2014. "First Evidence of Leatherback Turtle (*Dermochelys coriacea*) Embryos and Hatchlings

Bastian, Michelle. "Encountering Leatherbacks in Multispecies Knots of Time" This is the pre-publication version of a chapter in van Dooren, T., D. Bird Rose, M. Chrlew (eds) *Extinction Studies: Stories of Time, Death and Generations* New York: Columbia University Press, 2017.

Emitting Sounds." *Chelonian Conservation and Biology* 13 (1):110-114. doi: 10.2744/ccb-1045.1.

Florance, Loretta. 2014. "Endangered leatherback sea turtle spotted in Melbourne's Port Phillip Bay." *ABC News*, 21 Dec 2014. <http://www.abc.net.au/news/2014-12-20/endangered-leatherback-turtle-spotted-in-port-phillip-bay/5981088>.

Gershwin, Lisa-Ann. 2013. *Stung!: On Jellyfish Blooms and the Future of the Ocean*. Chicago: University of Chicago Press.

Gibbons, Mark J., and Anthony J. Richardson. 2013. "Beyond the jellyfish joyride and global oscillations: advancing jellyfish research." *Journal of Plankton Research* 35 (5):929-938. doi: 10.1093/plankt/fbt063.

Gordon, Lucía Galeán, and Emma Harrison. 2012. Report on the 2011 Leatherback Programme at Tortuguero, Costa Rica. San Pedro, Costa Rica: Sea Turtle Conservancy.

Guilder, James, Benjamin Barca, Stephanny Arroyo-Arce, Roberto Gramajo, and Roberto Salom-Pérez. 2015. "Jaguars (*Panthera onca*) increase kill utilization rates and share prey in response to seasonal fluctuations in nesting green turtle (*Chelonia mydas mydas*) abundance in Tortuguero National Park, Costa Rica." *Mammalian Biology - Zeitschrift für Säugetierkunde* 80 (2):65-72. doi: <http://dx.doi.org/10.1016/j.mambio.2014.11.005>.

Hay, Steve. 2006. "Marine Ecology: Gelatinous Bells May Ring Change in Marine Ecosystems." *Current Biology* 16 (17):R679-R682. doi: <http://dx.doi.org/10.1016/j.cub.2006.08.010>.

Bastian, Michelle. "Encountering Leatherbacks in Multispecies Knots of Time"
This is the pre-publication version of a chapter in van Dooren, T., D. Bird Rose, M.
Chrlew (eds) *Extinction Studies: Stories of Time, Death and Generations* New
York: Columbia University Press, 2017.

Hays, Graeme C. 2008. "Sea turtles: A review of some key recent
discoveries and remaining questions." *Journal of
Experimental Marine Biology and Ecology* 356 (1–2):1-7. doi:
<http://dx.doi.org/10.1016/j.jembe.2007.12.016>.

Heaslip, Susan G., Sara J. Iverson, W. Don Bowen, and Michael
C. James. 2012. "Jellyfish Support High Energy Intake of
Leatherback Sea Turtles (*Dermochelys
coriacea*): Video Evidence from Animal-Borne
Cameras." *PLoS ONE* 7 (3):e33259. doi:
[10.1371/journal.pone.0033259](https://doi.org/10.1371/journal.pone.0033259).

Houghton, Jonathan D. R., Thomas K. Doyle, Mark W. Wilson,
John Davenport, and Graeme C. Hays. 2006. "Jellyfish
Aggregations and Leatherback Turtle Foraging Patterns
in a Temperate Coastal Environment." *Ecology* 87
(8):1967-1972. doi: [10.1890/0012-
9658\(2006\)87\[1967:jaaltf\]2.0.co;2](https://doi.org/10.1890/0012-9658(2006)87[1967:jaaltf]2.0.co;2).

Howell, Evan A., Aimee Hoover, Scott R. Benson, Helen Bailey,
Jeffrey J. Polovina, Jeffrey A. Seminoff, and Peter H.
Dutton. 2015. "Enhancing the TurtleWatch product for
leatherback sea turtles, a dynamic habitat model for
ecosystem-based management." *Fisheries Oceanography*
Early view:1-12. doi: [10.1111/fog.12092](https://doi.org/10.1111/fog.12092).

James, Michael C., C. Andrea Ottensmeyer, A. Ransom, and
Andrew E. Myers. 2005. "Identification of high-use
habitat and threats to leatherback sea turtles in northern
waters: new directions for conservation." *Ecology Letters*
8:195-201. doi: [10.1111/j.1461-0248.2004.00710.x](https://doi.org/10.1111/j.1461-0248.2004.00710.x).

Bastian, Michelle. "Encountering Leatherbacks in Multispecies Knots of Time" This is the pre-publication version of a chapter in van Dooren, T., D. Bird Rose, M. Chrlew (eds) *Extinction Studies: Stories of Time, Death and Generations* New York: Columbia University Press, 2017.

Kinninment, Megan. 2013. "Rare giant turtle washes up at Suffolk Park." Last Modified 24th Nov 2013 Accessed 4th August 2014. <http://www.northernstar.com.au/news/a-rare-leatherback-turtle-has-been-found-washed-up/2093769/>.

Kwek, Glenda. 2011. "Jellyfish force shutdown of power plants." Accessed 31st July 2014. <http://www.smh.com.au/environment/jellyfish-force-shutdown-of-power-plants-20110711-1haa6.html>.

Lester, Nick. 2013. "Are you a little lost? Tourists picture giant leatherback turtle 3,000 miles from home as it makes rare appearance in British waters in the hunt for jellyfish." Last Modified 13 September 2013 Accessed 4 August 2014. <http://www.dailymail.co.uk/news/article-2419937/Giant-leatherback-turtle-spotted-makes-rare-appearance-British-waters-hunt-jellyfish.html>.

Mann, Adam. 2014. "How the U.S. Built the World's Most Rediculously Accurate Atomic Clock." *Wired*, 4th April 2014, Science. <http://www.wired.com/2014/04/nist-atomic-clock/>.

Martin, Kathleen, and Michael James. 2005. "The Need for Altruism: Engendering a Stewardship Ethic Amongst Fishers for the Conservation of Sea Turtles in Canada." *MAST: Maritime Studies* 4 (1):105-118.

Mrosovsky, N., Geraldine D. Ryan, and Michael C. James. 2009. "Leatherback turtles: The menace of plastic." *Marine Pollution Bulletin* 58 (2):287-289.

Bastian, Michelle. "Encountering Leatherbacks in Multispecies Knots of Time" This is the pre-publication version of a chapter in van Dooren, T., D. Bird Rose, M. Chrlew (eds) *Extinction Studies: Stories of Time, Death and Generations* New York: Columbia University Press, 2017.

Pauly, D. 1995. "Anecdotes and the shifting base-line syndrome of fisheries." *Trends in Ecology & Evolution* 10 (10):430-430. doi: 10.1016/s0169-5347(00)89171-5.

Pittendrigh, Colin S. 1981. "Circadian Systems: Entrainment." In *Biological Rhythms*, edited by Jürgen Aschoff, 95-124. Springer US.

Puig de la Bellacasa, María. 2012. "'Nothing comes without its world': thinking with care." *The Sociological Review* 60 (2):197-216. doi: 10.1111/j.1467-954X.2012.02070.x.

Purcell, Jennifer E. 2012. "Jellyfish and Ctenophore Blooms Coincide with Human Proliferations and Environmental Perturbations." *Annual Review of Marine Science* 4 (1):209-235. doi: doi:10.1146/annurev-marine-120709-142751.

Purcell, Jennifer E., Shin-ichi Uye, and Wen-Tseng Lo. 2007. "Anthropogenic causes of jellyfish blooms and their direct consequences for humans: a review." *MARINE ECOLOGY PROGRESS SERIES* 350:153-174.

Richardson, Anthony J., Andrew Bakun, Graeme C. Hays, and Mark J. Gibbons. 2009. "The jellyfish joyride: causes, consequences and management responses to a more gelatinous future." *Trends in Ecology and Evolution* 24 (6):312-322.

Roberts, Callum. 2007. *The Unnatural History of the Sea: The past and future of humanity and fishing*. London: Gaia

Rose, Deborah Bird. 2012. "Multispecies Knots of Ethical Time." *Environmental Philosophy* 9 (1):127-140.

Bastian, Michelle. "Encountering Leatherbacks in Multispecies Knots of Time" This is the pre-publication version of a chapter in van Dooren, T., D. Bird Rose, M. Chrlew (eds) *Extinction Studies: Stories of Time, Death and Generations* New York: Columbia University Press, 2017.

Rose, Deborah Bird. 2013. "Slowly ~ writing into the Anthropocene." *TEXT* Special Issue 20: Writing Creates Ecology and Ecology Creates Writing:1-14.

Saba, Vincent S., George L. Shillinger, Alan M. Swithenbank, Barbara A. Block, James R. Spotila, John A. Musick, and Frank V. Paladino. 2008. "An oceanographic context for the foraging ecology of eastern Pacific leatherback turtles: Consequences of ENSO." *Deep Sea Research Part I: Oceanographic Research Papers* 55 (5):646-660.

Sales, Sonny. 2013. "Rare Leatherback Turtle released to sea." Last Modified 2 October 2013 Accessed 4 August 2014. <http://www.voxbikol.com/article/rare-leatherback-turtle-released-sea>.

Schrope, Mark. 2012. "Marine ecology: Attack of the blobs." *Nature* 482:20-21. doi: 10.1038/482020a.

Sharma, Sarah. 2014. *In the Meantime: Temporality and Cultural Politics*. Durham and London: Duke University Press.

Schrader, Astrid. 2012. "The Time of Slime: Anthropocentrism in Harmful Algal Research." *Environmental Philosophy* 9 (1):71-93.

Shillinger, George L., Emanuele Di Lorenzo, Hao Luo, Steven J. Bograd, Elliott L. Hazen, Helen Bailey, and James R. Spotila. 2012. "On the dispersal of leatherback turtle hatchlings from Mesoamerican nesting beaches." *Proceedings of the Royal Society B: Biological Sciences* Early View. doi: 10.1098/rspb.2011.2348.

Shillinger, George L., Daniel M. Palacios, Helen Bailey, Steven J. Bograd, Alan M. Swithenbank, Philippe Gaspar, Bryan P.

Bastian, Michelle. "Encountering Leatherbacks in Multispecies Knots of Time"
This is the pre-publication version of a chapter in van Dooren, T., D. Bird Rose, M.
Chrulew (eds) *Extinction Studies: Stories of Time, Death and Generations* New
York: Columbia University Press, 2017.

Wallace, James R. Spotila, Frank V. Paladino, Rotney

Piedra, Scott A. Eckert, and Barbara A. Block. 2008.

"Persistent Leatherback Turtle Migrations Present

Opportunities for Conservation." *PLoS Biol* 6 (7):e171.

Shillinger, George L., Alan M. Swithenbank, Helen Bailey,

Steven J. Bograd, Michael R. Castelton, Bryan P. Wallace,

James R. Spotila, Frank V. Paladino, Rotney Piedra, and

Barbara A. Block. 2011. "Vertical and horizontal habitat

preferences of post-nesting leatherback turtles in the

South Pacific Ocean." *Marine Ecology Progress Series*

422:275-289. doi: 10.3354/meps08884.

Shillinger, George L., Alan M. Swithenbank, Steven J. Bograd,

Helen Bailey, Michael R. Castelton, BP Wallace, JR

Spotila, FV Paladino, Rotney Piedra, and Barbara A.

Block. 2010. "Identification of high-use interesting

habitats for eastern Pacific leatherback turtles: role of the

environment and implications for conservation."

Endangered Species Research 10:215-232. doi:

10.3354/esr00251.

Spotila, James R., Richard D. Reina, Anthony C. Steyermark,

Pamela T. Plotkin, and Frank V. Paladino. 2000. "Pacific

leatherback turtles face extinction." *Nature* 405:529-530.

doi: 10.1038/35014729.

Stanford University. 2008. "Leatherback Turtles' Newly

Discovered Migration Route May Be Roadmap To

Salvation [Press Release]." Accessed 28th July 2014.

<http://news.stanford.edu/pr/2008/pr-leatherb->

072308.html.

Bastian, Michelle. "Encountering Leatherbacks in Multispecies Knots of Time" This is the pre-publication version of a chapter in van Dooren, T., D. Bird Rose, M. Chrlew (eds) *Extinction Studies: Stories of Time, Death and Generations* New York: Columbia University Press, 2017.

Stewart, Kelly, Michelle Sims, Anne Meylan, Blair

Witherington, Beth Brost, and Larry B. Crowder. 2010. "Leatherback nests increasing significantly in Florida, USA; trends assessed over 30 years using multilevel modeling." *Ecological Applications* 21 (1):263-273. doi: 10.1890/09-1838.1.

Taylor, Hollis. 2008. "Decoding the song of the pied butcherbird: An initial survey." *Transcultural Music Review* 12.

Taylor, Hollis. 2013. "Connecting interdisciplinary dots: Songbirds, 'white rats' and human exceptionalism." *Social Science Information* 52 (2):287-306. doi: 10.1177/0539018413477520.

van Dooren, Thom. 2014a. *Flight Ways: Life and loss at the edge of extinction*. New York: Columbia University Press.

van Dooren, Thom. 2014b. "Care" in the Living Lexicon for the Environmental Humanities. *Environmental Humanities* 5:291-294.

Veríssimoa, D., D. A. Jonesa, R. Chaverria, and S. R. Meyer. 2012. "Jaguar Panthera onca predation of marine turtles: conflict between flagship species in Tortuguero, Costa Rica." *Oryx: The international journal of conservation* FirstView Article:1-8.

Vincent, Blair. 2013. Giant Leatherback Sea Turtle Freed From Entanglement. YouTube.

Weisman, Alan. 2007. "Polymers Are Forever." *Orion Magazine*.

Witt, Matthew J., A.C. Broderick, D.J. Johns, C. Martin, R. Penrose, M.S. Hoogmoed, and B.J. Godley. 2007. "Prey

Bastian, Michelle. "Encountering Leatherbacks in Multispecies Knots of Time"
This is the pre-publication version of a chapter in van Dooren, T., D. Bird Rose, M.
Chrulew (eds) *Extinction Studies: Stories of Time, Death and Generations* New
York: Columbia University Press, 2017.

landscapes help identify potential foraging habitats for
leatherback turtles in the NE Atlantic." *Marine Ecology
Progress Series* 337:231-243. doi: 10.3354/meps337231.