Waste Journeys: Using Object Itineraries to Investigate Marine Plastic in Galapagos

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Abstract

Plastics, as supermodern artefacts of the Anthropocene, form a significant part of waste landscapes. But they also pollute landscapes – cultural and natural, marine and terrestrial – across the globe, including in the most isolated of places. The material’s resilience means that plastic pollution is one of the biggest global challenges facing contemporary society.

Taking a multidisciplinary approach, this paper demonstrates how archaeological methods can help address the issue of plastic pollution in Galapagos, which is listed as a UNESCO World Heritage Site for its “Outstanding Universal Value” to humanity.

Keywords: contemporary archaeology, object itinerary, plastic waste, UNESCO, waste landscape
Studied archaeologically, plastics are artefacts that through careful observation can yield precious information about their journey to this archipelago. As objects of story writing and the focus of object itineraries, they can also be used as a window into perceptions of plastic litter locally, as well as providing an opportunity to engage students in the topic.

Introduction

Plastic pollution is among the most urgent global challenges of the Anthropocene. 1 In addition to becoming embedded in geology (Corcoran et al. 2009) and stratigraphy, plastic pollution is universal, present on the most remote islands (Lavers and Bond 2017), in deep waters (Pham et al. 2014) and on the highest peaks (Napper et al. 2020). Plastics are also creating entirely new seascapes, such as the Great Pacific Garbage Patch, an area of pollution that exceeds the size of Texas. From that perspective, plastic-polluted areas constitute newly configured waste landscapes that are marked by plastic’s omnipresence (from nano to macro), the global journeys of plastic objects and plastic’s long resistance to natural degradation processes. In our paper, waste landscapes are understood as natural and cultural spaces dominated by matter that (1) can appear “out of place” (after Douglas 2002) to humans, and that (2) has gone through a loss of value, from being functional and useful to becoming useless, at least to the eyes of a utilitarian anthropocentric society. We use the term “waste landscapes” specifically for such areas characterised by the presence of plastic pollution. While sharing similarities with other waste, plastic is distinct. This is largely because it has become a material emblematic of supermodernity, symbolising overconsumption and destruction. By transforming landscapes, plastics contribute to generating a feeling of solastalgia (after Albrecht 2005, 2020), a sense of distress caused by environmental change of one’s home or territory. Plastics permeate our environments (e.g. Harris et al. 2021), including the air we breathe (Jenner, Sadofsky et al. 2022) and is found in both animal (e.g. Ayala et al. 2023) and human bodies (Jenner, Rotchell et al. 2022; Leslie et al. 2022). As a comparatively recent invention (with fully synthetic plastics first appearing in the early twentieth century), it is not yet known how long plastics will remain in the environment. What is known, though, is that they display persistence and omnipresence and that these characteristics disrupt the scales of time and space (Edgeworth 2010, 2013) that archaeologists are accustomed to. This may be why plastics have rapidly become an object of study for a wide range of disciplines (including but not limited to marine biology, sociology, eco-toxicology and engineering). This list also now includes archaeology (e.g. Schofield et al. 2021; Praet and Delaere, in press). In this paper, we argue that archaeology has an important role to play in studying and understanding plastic pollution and the landscapes in which it exists, whether visible (as macro- and microplastics) or not (the equally if not more harmful nanoplastics).

While loss of value, either economic or symbolic, drives the categorisation of objects as waste, archaeologists find waste valuable for its interpretative potential. Archaeologists consider waste as a source of information (Monsaingeon 2017) on various topics,

1. For a thorough discussion, see the 2014 Forum Archaeology of the Anthropocene in JCA 1 (1).
such as food consumption (McKillop 2013), artefact production (van Gijn 2003) and management systems (Wong 2018). However, studying waste is not only relevant for past societies, but also adds to our understanding of the contemporary world. Contemporary waste was first explored using archaeological methods by William Rathje through the Garbage Project (e.g. Rathje and Murphy 2001; Rathje 2011), which used the material culture of landfills and household waste to reveal unacknowledged habits and previously undocumented patterns of domestic consumption behaviours (Reno 2013, 263). The results reinforced the potential of studying waste as archaeological materials through time (e.g. Sosna and Bruncliková 2017).

Waste is a particularly important focus for studies of the Anthropocene, which encompasses “all forms of environmental destruction” (Gille 2022, 8). Now, more than ever, ours is not only “a civilization of waste” (González-Ruibal 2018, 179) but a civilisation socio-economically shaped and physically marked by waste.

With plastic pollution transgressing traditional temporal and geographical scales, archaeology offers the possibility of viewing it from new angles. Considering plastics as artefacts provides a useful starting point for understanding and mapping the connections necessary for an object to be produced, used and finally disposed of, and therefore also the global landscapes to which these plastic objects contribute. Labels, form and evidence of wear are all examples of information that can indicate a plastic object’s often long and complex journey from its source to its current destination, or from “tap to sink” as it is sometimes described. As these artefacts are made more relatable, the problem of global environmental pollution becomes less abstract. It is then easier to engage people more directly on plastic pollution, raising awareness and eventually gaining a window into local perceptions.

Despite its geographical remoteness, the World Heritage Site of Galapagos is not spared from plastic pollution. Most plastics arrive on the archipelago having been transported by ocean currents – mainly the Humboldt Current – from continental sources and marine activities, including fishing. While marine biology and environmental studies often focus on quantifying plastic waste and its impact on wildlife, we decided to adapt an archaeological framework known as object itineraries (after Joyce 2015). We used this to design workshops with local secondary-school students to focus more on cultural influences. This approach makes it possible to consider not only an object’s journey but also its entangled relationships with culture and nature along the way.

This paper first addresses the theoretical framework of object itineraries and then presents background information about plastic pollution in Galapagos, before exploring how the itineraries relate to local perceptions and can be used as an engagement tool. The itineraries were reconstructed by the local students through story-writing workshops in Galapagos, with subsequent qualitative analysis of their stories identifying key themes. The itineraries not only focus on individual objects, but question how these objects contribute to the configuration of supermodern waste landscapes. While this paper primarily focuses on marine plastic litter (MPL) itineraries in Galapagos, the World Heritage Site of Hawaii will also be briefly presented as an emerging project where this methodology is also being applied.
From Biographies to Itineraries

Reconstructing an artefact’s story has been widely used in archaeological investigations as an interpretive and methodological framework. Initially, the approach was based on the concept of object biographies (Gosden and Marshall 1999; Joy 2009), adapted from anthropology (Kopytoff 1986), and was used to reconstruct an object’s life from birth to death (Gosden and Marshall 1999) while accounting for the human relations they were entangled within (Joy 2009). Despite being a popular concept, its limitations, such as anthropocentrism (Joyce 2015, 23), were later questioned, and object itineraries (Joyce and Gillespie 2015) was developed as an alternative that would focus on the journey instead of reducing the object to its relationships with humans alone. Just as with any pre-industrial artefact, MPL objects hold information useful to reconstructing their spatial and temporal journeys. For example, manufacturers’ marks and labels can identify the object’s origin and age (Falk-Andersson et al. 2021; Ryan et al. 2021), while physical and chemical degradation can inform researchers about the length and types of interactions that the object has gone through before becoming waste, as can the eventual presence of epibionts, organisms that can live on a host organism, for example a mollusc on a plastic fragment. Perhaps surprisingly, while they hold such significant information, plastic items have not often been the subject of object biographies or itineraries (although see Schofield et al. 2020; Praet and Delaere, in press).

This scarce use of object biographies to investigate plastics is maybe best understood through the specific challenges to reconstructing a conventional narrative biography (birth → life → death). For example, it is difficult to determine a plastic artefact’s “birth”. It might start with the extraction of fossil fuels or its moulding into a specific shape. It could even begin with the creation of fossil fuel, millions of years ago. Also, even by looking at plastic objects, it can be difficult to assess their functional origin. Plastic items are often designed to be “universal, replicable, exchangeable, untraceable, and non-localizable”, comprising features that contribute to their “synthetic universality” (Davis 2022, 48).

A plastic object’s “life” is complex, often requiring several disciplines to understand the journey that it might take, including oceanography (van Sebille et al. 2019), waste (mis)management studies (Lebreton and Andrady 2019) and behavioural psychology (Eastman et al. 2013), amongst others. The itineraries of plastics sometimes span several continents, reflecting globalisation. For example, the itinerary of a flip-flop might start in Kuwait, pass through China and Korea, to end up as a product in Ethiopia (Knowles 2015). These therefore are items sharing a sense of “globalised unlocality”, defined as a dissociation from specific locations and so contributing to a sense of universality (Davis 2022, 5). In addition to the spatial dimension of disposal (Hetherington 2004, 160), there may also be significant time lapse between an item’s production and its eventually becoming waste, a classification that does not necessarily represent a final closure (Hetherington 2004, 159).

The question of “death” for plastic objects is therefore also challenging. Plastics pollute the environment through their journey as artefacts, contributing to waste landscapes often out of sight, especially for Western countries disposing of their waste by exporting it (Barnes 2019). From that perspective, plastic waste is imposed on peoples and places that do not consent to the consequences of its presence (Davis 2022, 5), contributing
to colonial mechanisms of pollution (Liboiron 2021). Besides, plastic never really “dies”, as it breaks down and enters human and non-human bodies and their environments as microplastics (Jenner, Rotchell, et al. 2022; Leslie et al. 2022). Plastics have thus transformed from dead organic matter trapped in the ground (for fuel-based plastics at least) to becoming a part of living organisms and colonising our bodies. They therefore move with human and non-human beings, following global flows of migration, conflict and tourism, amongst others (Farrelly 2021, 266).

In brief, pinpointing a birth, life and death is challenging for such flexible and mouldable items, reaching the limits of object biographies as a theoretical framework. The synthetic universality of plastics as global and colonial waste, along with their resilience in outliving human lifespans, fits better with the concept of object itineraries. As discussed above, object itineraries also offer consideration of an object’s existence independent of its relationships with humans, a framework much needed for plastic waste that develops affordances (e.g. shelter for molluscs) and interactions with non-humans in the natural environment. The framework of object itineraries recognises the spatial and global aspect of the journey, which sheds light on how MPL becomes a part of new waste landscapes such as polluted beaches. We here focus on the itineraries of plastic artefacts, and how they are re-constructed and perceived locally, as they pollute a particularly valued natural environment: the Galapagos archipelago, recognised by UNESCO as a World Natural Heritage Site (WHS) for its “Outstanding Universal Value”.

MPL Itineraries in Galapagos

Background

Known for its unique biodiversity and the key role it played in shaping Charles Darwin’s theory of evolution, Galapagos is a volcanic archipelago located in the Pacific Ocean ca. 1000 km from mainland Ecuador, the country of which the archipelago is a province. Despite its physical remoteness, the archipelago has been a part of global dynamics for centuries, acting as a refuge for pirates in the sixteenth and seventeenth centuries and as a hunting area for British and American whalers from the mid-eighteenth century (Stackpole 1972, cited in Stahl et al. 2020). With a relatively recent human occupation (Stahl et al. 2020), Galapagos’s biodiversity quickly became a topic of concern and financial interest. The archipelago is now a hub for conservation projects to maintain its unique wildlife at all costs, sometimes requiring the mass killing of invasive species such as goats (Hennessy 2019, 206–207). Inscribed as a UNESCO WHS since 1978, Galapagos became a WHS in Danger in 2007 to 2010 due to a series of anthropogenic threats such as increasing tourism and immigration and illegal fishing. While plastic pollution was not at that time identified as a distinct issue by UNESCO (2006), the factors highlighted do contribute to an increase in the arrival of MPL. Despite multiple attempts to restore Galapagos into an evolutionary Eden (Hennessy 2019, 206), humans still leave traces and plastic pollution is one of numerous anthropogenic pressures that the archipelago is facing (Alava et al. 2022).

Before presenting how plastic pollution is perceived by the local people who contributed to our project by creating object itineraries, it is important to summarise what was
previously known about plastic pollution in Galapagos. We can begin with its location. With Galapagos located at the junction of the Panama, Cromwell and Humboldt currents, the archipelago is exposed to global MPL carried on and by those currents. Thus, in addition to any land and marine local sources, the archipelago also receives MPL washing ashore from distant sources, a feature typical for islands (Lavers and Bond 2017). Several studies, from biology to oceanography, have contributed to a better characterization of plastic pollution in Galapagos through identifying potential sources (the “taps” at the start of the itinerary) and impacts (the network of relationships that the object is entangled in) of plastic waste. This research contributes to understanding how these new waste landscapes (the “sinks”) are dominated by plastics.

Recent work (e.g. van Sebille et al. 2019, Jones et al. 2021; Sánchez-García and Sanz-Lázaro 2023) has significantly improved our understanding of the origins of MPL in Galapagos, which originates in a combination of marine and terrestrial (local and external) sources. For example, amongst identifiable items, maritime-related items (e.g. discarded fishing gear) account for just 10% in a recent study by Jones et al. (2021) but reach up to 29% in a study by Sánchez García (2020), further identifying the prominence of fibres, fragments and films as the most recurrent plastic types found. Following the methodology of Thiel et al. (2013), Jones et al. (2021) assumed that little evidence of marine exposure (e.g. epibionts, degradation, yellowing) of macroplastic was associated with local origins, with such items accounting for 2% of the items recorded, whereas 88% were unsourced and therefore external. External sources of MPL in Galapagos are thought to include mainland Ecuador and other Latin American countries, after findings from oceanographic modelling (Tsakali 2019; van Sebille et al. 2019). These conclusions resonate with information provided by consideration of the labels on macroplastics, which indicate provenance from fishing vessels and from continental Latin America (including Panama, Peru and Ecuador) (Sánchez García 2020, 32). A more recent study by Muñoz-Pérez et al. (2023) has found that the most recurrent macroplastic items were formed of polyethylene terephthalate (PET) originating from consumers or fisheries and belonging to brands from Peru, China and mainland Ecuador.

These examples indicate how oceanographic and marine biological studies have started to incorporate an archaeological interpretive lens (maybe without perceiving or labelling it as such) to understand the itineraries by which plastic artefacts have reached the Galapagos archipelago. Most of the work to re-create itineraries of plastic artefacts offers individuals the potential to consider the mega-scale of plastic pollution and polluted beaches as waste landscapes, as well as the nano-scale of degradation into micro- and nanoplastics entering all systems (see Edgeworth 2010 for an archaeology of the mega and the nano). The objects themselves, on a macro-scale, reveal sets of relationships marking plastic production, use and discard. To discuss how this global issue affects Galapagos, there is scope for focused archaeological projects, and particularly for a more consistent and comprehensive study of macroplastic itineraries, which could confirm estimates of local versus regional sources, for example.

It is important to stress, however, that, in Galapagos, natural landscapes are not all equally affected by plastic pollution. The beaches most exposed are east-facing, receiving waste carried by the Humboldt Current (Jones et al. 2021). These are gener-
ally the beaches that are the least accessible to local residents and further away from the main towns. Some of them are cleaned by Conservation International and the Galapagos National Park several times a year. In contrast, tourist beaches are cleaned more regularly by park rangers, residents and tourists alike, avoiding the accumulation of macroplastics. These beaches also face away from the Humboldt Current (Jones et al. 2021), and so receive less plastic waste than the east-facing shores. However, while Galapagos waste landscapes are therefore formed differently, they share a common entanglement between nature and culture, with plastics often entangled in natural habitat such as mangroves, and potentially representing a threat for endemic wildlife such as sea lions (Figure 1). Galapagos’s wildlife is severely affected by the presence of plastic debris in the environment: Jones et al. (2021) identified 27 marine vertebrates highly at risk from interactions with plastic as a priority group for targeted actions, while Muñoz-Pérez et al. (2023) recently used Citizen Science to show that interactions with plastic has occurred for 52 species. This situation has not improved with the socio-economic consequences of the COVID-19 pandemic, leaving the archipelago relying heavily on tourism with fewer other revenues (GCT and Utrecht University 2021) and with the likely additional impact of COVID-19-related plastic waste in the form of personal protective equipment (PPE) found universally at sea and within terrestrial (including notably urban) landscapes (Schofield et al. 2021).

Based on this knowledge, there is scope to reconstruct the artefacts’ itineraries through archaeology, and a proposed method involving local secondary-school students is detailed in the next section. This framework notably invites a consideration of human and

FIGURE 1. Marine plastic litter entangled in mangroves in the urban area, Santa Cruz.
non-human interactions within which the objects are entangled. Although plastic waste exists independently from human interactions (Godin 2022) and becomes part of new interactions during its journey in the environment, we here focus on using archaeology to approach human behaviours towards plastics. Archaeology offers a unique lens on MPL, providing new understandings of how human behaviours contribute to plastic pollution. While we recognise that plastic pollution is a failure of a global plastics economy (Farrelly et al. 2021), all plastic artefacts remain entangled in a set of relationships with humans (Sheavly and Register 2007), whose individual actions and decisions contribute (in)directly and (in)voluntarily to the issue (Praet et al. 2023). From that perspective, interacting with macroplastics as artefacts offers a less abstract way to engage with the topic than with microplastics. One way to achieve this level of direct engagement is through object-based story writing (Bergmann 2021). The content of stories, often explored in qualitative approaches (Savin-Baden and Howell-Major 2013), offers a way into local perceptions of MPL and its itineraries, as explored by Praet et al. (2023).

Methods

Our study uses object itineraries as a framework to explore local perceptions of plastic pollution and engage students on the topic through story-writing workshops. Building on the narrative approaches of qualitative studies (Savin-Baden and Howell-Major 2013), we asked students in Galapagos to take part in a set of workshops to reflect on plastic as artefacts and write a story using elements of artefacts they could observe during the workshop. This approach is inspired by earlier studies that have demonstrated the potential of using artefacts in educational activities (Aerila et al. 2016), including plastics (Schofield et al. 2020; McKay et al. 2021). The study was designed as a comparison to a case study undertaken in the Latin American countries along the eastern Pacific. That study (Praet et al. 2023) investigated the success of story-writing workshops to explore perceptions of MPL and as an engagement tool to improve pro-environmental behaviours (PEBs). Due to the scope of this case contribution to the special forum on Waste Landscapes, we will focus here only on perceptions of MPL itineraries in surveys and stories.

The Activity

Workshops were designed (inspired by the activity described in Praet et al. 2023) and undertaken in Spanish by Estelle Praet and Anne Guézou in two secondary schools of Santa Cruz, Galapagos in August 2022: Unidad Educativa Nacional Galápagos (UENG) and Unidad Educativa Colegio Tomás de Berlanga (TdB) (Figure 2). The schools were selected based on the interest of school directors and teachers in having their students take part. At UENG, all students at the third Bachillerato level participated, as the activity was part of the Galapagos school curriculum based on sustainability goals. In total, 331 students participated in the project, aged between 12 and 22 years old. Group sizes oscillated between six and 32 students. All students participated in a series of two workshops. The first consisted of one two-hour session, where students first filled out a pre-survey self-assessing their understanding of MPL and their PEBs. Next, archaeology as a discipline was presented to the students, emphasising how it can be used to approach plastic pollution through object itineraries, as well as briefly
FIGURE 2. Map showing locations of participating schools, TdB and UENG, on the island of Santa Cruz.
discussing plastic pollution in Galapagos without revealing proportions of sources. A selection of 11 objects found during beach cleanups across the archipelago (Figure 3) were distributed for a group activity, and participants were asked to answer seven questions on their allocated object:

1. What is the object?
2. How old is it?
3. Where does it come from?
4. How was it used and by whom?
5. How did it reach the sea?
6. How did it interact with the environment?
7. What actions could have prevented the object ending up on a beach?

FIGURE 3. Objects presented to students for the workshops. On the second line to the right, there is a picture of the life buoy with a close-up showing the inscription Antonio Jimenez.
These questions served as a basis from which to develop an individual story following a narrative structure – introduction, development, dilemma, outcome and ending – that was presented to them. Each student was then given time to finish their story at home. A second, shorter workshop involved filling in a post-survey (asking the same questions as in the pre-survey but with some additional feedback questions) while collecting the stories as well as student and parental consents.

Analysis

Analysis of the stories was undertaken using NVivo 2020. A social constructivist perspective, acknowledging the socially constructed nature of knowledge by the participants at an individual level (Savin-Baden and Howell Major 2013, chapter 4), guided the analysis. We believe, following a narrative approach, that stories provide information about how participants make sense of the world (see Savin-Baden and Howell Major 2013, chapter 15), and more particularly here of MPL. Thematic coding was applied to analyse the content of 137 stories, a method commonly used in narrative analysis (Savin-Baden and Howell Major 2013, 238). Given the scope and focus of this paper, a selection of codes related to the object itineraries of MPL are presented (see the codebook in the Appendix 1 for a description of the codes and their occurrence). Future publications will combine the data from the surveys with coding results to explore local perceptions of MPL and evaluate the impact of the activity on PEBs (and eventually compare the results to Praet et al. 2023).

Results

As noted above, a total of 137 stories – mostly textual, but some presented as comics – were suitable for analysis and included parental and student consents. Recognising a story in these objects provided participants with a less abstract way of approaching MPL (Bergmann 2021). It was also less overwhelming, offering a way to engage by understanding how behaviours towards individual objects contribute to a global problem. Results of the thematic analysis are presented in overarching themes discussing plastics’ materiality, the complexity of the object’s itinerary, waste interactions with non-humans and plastics as components of the broader Galapagos waste landscapes.

Exploring Plastic’s Materiality

All the objects that featured in the stories presented details that offered insights into their journeys, such as the brand name (e.g., fishing sacks and plastic bottles), weathering and degradation indicators (e.g., loss of colour, seen in a frisbee and Hulk figurine) as well as features indicative of time spent at sea (e.g., shell on the bucket fragment – see Figure 3E, above). These helped anchor the story, with participants noting a variety of elements, including the object’s degradation (n = 51, where n corresponds to the number of stories with the degradation code), brand (n = 33), age (n = 32), use (n = 30) and origin (n = 24). With degradation including the loss of material properties (e.g., shape, colour), participants explored the effects of the environment (e.g., sea water, sun, animals) on the object. For example, one participant considered degradation to be loss of colour
due to exposure to UV: “And it [the bucket] was very worn out by the sun and the sea water and it arrived at a beach called El Garrapatero”. Actions were also explored to explain some features of the object, including age:

From different observations, it can be said that the object is approximately 5 years old since it was discarded, as it shows wear on the upper part and is intact on the lower part, as it is believed that it was tied just in the middle, deteriorating the upper part.

This degradation is central to the consideration of objects as waste, as well as to them being considered “out of place” (Douglas 2002), for example when encountering animals sometimes annoyed by their presence:

But once a shark came up to me and bit me [the plastic bottle], it didn’t hurt me much, it just left a scratch and tore off a small piece of my tag, it was very upset and complained about how now there are no fish to eat and there is only rubbish floating in the ocean, I couldn’t even ask [the shark] a question […] so there is a lot more rubbish floating in the sea?

About 75% (n = 102) of the participants used elements of the object to re-construct different aspects of its itinerary. While the others have not necessarily explored this in their writing, 128 students specified enough contextual elements to know which object was the key figure of their story (Figure 4), reflecting a good understanding of story-writing instructions presented in the workshop.

Participants also physically interacted with the objects in an active way, sometimes creating new marks of their own. For example, one participant signed on a life buoy (see Figure 3G, above), and this inscription was then used by other participants as an element to incorporate into the story as information about the owner: “There was once a happy red buoy in a store waiting to be bought to save the lives of humans. Then a person bought it, his name was Antonio Jimenez”. The Hulk figurine (see Figure 3I,
above) provoked a lot of interest, and its missing head raised questions. Some participants highlighted the Hulk’s muscular features by outlining them with a sharpie. The joints of the toy were fairly loose after the workshops, with some students even asking if they could take it home. The frisbee (see Figure 3J, above) was also subject to active engagement, with students trying out its flying characteristics outside of the classroom.

While, overall, participants engaged actively with the objects in the classroom, it remains difficult to evaluate the impact that the activity might have had on the way they wrote the story. Interactions in the workshops varied, depending on group composition (between six and 33 students), and AG’s and EP’s positionality (Appendix 2) might have had an impact on how students approached the object, and the content of their stories. The more tangible and concrete nature of an in-person workshop with physical objects might also change the way participants wrote about MPL when compared to a similar online project carried out by ReCiBa (Praet et al. 2023), the network of litter scientists (Red de Científicos de la Basura), a Latin American citizen science project.

A Complex Itinerary

Participants reflected on the fact that the itinerary of a plastic object is diverse and complex and does not necessarily end when the object becomes waste. The diversity of potential ways the MPL might have entered the environment was reflected upon by some participants (n = 16) in their stories: “The route of this bottle is very impressive, and we also think of one of the many ways in which it could have reached the Galapagos Islands”. In addition to noting the diversity of potential journeys, one participant also recognised that a lot of other objects have their own itinerary: “In the complex and extensive process of moving goods and products between Guayaquil and Galapagos, an infinite number of journeys are made by ship, where it is very common to encounter different stories of many products or plastic objects”. Several stories considered the workshop itself as part of the object itinerary (n = 19), reinforcing the observation that an itinerary does not stop when an object becomes waste. Participants emphasised that analysis of the object can help with understanding plastic pollution:

Some time after, it [the fishing sack] was found, it was taken to educational institutions, until one day it arrived at the Colegio Galapagos where the students analysed it and tried to find out its origin, life span and options to have prevented the sack from reaching the sea.

Sometimes, stories adopt the perspective of an object to include the analysis as part of the object’s journey:

I [the plastic bottle] woke up and I was in a laboratory in a school, I was very confused. By the time I relaxed I could hear what they were talking about. It was very interesting to me how there was so much rubbish in the sea […].

Stories, then, offer a way to consider the different steps of an object’s itinerary, starting with its origin. Perceptions of MPL origin by local students can be better understood through the content of the stories and their agreement with certain statements in the surveys. Stories mentioned different sectors contributing to the issue, such as fishing
industries \((n = 44)\), sometimes specifying if these were national \((n = 26)\) or international \((n = 14)\). Some objects with Chinese writing led participants to comment on illegal fishing for highly sought-after shark fins \((n = 4)\) at the edge of the Galapagos Marine Reserve: "I [the fishing sack] do not know what animals all these leftovers belonged to but I am pretty sure I saw a shark fin go inside me too". Participants also refer to tourism \((n = 25)\), local activities \((n = 17)\) and activities on the mainland \((n = 8)\) as sectors contributing to MPL. While litter disposal can be accidental or intentional, references to fishing in the stories can be better understood in the context of the importance of local fishing industries for the livelihoods of Galapagueños/as, a sector that has proven particularly adaptive, resilient and essential for food provisioning through the COVID-19 pandemic (Viteri Mejía et al. 2022). The choice of some international fishing-related objects (see Figure 4, above) might have prompted participants to reflect on this topic, including events that had been highly mediatised such as the above-mentioned illegal shark fishing by Chinese fleets (Collyns 2020).

The pre- and post-surveys also asked participants about the sector contributing to MPL. Answering on a Likert scale from 1 (totally disagree) to 5 (totally agree), participants assessed if they believed that marine litter came from (a) domestic activities in Galapagos, (b) fishing activities or (c) distant areas (Figure 5). Participants recognised the diversity of MPL origins by showing a general agreement with all three statements. However, while answers might present an acquiescence bias (the most popular answer being "I totally agree"), stories did identify mainland activities as well as fishing industries – international and national – contributing to MPL. In the surveys, greater agreement occurred for marine litter being identified as coming from distant areas: 61% of the participants totally agreed with this statement. This is higher than for agreement with an origin from fishing industries (46% of participants totally agreeing) and from domestic activities in the archipelago (40% of participants totally agreeing). Results from a Wilcoxon signed rank test for paired samples show no significant difference between the pre- and post-survey answers regarding marine litter’s origin. Overall agreement with the external origin MPL coincides with the results of recent studies identifying the considerable contribution of external sources to marine plastic pollution in Galapagos (van Sebille et al. 2019; Jones et al. 2021). However, these results may also indicate a tendency of not taking responsibility for plastic waste, further contributing to the question of plastic waste ownership (an issue already noticed by Reno [2013, 2018] for contemporary waste).

**Plastic Interactions with Non-Humans**

Perceptions recorded in the workshops indicate support for the view that plastic objects exceed human lifetimes, and that their itineraries are not necessarily limited to interactions with humans \((n = 101)\) but also include interactions with the environment \((n = 83)\) and with animals \((n = 52)\). Participants included a variety of elements from the environment as interacting with the object, but ocean currents were the most frequently mentioned \((n = 47)\): "After a long time of being rolled, pushed and trampled by people in the street until it [the V220 bottle] fell into the sea of Guayaquil where it was pushed by the sea currents to the beach La Ratonera in Galapagos, Santa Cruz". This coincides with the role of currents as carriers of MPL to Galapagos, which is now better understood...
FIGURE 5. Answers to pre- and post-survey statements regarding the origin of marine litter from (a) distant areas of Galapagos, (b) domestic activities in the archipelago and (c) fishing activities.
through oceanographic modelling (Tsakali 2019; van Sebille et al. 2019). In the stories, the objects mostly interacted with fish ($n = 16$) and sea turtles ($n = 14$), with ingestion ($n = 28$) being the most frequent interaction mentioned, a trend already identified by Praet et al. (2023) and potentially reflecting common themes in the communication of plastic pollution campaigns.

Participants further emphasised the relationships with non-humans when discussing the impacts of plastic waste, particularly on the environment ($n = 48$), for example as a source of contamination: “His story [the Hulk’s] is a tragic one, as he ended up as a polluting object”. The outcome of interactions between plastic and wildlife was potentially deadly ($n = 17$): “She ended up dying from having an unknown object in her body; the turtle made it to the shore of a beach where experts in the middle of an expedition found her lifeless”. In that perspective, some MPL itineraries resemble the death histories of artefacts (Hicks 2020, 24), a framework that accounts for the death of people, culture and objects when telling an artefact’s life history. In addition to wildlife, several stories ($n = 7$) questioned the impact of microplastics on the trophic chain, and eventually on human health: “Because over time these become microplastics and the fish, which I catch myself, feed on them and this affects not only the fish but also all of us because we feed on them”. Despite the lack of scientific consensus on the dangers of plastics to humans (see Rodrigues et al. [2019] for a review of impacts known so far for the most common plastic types), some participants seemed concerned by the potential impacts of microplastics’ presence in their food chain. The use of object itineraries has allowed students to express these concerns and consider the potential death histories of MPL that are most evident. Yet, it has also offered a framework to question the agency of objects and their feelings during their journeys, notably as products and as waste.

A perspective from the objects themselves, as sometimes having emotions ($n = 16$), is a reminder that these “monsters of the Anthropocene” (Godin 2022) that we qualify as waste do not necessarily perceive themselves as “out of place” (despite what humans and animals might think – see above). The emphasis on relationships that those objects develop with the environment reinforces the idea of an Anthropocene where non-humans have proliferated and accumulated in our environment (Godin 2022, 118). One story included a dialogue between a plastic bottle (B) and a sea lion (SL) hoping to bring it back to its food chain:

<table>
<thead>
<tr>
<th>B:</th>
<th>SL:</th>
</tr>
</thead>
<tbody>
<tr>
<td>...Hey, sea lion</td>
<td>Yeah?</td>
</tr>
<tr>
<td>When you told me that everyone would be worried about me... who are those “everyone”?</td>
<td>Well... I do not know, but assuming where you live, I assume everyone would be worried about you</td>
</tr>
<tr>
<td>How do you know where am I?</td>
<td>Because you told me you were from everywhere</td>
</tr>
</tbody>
</table>

This dialogue denotes a lack of human care for plastic waste (in the sense of care for new technologies as defined by Latour 2011, also cited in Godin 2022, 120) as well as a question of ownership, central to the issue and categorisation of waste (Reno 2013).
**Plastics: A Component of Galapagos Waste Landscapes**

Reconstructing a single object’s itinerary allowed students to think about the global nature of its journey and its contribution to different types of waste landscape. Some participants specifically addressed the global nature of an object’s itinerary in their stories ($n = 24$): “The currents in the oceans dragged plastic from all corners and ends of our planet”. They thought beyond the local framework and considered different countries and regions, with the most popular after Galapagos ($n = 83$) being mainland Ecuador ($n = 41$) and China ($n = 34$). These codes show an awareness of the global connectivity of Galapagos (Hennessy 2019) that facilitates the creation of its waste landscapes.

Waste landscapes are characterised by matter “out of place” (from our human researcher perspective) at an unprecedented scale. Plastics as a material “out of place” can be identified easily in a WHS celebrated for its unique biodiversity and nature. Participants identified the extent of plastic pollution ($n = 15$) on Galapagos landscapes: “And this is one more reason why Galapagos beaches are becoming increasingly dirty because of the waste brought in by the ocean currents”. Here, plastic waste is identified as responsible for the ugliness of the beach that becomes dirty, reinforcing the idea proposed by Godin (2022) of drift matter as monsters of the Anthropocene, cited earlier. This discourse is particularly important for Galapagos. not least as plastic pollution represents a threat to the biodiversity so important to several of the project participants ($n = 8$):

> That is why we have to take care of the environment and most importantly the Galapagos Islands because there are beautiful species of animals there and we have to take care of them because they are the natural heritage of the Galapagos Islands.

One participant clearly identified that plastic represents a threat to the paradise of Galapagos: “Without straying too far from his companions, he wandered close to the shore and saw a large number of bottle caps and plastics on the rocks. He was bewildered, it was as if paradise had lost its veracity”. Plastic appears here as a global material, one that is troubling the image of Galapagos as a pristine paradise, and that implies threat towards its UNESCO status as having Outstanding Universal Value. Plastic pollution’s scale and globalised sense of unlocality transforms terrestrial and marine environments equally. The extent of plastic pollution was noted on land but also at sea:

> The little plastic bottle set off on a journey of which it would not know the destination. It would take weeks and at every moment it encountered some things it had never seen before. On its journey it encountered similar items, made of plastic, it came across plastic bags and other bottles but it didn’t understand their language, it didn’t know what they said.

A few participants ($n = 3$) further explored the issue of these plastics contributing to waste seascapes such as garbage patches: “As well as questions such as what currents led her to: meet whales, encounter a fishing boat, spend time on Pacific Garbage Patch and be home to tiny organisms”. The object itinerary framework offers a way to explore the global scale of waste landscapes and how its different aspects affect both Galapagos seascapes and landscapes.
Future Approaches

In addition to this case study, research is planned on other waste landscapes of the Pacific region, including in the Hawaiian Islands, a World Heritage Site since 2010 and where a new project has already begun. The work undertaken there is expected to focus on workshops not only with students, but also with local stakeholders and community members to understand their perceptions of how plastics have impacted their communities and culture. Based on the results from the workshops in Galapagos, the research in Hawaii will use comparable object itinerary methodologies to explore this material culture. It will be particularly insightful to compare local perceptions of MPL in both archipelagos, which share a similar natural environment (both are volcanic archipelagos praised for their natural landscapes) yet differ in the meanings assigned to them. Indigenous Hawaiians, also known as Kanaka Maoli, hold a deep connection with and respect for nature, and their creation stories stem from the oceanic landscape. Galapagos, in contrast, was shaped by recent migrations involving people of different cultures, including members of indigenous groups from mainland Ecuador.

Both these World Heritage Sites are affected by plastic pollution, but from differing sources. Galapagos receives waste from specific parts of continental South America and known marine sources. However, plastics arriving in Hawaii are mainly from the ever-expanding Great Pacific Garbage Patch, making it more problematic to target the sources of the plastics and potentially reduce impacts. Here too, plastics of unknown origin offer an additional threat to that facing Galapagos, being a threat to people’s identity, given their strong connection to the ocean through their origin stories. Understanding how local perceptions of MPL origins and impacts vary between archipelagos is needed to help shape solutions and policies to address this challenging issue in ways that reflect local needs.

Conclusion

We argue that archaeology, through the use of object itineraries, can provide an understanding of plastic pollution at different levels, from human perceptions of plastic waste journeys to the consideration of global waste landscapes. The exploration of object itineraries, reconstructed thanks to the objects’ specificities, has shown that weathering and degradation inspire reflections on the interactions between plastic items, marine species and places. The complexity of the journey is also acknowledged, contributing to understanding global geographies of waste and the cultural and natural factors that can influence the journeys that objects take. The use of this archaeological framework provides a way to reflect on plastics as artefacts that are non-local, yet which are also easily relatable and show agency when interacting with non-humans. This project has demonstrated how an engaging tool can be used to explore local perceptions of MPL that contribute to the formation of global waste landscapes. To understand MPL in places like Galapagos and Hawaii, the insights and perspectives of local people are needed, as Hennessy (2019) shows in her analysis of conservation practices on the Galapagos archipelago. Local views and knowledge of the issue need to be included in the design and implementation of future solutions, especially as marine plastic pollution can hardly be dissociated from human actions. Focusing on a single item of MPL might
be a less abstract way to discuss MPL, in a context where the scale and resilience of plastic pollution can turn into an overwhelming issue contributing to a general ecological anxiety – or rather, solastalgia, as described previously (after Albrecht 2005, 2020).

It is hoped that this archaeological approach to local perceptions of MPL will contribute to solutions through policy making, especially for World Heritage Sites facing a series of threats to their Outstanding Universal Value status. With future work investigating local and Indigenous perceptions of MPL in Hawaii, we will be able to compare how plastic itineraries are perceived to contribute to these new waste landscapes, and offer tailored solutions that include local human actors for a better management of coastal landscapes, islands and archipelagos valued for their environmental and cultural significance.

Appendix 1: Codebook

**Complex object itinerary** (Files: 84 References: 117)
This code focuses on the itinerary of the object and the complexity of such journeys. It starts with the potential sectors responsible and the diversity of potential ways an object can enter the environment. It also includes the fact that the workshop was considered as part of the itinerary.

- **Diversity of potential journeys** (Files: 16 References: 18)
  This codes for sections of the stories emphasising the existence of multiple potential itineraries of the object.

- **Global nature of the journey** (Files: 24 References: 27)
  This code for elements emphasising the extent and global nature of the journey a plastic object undertakes.

- **Sector responsible for the issue** (Files: 49 References: 51)
  This codes for sectors perceived as being responsible for the object entering the environment. These can be fishing industries (either international or national), mainland activities, local life or tourism.

- **Activities on the mainland** (Files: 8 References: 9)
  This codes for mentions of activities on mainland South America (mostly Ecuador) that play a role in the object’s disposal. This can be coastal activities, for example leaving something on an Ecuadorian beach that is then brought by currents to Galapagos.

- **Local activities** (Files: 17 References: 24)
  This codes for activities undertaken locally (in Galapagos) that lead the object to become waste.

- **Marine activities** (Files: 6 References: 6)
  This codes for marine activities contributing to the object becoming waste. It can include fishing industries (national or international, and sometimes illegal), or just generally refer to marine activities.

- **Fishing industry** (Files: 44 References: 51)
  Fishing industry is depicted, sometimes referring to small local fishermen or discussing big fishing fleets, as a sector contributing to marine plastic litter. When discussing fishing industries some participants also noted that illegal fishing practices in the Galapagos Marine reserve could contribute to the issue MPL.

- **Illegal fishing practices** (Files: 4 References: 4)
  This codes for mentions of illegal fishing in/and or around the Galapagos Marine Reserve.
International (Files: 14 References: 16)
This codes for non-Ecuadorian fishing fleets, identified thanks to geographical or cultural elements specified in the stories.

National (Files: 26 References: 30)
National fishing industries are considered here as Ecuadorian, including Galapagos fishing practices. In the comics, some fishing vessels are represented with Ecuadorian colours.

Tourism (Files: 25 References: 26)
This codes for tourist activities (on land and at sea) during which the object becomes waste.

Workshop as a part of the object itinerary (Files: 19 References: 21)
This codes for references to students playing an active role in the object journey. It includes mentions of the workshop as a stage of the story.

Plastics as part of a global Galapagos waste landscape (Files: 102 References: 217)
This code gathers sub-codes offering reflections from the students on Galapagos waste landscapes as part of global dynamics, as made evident from the mention of different places in the stories. They contain reflections on the global nature of plastic pollution and its extent, and the importance of Galapagos biodiversity affected by this. It also includes considerations of the garbage patches.

Extent of plastic pollution (Files: 15 References: 24)
This codes for considerations on the extent of plastic pollution by acknowledging the amount of plastic objects at sea or on the beach.

Galapagos biodiversity (Files: 8 References: 9)
This codes for the importance of Galapagos's biodiversity and ecosystem. It also considers emphasis on its protection and conservation.

Garbage patch (Files: 3 References: 4)
This codes for mentions of the garbage patches, an element of waste seascapes.

Geography (Files: 97 References: 170)
This code gathers sub-codes providing geographical information about the country the story takes place in. Several regions/countries can be mentioned in one story, either specifically or guessable from beach/city/shop names.

Asia (Files: 33 References: 34)
This codes for different Asian countries. It also includes sub-codes of specific Asian countries mentioned in the stories.

China (Files: 34 References: 34)
Caribbean (Files: 1 References: 1)
East Pacific (Files: 87 References: 131)
This codes for mention of the Pacific Ocean and region without specifications. It also includes specific countries on the eastern Pacific.

Chile (Files: 1 References: 1)
Colombia (Files: 3 References: 3)
Galapagos (Files: 83 References: 95)
Mainland Ecuador (Files: 41 References: 42)

Europe (Files: 1 References: 1)
Mexico (Files: 1 References: 1)
USA (Files: 2 References: 2)
Global nature of the issue (Files: 8 References: 10)
This codes for the global nature of the issue of plastic production and pollution. It emphasises that plastics cross continents and countries and occur as a product of global dynamics.

Plastics materiality (Files: 132 References: 318)
This code gathers elements explored by the students relating to the materiality of plastic artefacts, including the observation itself and the choice of the object. Observation of material characteristics could trigger reflection on their degradation, their use, their origin, their brand and their age.

Object chosen (Files: 128 References: 129)
This code refers to the object chosen by the participants amongst the 11 objects presented to them.

220V bottle (Files: 15 References: 15)
This is a blue 220V bottle. It is an energy drink sold for $1 (price is on the cap). It has a barcode with information on the origin: the bottle is produced by the Tesalia Springs Company, an Ecuadorian company. There is a date that is difficult to read on the bottle cap.

Angermeyer information sign (Files: 5 References: 5)
This is an information sign with opening hours of the Angermeyer Point restaurant in Puerto Ayora, Santa Cruz (since 2001). The back of the sign has green marks, potentially from algae, and corrosion marks. It was recently broken in half (cut is fresh) after being weakened in this section.

Bucket (Files: 15 References: 15)
This is the bottom part of a red bucket made of high-density polyethylene. There are several inscriptions on the bucket successively giving information about material, origin and age: HDPE (2), … Ecuatorianos Guayaquil Ecuador, and a clockface with years indicating 98. It also previously had a mollusc stuck on it, with visible remains of a shell.

Chinese bag (Files: 16 References: 16)
This is a fishing sack that has Chinese characters printed on it. It also shows a table with different weights from less than 100 g to more than 600 g.

Chlorine gallon (Files: 2 References: 2)
This is a big chlorine (5%) gallon recommended for use with cisterns and swimming pools, and to neutralise bad smells in food industries and in hospitals. It has a lot number (2021015), an expiry date (15/10/2023) and a production date (15/10/2021). It is branded to an Ecuadorian company and has a contact number and email on the label.

Clorox bottle (Files: 8 References: 8)
This is a Clorox bottle (500 ml) that has a label with a barcode and inscriptions of an Ecuadorian company (Montecristi for Clorox del Ecuador S.A.). It has bumps and the remains of eggs laid by a winkle.

Copropag Galapagos bag (Files: 15 References: 15)
This is a fishing sack of the Galapagos traditional fishing cooperative Copropag. It has inscriptions: “por favor no arrojar al mar” (please do not throw it in the sea).

Frisbee (Files: 9 References: 9)
This is an orange worn yet complete frisbee. It bears the inscription “Mall del Sol”, a famous mall in Guayaquil, mainland Ecuador.

Hulk (Files: 12 References: 12)
This is an action figurine of Marvel’s Hulk. Its green colour has faded on its back and its joints are corroded. It is also missing the head.
Life buoy (Files: 14 References: 15)
This codes for an orange plastic life buoy. It has several inscriptions on it: 5556 (model), 2.5kg (weight), Life Buoys (brand), SOLAS96 (compliance with Safety Of Life At Sea regulation) and MSO.81.(70) (regulation on testing of life-saving appliances). It is only a section of the life buoy and it lacks the foam.

Nongfu Spring bottle (Files: 17 References: 17)
This is a bottle that has a weathered label that represented a mountain. The bottle cap has an inscription: “Nongfu Springs”. It also has a date (2019/07/31) and a number (222950 Y5). On the bottom, an inscription gives plastic category 1 (corresponding to polyethylene terephthalate – PET).

Observation of the object (Files: 102 References: 189)
This code gathers statements indicative of participants’ observation of the object and detailing different aspects of it: its origin, brand, age, etc.

Age (Files: 32 References: 33)
This codes for elements of the object (e.g. production date, use by date, etc.), giving participants an idea of its age.

Brand (Files: 33 References: 34)
This codes for information related to the brand of the object. It may only mention the name or offer extra information about the brand.

Degradation of the object (Files: 51 References: 61)
This codes for elements evaluating the degradation of the object (e.g. loss of parts, loss of colour, change in shape).

Information about owner (Files: 1 References: 1)
This codes for elements of the object giving information about the owner (name, use of the object or any relevant information).

Materials (Files: 4 References: 4)
This codes for description of the different components of the object (e.g. plastic type, presence of elements of metal, etc.).

Origin (Files: 24 References: 24)
This codes for sections discussing the geographical origin of the object, based on observable elements.

Smell (Files: 2 References: 2)
This codes for references to the smell of the object and conclusions that can be drawn from this.

Use (Files: 30 References: 30)
This codes for elements of information identifying the use of the object or giving information about the context in which it is used. This can be linked to the object properties and characteristics.

Waste interactions with humans and non-humans (Files: 130 References: 503)
This codes for interactions that the object (as waste) is involved in. It includes the impact of the object as waste on the environment (generating general reflections about the impacts of plastic on the environment). It also considers the emotions of the object, changing perspective and acknowledgement that objects exist independently from humans.

Emotions of the object (Files: 16 References: 36)
This code gathers mentions of the plastic object’s emotions, from happiness to despair and loneliness. Sentences suggesting emotions use a semantic field related to feel/feeling/being.
Impact of the plastic on the environment (Files: 48 References: 58)
This codes for a reflection on the range of impacts of plastic pollution on the environment.

Microplastic (Files: 7 References: 7)
This code identifies the specific impacts of microplastics on the environment (including ourselves). For example, several stories show a concern for microplastics entering the food chain.

Interactions (Files: 130 References: 409)
This code is for interactions between the object and its environment and with animals and humans during its journey.

Animals and objects (Files: 52 References: 135)
This codes for sections referring to interactions between animals and the object during its journey, from production to waste.

Deadly outcome of the interaction (Files: 17 References: 17)
This codes for an animal’s death as the direct consequences of its interaction with a plastic object. It can happen in the story or is also suggested as a potential outcome.

Type of animal (Files: 42 References: 65)
This code gathers mentions of specific animal genus, family or species. They are referred to by their common name, with no species identification if referred to more broadly. As these sub-codes are descriptive and self-explanatory, they are not described individually.

Bird (Files: 10 References: 11)
Crab (Files: 3 References: 3)
Dolphin (Files: 2 References: 2)
Fish (Files: 16 References: 16)
Iguana (Files: 3 References: 3)
Micro-organisms (Files: 5 References: 5)
Mollusks and crustaceans (Files: 6 References: 6)
Rat (Files: 1 References: 1)
Sea lion (Files: 2 References: 2)
Shark (Files: 2 References: 2)
Turtle (Files: 14 References: 14)
Whale (Files: 1 References: 1)

Type of interaction (Files: 36 References: 53)
This code gathers the different types of interactions that can occur between an animal and the object. They can be harmful (bites, ingestion, entanglement) or non-harmful (game, nest, shelter and dialogue). There can be multiple interaction types in one story.

Bites (Files: 7 References: 9)
This codes for animals biting the object, not necessarily ingesting it.
Dialogue (Files: 2 References: 8)
This codes for sections where the object and the animal talk together. Discussions can be of any type.
Entanglement (Files: 3 References: 3)
This code describes animals becoming entangled in plastic objects or having a plastic object stuck to them.
Game (Files: 2 References: 2)
This codes for animals playing with plastic objects.
Ingestion (Files: 25 References: 28)
This codes for animals ingesting or eating (parts of) plastic objects.

Nest (Files: 3 References: 3)
This codes for the plastic being used as part of or as a nest; for example, to lay eggs in.

Shelter (Files: 6 References: 6)
This code describes the plastic object acting as shelter for the object.

Environment (Files: 83 References: 123)
This codes for interactions between the natural environment and plastic objects, including sea currents, rain, salinity of the sea, sun, tide, waves and wind. These elements can contribute to the object becoming waste, its journey and its degradation.

Currents (Files: 47 References: 50)
This code refers to oceanic currents being mentioned, often carrying the plastic object from one place to another.

Rain (Files: 3 References: 3)
This codes for the rain being mentioned as a factor of deterioration or more generally as an environmental element that the object is impacted by.

Salinity (Files: 7 References: 7)
This codes for salinity of sea water being mentioned, most often as a factor contributing to degradation.

Sun (Files: 18 References: 18)
This codes for mentions of the sun, often being seen as contributor to the object degradation.

Tide (Files: 12 References: 13)
This codes for the tide being mentioned in stories, often contributing to the object entering the environment or washing up on a beach after its journey.

Waves (Files: 6 References: 6)
This codes for mentions of waves contributing to the object becoming waste or to its journey.

Wind (Files: 26 References: 26)
This codes for the wind as a factor influencing the object’s journey.

Appendix 2

EP and AG are both educated western women. While AG has lived in Galapagos for 30 years, it was the first time that EP was undertaking research in Galapagos. We acknowledge that our presence and privileges may have influenced the results of this research. While both of us speak fluent Spanish, which facilitated the workshop, the group size and the unusual nature of the workshop, presenting archaeology to the students for the first time, may also have impacted the way students engaged with the workshop and the content of the stories. The occasional nature of the workshop meant that students did not know EP beforehand, and may have lacked trust to undertake this activity. However, the presence of AG (whom some of the students knew), along with her experience in education in Galapagos, also limited bias in undertaking workshops and encouraged students to take part.
AG and EP are also both aware that the topic of plastic pollution itself is an overwhelming one that can cause anxiety and distress. These feelings can also influence how EP and AG presented the issue to students, and how EP undertook data analysis. To counter those limitations, self-reflexion was undertaken by keeping notes during the workshop and thinking about positionality throughout the analysis, annotating potential biases.

**Ethics statement**

Authorisation from the Ministry of Education (Republic of Ecuador) was obtained (MINEDUC-C25-2OD01-UDAC-2022-0936-E) and ethical clearance was obtained from the University of York. Parental and student consent were obtained for analysis of stories and surveys and clear information was provided to the students regarding data use. This work was supported by the Arts & Humanities Research Council (grant number AH/R012733/1) through the White Rose College of the Arts & Humanities.

**Conflict of interest**

The authors declare no conflict of interest.

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**Credits**

Estelle Praet: conceptualization; methodology; coding; investigation; resources; formal analysis; writing – original draft; writing – review and editing; visualization; Anne Guézou: conceptualization; resources; investigation; writing – review and editing; John Schofield: conceptualization; writing – review and editing; Raveena M. Tamoria: conceptualization; writing – original draft; writing – review and editing

**References**


Waste Journeys


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