Short Communication: A novel hypopigmentation for southeast Pacific humpback whales

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ABSTRACT

Southeast Pacific humpback whales (*Megaptera novaeangliae*) migrate annually to breeding grounds in Machalilla, Ecuador, and Uramba Bahía Málaga, Colombia. This species usually displays a black/grey body colouration with its dorsal and caudal fins exposed above water. Between 2005 and 2023, whales in these regions were studied and photographed on 1,627 days. Results indicated that 29 whales have novel body markings, including white spots, irregular circles and sinuous lines, which resemble the paintings of 20th Century artist Jackson Pollock. While this novel 'Pollock-style' pigmentation does not appear to cause health problems, we recommend further studies to evaluate its origin and effects.

KEYWORDS: *MEGAPTERA NOVAEANGLIAE*; PIGMENTATION; ECUADOR; COLOMBIA; SOUTHEAST PACIFIC

The southeast Pacific population of humpback whales (*Megaptera novaeangliae*), which the International Whaling Commission (IWC) refers to as 'Breeding stock G' (IWC, 2006), migrate annually to the Ecuadorian and Colombian Pacific between May and November in order to mate, calve and nurse in feeding areas in the Antarctic Peninsula and south of Chile (Stone *et al*., 1990; Stevick *et al*., 2004; Castro *et al*., 2008; Acevedo *et al*., 2017; Avila *et al*., 2020). Currently, it is estimated that ca. 12,000 whales are in the Southeast Pacific (Félix *et al*., 2021). Although humpback whales are classified globally as 'Least Concern' on the IUCN Red List of Threatened Species (Cooke, 2018), this species is currently the marine mammal with the greatest risk exposure based on the distribution of worldwide threats (i.e., incidental catch, pollution, traffic and tourism-related threats; Avila *et al*., 2018). In Colombian waters, humpback whales are one of the most affected marine mammal species in terms of anthropogenic threats (Avila & Giraldo, 2022), including vessel collisions, disturbance by tourist boats, pollution and incidental entanglement (Capella *et al*., 2001; Flórez-González & Capella, 2010; Avila *et al*., 2015; 2017; 2022). Marine pollution, boats and fisheries also affect humpback whales in Ecuadorian waters (Scheidat *et al*., 2000, 2004; Félix & Van Waerebeek, 2005; Alava *et al*., 2012; Rosero, 2019; Castro & Van Waerebeek, 2019; Castro *et al*., 2020).

Humpback whales are characterised by predominantly black/grey body colouration, with white undersides to their flukes, flippers and abdomen (Clapham, 2018). Newborn humpback whale calves are partly white, with white patches on the flanks and abdomen, but this colouration grows darker with age (Faria *et al*., 2013). In addition, the eyes of both adults and calves have dark colouration (Kaufmann & Forestell, 1986). However, due to injuries, diseases or genetic conditions, this typical body colouration may change. A wide variety of skin conditions have been registered in this species, including wounds, teeth marks, skin loss, ectoparasites, epibionts, mesoparasites, tattoo skin disease-like dermatopathy and albinism (Avila *et al*., 2011; 2022; Castro *et al*., 2011;

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Van Bressem *et al*., 2014; Koper *et al*., 2017; Capella *et al*., 2018; Fraija-Fernandez *et al*., 2018; Minton *et al*., 2022; Mora *et al*., 2022; Pirotta *et al*., 2022; Giri *et al*., 2024; Li *et al*., 2024).

Entanglement with fishing gear and/or ropes can leave marks on the bodies of whales, which, if the rope or nets cannot be removed in the short term, may cause lacerations that over time amputate limbs or parts of the fins (e.g., Avila *et al*., 2022). Collisions with boats can also scar or modify fins and other parts of the body (e.g., Van Waerebeek *et al*., 2007; Minton *et al*., 2022). Several humpback whales, including calves, were observed with wounds and scars caused by the bites of killer whales (*Orcinus orca*; e.g., Capella *et al*., 2018; Minton *et al*., 2022). In addition, ectoparasites and epibionts are commonly observed on the bodies of humpback whales. Skin colonisation by cyamids and diatoms can alter the colour of the body and leave round marks when detached (Avila *et al*., 2011; Minton *et al*., 2022). Mesoparasitic copepods, such as *Pennella balaenoptera*, found on a variety of marine mammals, including humpback whales, leave line marks and crater-like scars on the body surface (dark or white). *P. balaenopterae* has also been found attached to the whales' bodies (Alps *et al*., 2017; Fraija-Fernandez *et al*., 2018; Hanninger *et al*., 2023; Zeng & Lin, 2023). Tattoo skin disease-like lesions in humpback whales are characterised by irregular or rounded light grey cutaneous marks, often showing a contrasting outline (Van Bressem *et al*., 2014; Minton *et al*., 2022). Finally, abnormal white colouration, a result of genetic anomalies, such as leucism or albinism, has also been recorded in humpback whales (Polanowski *et al*., 2012; Lydersen *et al*., 2013; Fertl & Rosel, 2018; Mora *et al*., 2022). Both are types of hypopigmentation, a condition where the skin is either lighter than normal or completely without colour (Fert & Rosel, 2018). The colouration of skin, hair and eyes depends on the presence (or absence) of melanin pigment, whose production involves the enzyme Tyrosinase. An albino animal is recognised by the lack of pigment in its skin and its pink/red eyes. Often it also has a higher sensitivity to light. Leucistic animals have reduced pigmentation, with white or beige patches of skin, and normal-coloured eyes. Other colouration anomalies associated with melanin pigment are piebaldism (missing pigmentation in some areas), melanism (overproduction of melanin that causes anomalously dark colouration) (Fertl & Rosel, 2018). Furthermore, reduction of melanin production causes an anomalous pigmentation pattern in Southern right whales (*Eubalena australis*) called grey morphism, where the whales are white at birth, changing to a brownish grey a when adult (Eroh *et al*., 2017). Another depigmentation disease is vitiligo, a chronic skin condition marked by the gradual loss of pigmentation, leading to the emergence of white or depigmented patches on the skin. The cause of vitiligo possibly involves a blend of genetic, autoimmune and environmental factors (Giri *et al*., 2024; Li *et al*., 2024). Vitiligo has also been registered on a fin whale (*Balaenoptera physalus*) in northwest Spain (Methion & López, 2019).

In the present study, we analysed information from humpback whales sighted in Machalilla National Park, Ecuador (1°28'S, 80°46'W), between 2005–2023, and in Uramba Bahía Málaga National Park, Colombia (3°58'N, 77°19'W), between 2008–2023. We followed a group of whales from small boats (< 12 m) during daylight hours (08:00–18:00) and recorded the number of animals, age (calf, juvenile, adult), location (coordinates) and behaviour using focal sampling. Photos and videos of flanks and dorsal fins, flukes and bodies were analysed both for photo ID and the presence of abnormal external conditions. We analysed over 565,000 photographs taken in Machalilla during 1,540 effort days and Uramba Bahía Málaga during 87 effort days. The specific number of different whales sighted in each site is unknown and no matching between sites has been conducted to date. However, a total of 4,828 whales were selected based on photos of the dorsal flank and/or fin which were of suitable quality to enable diagnosis of pigmentation anomalies and photo ID – 4,482 registered in Machalilla and 346 in Uramba Bahía Málaga. Selected whales are different individuals per day but not per year or between sites. Of the total whales selected, 29 different individuals (three juveniles and 26 adults) displayed a similar novel pigmentation style (Table 1). These 29 individuals were analysed for matching and behaviour patterns (recorded in the field notes and images). This novel pigmentation includes a black/grey body with white spots, irregular circles and sinuous lines (Figure 1). As this colouration resembles the abstract paintings of 20th Century artist Jackson Pollock, we propose the term 'Pollock-style' pigmentation.

Whales sighted with 'Pollock-style' pigmentation were mainly adults (90%). While no calves with this pigmentation were recorded, there were three juveniles (7–12 m length). In Machalilla (Ecuador), 26 whales with 'Pollock-style' pigmentation have been identified since 2005 – two juveniles and 24 adults. In Málaga (Colombia), there have been three whales with 'Pollock-style' pigmentation identified since 2009 – one juvenile

Figure 1. Humpback whales in the southeast Pacific showing 'Pollock-style' pigmentation. A1–2 (Aug 2016) and B1 (Jul 2005) show adults in Ecuadorian waters. C1–4 (Jul 2021) show a juvenile with pigmentation over almost all its body in Colombian waters; note its eyes have normal colouration (C2). D1–4 (Oct 2021) show an adult in Colombian waters.

and two adults. Based on the selected whales with high-quality images, the percentage of whales observed with 'Pollock-style' pigmentation increased from 0.7% in 2005 to 2.2% in 2023 (Table 1). However, we cannot asses the overall prevalence of 'Pollock-style' pigmentation until all matching and analyses are complete. All 29 individuals with 'Pollock-style' pigmentation were photographed on the dorsal surface, but pictures of the entire body or ventral surfaces (e.g., when breaching) were only obtained for five whales. All the whales with 'Pollock-

Table 1

Humpback whales in the southeast Pacific showing 'Pollock-style' pigmentation, sighted in Machalilla National Park, Ecuador, and Uramba Bahía Málaga National Park, Colombia, between 2005 and 2023. Effort is displayed in monitoring days and number of photos captured. 'Selected whales' refers to the number of whales with photos of the dorsal flank and/or fin of suitable quality to enable the diagnosis of pigmentation anomalies and photo-ID.

Year	Study site	Effort in days	Effort in photos	Selected whales	Whales with 'Pollock-style' pigmentation			
					Number of whales	% whales	Type of whale	Registered
2005	Machalilla	84	5898	270	2	0.7	1 juvenile, 1 adult	Machalilla
2006	Machalilla	79	3919	186	0	0.0		
2007	Machalilla	68	4784	191	0	0.0		
2008	Machalilla & Málaga	84	11038	287	0	0.0		
2009	Machalilla & Málaga	81	16518	322	2	0.6	2 adults	Machalilla & Málaga
2010	Machalilla & Málaga	63	10209	197	1	0.5	1 adult	Machalilla
2011	Machalilla & Málaga	72	23207	150	1	0.7	1 adult	Machalilla
2012	Machalilla & Málaga	61	25807	196	3	1.5	3 adults	Machalilla
2013	Machalilla & Málaga	79	39302	162	0	0.0		
2014	Machalilla & Málaga	87	25823	200	1	0.5	1 adult	Machalilla
2015	Machalilla	49	25061	216	1	0.5	1 adult	Machalilla
2016	Machalilla & Málaga	87	37225	320	2	0.6	2 adults	Machalilla
2017	Machalilla	95	49653	343	0	0.0		
2018	Machalilla	58	26903	121	0	0.0		
2019	Machalilla & Málaga	106	46941	421	1	0.2	1 adult	Machalilla
2020	Machalilla & Málaga	55	51069	241	0	0.0		
2021	Machalilla & Málaga	118	47393	214	3	1.4	2 juveniles, 1 adult	Machalilla & Málaga
2022	Machalilla & Málaga	134	43243	388	3	0.8	3 adults	Machalilla
2023	Machalilla & Málaga	167	71512	403	9	2.2	9 adults	Machalilla

style' pigmentation were apparently healthy (Pettis *et al*., 2004), and displayed normal behaviours, such as displacement and aerial behaviour (Whitehead, 1985; Avila, 2006). 'Pollock-style' marks were mostly observed in photos of the dorsal side, but for five animals, these 'Pollock-style' marks were observed over almost the entire body. Furthermore, in one individual, where both eyes could be observed, these showed the normal dark colouration, rather than the pink/red associated with albinism (Figure 1 – C2).

We have documented humpback whales with a variety of scars and injuries in Ecuador and Colombia (Castro *et al*., 2011; Avila *et al*., 2022), but the percentage of whales with 'Pollock-style' pigmentation has increased. In the last three years, we recorded at least three humpback whales per year with this novel pigmentation. To the best of our knowledge, these are the first cases of 'Pollock-style' pigmentation in humpback whales and the first for any cetacean species in the Eastern Tropical Pacific.

We have not been able to determine the origin of the scars. Interactions with fishing gear and boats can cause notable scars and/or fin disfigurements (e.g., Basran *et al*., 2019; Robbins & Mattila, 2001; Félix & Van Waerebeek, 2005; Castro *et al*., 2011; Avila *et al*., 2022; Minton *et al*., 2022), while interactions with other animals can leave scars and irregular lines (e.g., Capella *et al*., 2018), but 'Pollock-style' pigmentation does not seem to be related to such injuries. It is not clear whether these marks are linked to a parasite or pathogen that could compromise

the whales' health or fitness. The skin pattern of this unusual pigmentation is similar to skin patterns produced by the mesoparasitic copepod *P. balaenoptera* but without line marks and crater-like scars on the body (e.g., Alps *et al*., 2017; Hanniger *et al*., 2023). Whales with 'Pollock-style' pigmentation exhibit white spots, irregular circles and sinuous lines. We did not register any individual with *P. balaenotera* attached. Furthermore, the 'Pollock-style' pigmentation reported in this study does not appear to cause health problems, and the whales' behaviour appeared normal, with regular displacement and movements. Additionally, whales with 'Pollock-style' pigmentation did not exhibit any behaviour indicating high sensitivity to light or red/pink eyes (where we could see their eyes). Thus, we suggest that this abnormal 'Pollock-style' pigmentation could be a form of hypopigmentation, but not albinism and apparently not leucistic (e.g., Fertl & Rosel, 2018) or vitiligo (e.g., Methion & López, 2019), as the white scars resemble sinuous lines and circles rather than patches. Nevertheless, we do not know the consequences of this pigmentation. Further studies should therefore be conducted to clarify both the type of hypopigmentation and any possible consequences.

It is also important to study the origin of this pigmentation, which could be genetic, influenced by bacteria, fungus, parasites, viruses and/or environmental factors, such as a poor-quality diet, pollution or physical injuries (e.g., Fertl & Rosel, 2018; Polanowski *et al*., 2012; Mora *et al*., 2022). Abnormal colouration could cause higher vulnerability to predation due to the lack of camouflage or impair visual communication (Fertl & Rosel, 2018). To complement the photographic analyses, faecal samples, respiratory samples ('blow') and skin/blubber samples are recommended. Faecal samples provide information about intestinal parasitology and diet, as well as hormonal analyses, exposure to toxins and pollutants. Blow samples provide information about respiratory microbes, hormones, metabolites and immune-related substances. Biopsy dart samples provide information about genetic, contaminant, fatty-acid analyses, epidermal microbiome, skin lesions and epidermal diseases (Hunt *et al*., 2013). We recommend continued monitoring of this population to assess the origin of this colouration and its effects on the species. Given that only 29 animals were detected among a large number of photos examined, it appears to be rare, but the importance of this novel pigmentation for humpback whale health and survival will depend on what is found in further research efforts.

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