

Communication

# Humpback Whale Instigates Object Play with a Lion's Mane Jellyfish

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**Abstract:** Cetaceans are well-known for their intelligence, charismatic nature, and curiosity. Many species, particularly odontocetes, are known to investigate and manipulate novel objects they encounter. Yet, disentangling the drivers of these behaviors and distinguishing between those that are simply playful and those which serve a specific function remains challenging due to a lack of direct observations and detailed descriptions of behaviors. This is particularly true for mysticetes such as humpback whales (*Megaptera novaeangliae*), as records of object use are far less common than in odontocetes. Here, we present evidence of novel object use from a first of its kind encounter between an individual humpback whale and a large lion's mane jellyfish (*Cyanea capillata*) in the coastal waters off New England. We detail the interaction and discuss possible drivers for the behavior, with a focus on cetacean innovation, ectoparasite removal, and wound healing.

**Keywords:** humpback whale; innovation; lion's mane jellyfish; object use; cetacean



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## 1. Introduction

Cetaceans are some of the largest and most charismatic marine species. They display a high capacity for intelligence and are behaviorally plastic and capable of learning [1]. In further support of these traits is the fact that many cetacean species will actively investigate and manipulate novel objects as they encounter them, both in the wild and in captivity [2]. In particular, object manipulation is common in dolphins and other odontocete species. Wild dolphins have been observed harmlessly submerging seabirds in Argentina [3] and carrying sponges on their rostrum in Western Australia [4], while orcas have been observed similarly transporting dead salmon off the San Juan Islands [5]. In some listed examples, observed behaviors, such as the carrying of a sponge on the rostrum (hypothesized to protect the snout during benthic foraging [4]) support the notion that cetaceans are capable of innovation [1].

While there is no precise definition for innovation in animals, Patterson and Mann [1] describe it as the expression of creative (i.e., novel) behaviors for a functional purpose. The relatively few reports of mysticete whales employing potentially innovative behaviors have included the use of novel objects, such as bowhead whales interacting with floating logs in the Beaufort Sea [6]. Similarly, right whale calves in Patagonia have been observed manipulating kelp with their heads and flippers [7]. While the authors in both instances speculated these behaviors were likely play, it remains unclear what function or role they may indeed serve, and whether innovative, purpose-driven object use is present in other, more commonly observed mysticetes such as humpback whales (*Megaptera novaeangliae*).

Humpback whales are large, highly migratory, generalist consumers that are present in all oceans globally [8]. Following major population declines driven by historical whaling, this species has rebounded strongly, and as of 2018, the species has been characterized as "Least Concern" by the IUCN Red List of Threatened Species [9]. Due to their relatively

large numbers, predictable aggregations at seasonal feeding and nursery areas, and their iconic surface behaviors, humpback whales have become one of the most targeted whale-watching species in the world [10], and as such, observations by humans are relatively common. Despite the frequency of encounters, however, there is relatively little evidence to date of innovative object use by the species.

One of the few scientific records is from Australia, where juvenile and subadult humpback whales were observed interacting with *Phyllospora comosa*, a species of brown algae, on at least three occasions [11]. The whales were observed grasping seaweed in their mouths and draping it over their backs and pectoral fins. While the authors concluded the interactions likely represented object play, they posited several potential functions for the behavior, including tactile stimulation, removal of ectoparasites, or self-training to improve object manipulation skills [11]. Additionally, a single female humpback whale in Hawaii was observed passing cargo netting and rope between its pectoral fins and rostrum (see M.H. Deakos personal observations in [12]). Disentangling the functions of object usage in large cetaceans such as humpback whales, and what cognitive drivers may underpin them, remains a challenge due to a lack of extended observations and detailed ethograms. However, as the global whale watching industry continues to expand (>USD 2 billion in 2008 [13]; a figure which is likely to have grown substantially over the last 13 years), there is increased potential for documenting and describing these behaviors, which may improve our understanding of their potential function.

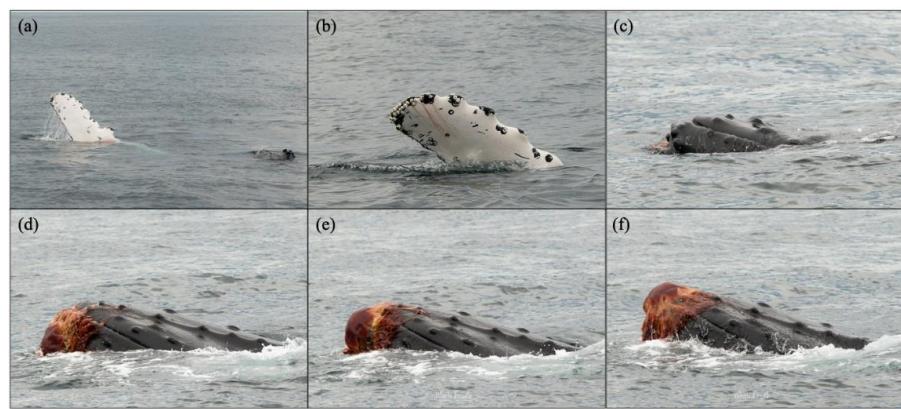
Here, we provide additional evidence for innovative object use in a large mysticete, by detailing observations of a single humpback whale interacting with a lion's mane jellyfish (*Cyanea capillata*) in the coastal waters off New England. We describe this first of its kind behavior and discuss whether it may be innovative and function as a means of ectoparasite removal and wound healing.

## 2. Materials and Methods

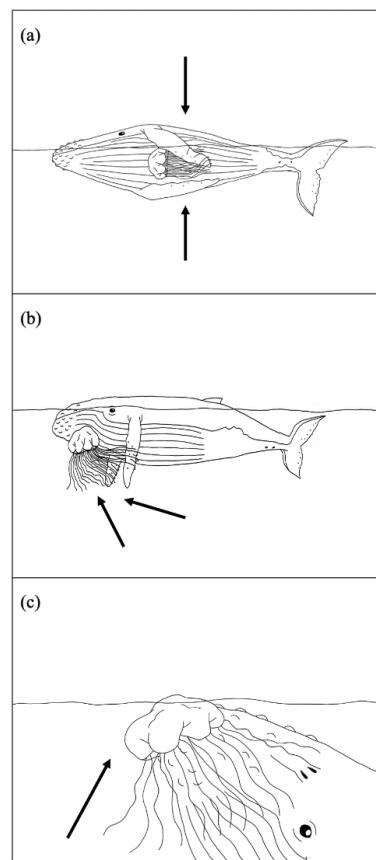
This interaction occurred offshore within the Stellwagen Bank National Marine Sanctuary (42.402° N, 70.423° W), within the Gulf of Maine, ~32 km east from Gloucester, Massachusetts, USA and ~10 km north from Provincetown, Massachusetts, USA, on 19 August 2020. Observations were made from aboard a 33 m ecotourism whale watching vessel, the Privateer IV of 7 Seas Whale Watch. Sea surface conditions were calm and glassy, with light wind (<5 knots) and overcast skies.

## 3. Results

At roughly 1450 h, an approximately 12 m long humpback whale, which was then identified as a known 6-year-old female (named Abyss), was observed laterally rolling at the surface and interacting with an unidentified organic object (Figure 1a). The object was first presumed to be a patch of algae or seaweed, but upon getting close to the individual the object was confirmed to be a large lion's mane jellyfish (bell radius estimated to be 1.0 m in diameter), which was confirmed by the presence of tentacles on the whale's flippers (Figure 1b). Over a period of 2 min, the whale continued rolling and began using its pectoral fins to move the intact jellyfish anterior towards the tip of the lower jaw (Figure 2a), positioning itself to actively lift the floating mass with its rostrum (Figure 1c). The whale stalled, permitting the ~5 m tentacles of the jellyfish to wrap around both pectoral fins before rolling back into a normal orientation at the surface (Figure 2b). By 1457, the whale had moved the jellyfish anterior to the point that it was completely covering the opening of the whale's mouth, extending its bell approximately 0.75 m posterior over the dorsal tubercles and the ventral grooves (Figures 1d,e and 2c). The whale remained stationary and in a state of rest at the surface, keeping its rostrum and the attached jellyfish out of the water for an additional 5 min (Figure 1f).



**Figure 1.** Photographs of interaction between humpback whale and lion's mane jellyfish. **(a)** Observers spotted the whale laterally rolling and interacting with an unknown organic object, later identified as a lion's mane jellyfish; **(b)** photo depicts the tentacles of jellyfish draped across the whale's pectoral fins; **(c)** the whale positioned the jellyfish near its rostrum; **(d–f)** the whale partially lifted the jellyfish onto its head, such that the bell covered the whale's mouth and extended over the dorsal tubercles and ventral grooves. Photo credits **(a–d)**: 7 Seas Whale Watch. Photo credits **(e,f)**: Mandy Houston/Whale Breath Photography.



**Figure 2.** Figure depicts the behavior of the humpback whale during the interaction with a lion's mane jellyfish. **(a)** Humpback whale using its pectoral fins to move the jellyfish anterior towards its rostrum but stalled with the tentacles wrapped around both pectoral fins; **(b)** the whale rolled back to a normal orientation at the surface and continued moving the jellyfish anterior; **(c)** the whale positioned the jellyfish near its rostrum, and partially lifted the jellyfish onto its head, such that the bell covered the whale's mouth and extended over the dorsal tubercles and ventral grooves. Graphic credit: Stephanie Blaine.

At 1502 the whale detached itself from the jellyfish and then approached the observation vessel. At this time, clear evidence of skin lesions from bottom-feeding behaviors were observed on the whale's dorsal rostrum, suggesting a generalized deterioration of skin condition and yellow, necrotic wound edges (Figure 3). Recent abrasion to the skin of the affected area was also apparent, likely due to being covered by the stinging mass of the jellyfish. The whale made a quick visual investigation of the boat and remained near the boat for ~30 min before the vessel left. The individual whale was seen two days later at the same site, engaging in numerous well-described behaviors including lobtailing, tail and fin slapping, and breaching.



**Figure 3.** Photographs of observed skin lesions on the humpback whale, likely from bottom feeding for sand lance. (a) Wounds visible, including yellow, necrotic wound edges; (b) evidence from a different individual (not studied here) exhibiting recent abrasion to the same general region of the rostrum area. Photo credit: 7 Seas Whale Watch.

#### 4. Discussion

Previous examples of object use in humpback whales have been hypothesized to be linked to tactile stimulation and/or aid in the removal of ectoparasites [11]. We present the first ever scientific evidence for behavioral interaction between humpback whales and jellyfish and make the case for a potential therapeutic—specifically would healing or parasite removal—function of the interaction due to the cognitive abilities of humpback whales.

Humpback whales are generalist consumers and display remarkable plasticity in their behaviors, including foraging techniques. Across their range, humpbacks feed on prey ranging from euphausiids to moderately sized forage fish and can make prey-specific and habitat-specific adjustments to feeding styles (e.g., bubble-netting, lunge feeding, pectoral herding [14,15]). Though their adaptability in foraging techniques is well-known, novel descriptions of innovative behaviors in mysticete whales, such as the one described here, are increasing. Using aerial drones, bowhead whales have been documented using rocks to assist with removal of skin during summer molting periods, where the whales had learned to select their seasonal habitats according to geological and oceanographic features which permitted this behavior [16].

Bio-fouling is common in humpback whales, as there are numerous anatomical sites that harbor the attachment of ectoparasites and sessile invertebrates. Barnacles are frequently seen around the tubercles on the rostrum and flippers, and whale lice are commonly found in wounds, on pectoral fins and within ventral pleats [17,18]. Fouling growth and micro-organisms present potential costs to humpback whales, ranging from increased drag leading to less efficient energy expenditure, to histological impacts and trauma that can lead to infection and morbidity (see [18]). During the encounter, the whale strategically positioned the jellyfish, and its stinging tentacles, across its pectoral fins and the tip of the lower jaw, two areas that are known to be densely populated with ectoparasites [17]. Additionally, in positioning the jellyfish such that its stinging tentacles spread across both pectoral fins, the whale may have been attempting to remove biofouling from its tubercles using the tentacles. Given the potential for innovation among this species, it is plausible that humpback whales may employ additional behavioral strategies such as the one described here, to reduce or remove bio-fouling.

Humpback whales also harbor diverse communities of skin bacteria [19], which may pose threats to open wounds. In our observations, we noted that the rostrum of the implicated whale was spotted with open—and seemingly infected—wounds, likely a result of their benthic-foraging strategy of diving and capturing sand lance (*Ammodytes* spp.) at the study site [20,21]. Furthermore, wounds are frequent sites of ectoparasite colonization [17]. Given that the humpback here covered this entire region with the stinging bell of the jellyfish, we believe this behavior could have been intentional such that the stinging nematocysts could serve to remove parasites and assist in wound healing at the site of trauma and infection. We realize this is speculative, but given the overlapping ranges between both species, humpback whales are likely to have learned about the stinging-nature of large, neritic jellyfish such as the lion's mane.

Humpback whales, and other mysticetes, have frequently been observed engaging in various forms of play [12,22,23]. There is even some evidence of humpback whales interacting with other species in behaviors which could be considered object play (with the other species as the “object”). Deakos et al. [12] described two separate occasions in which a humpback whale was observed using its rostrum to lift a bottlenose dolphin completely out of the water. Additionally, in Australia, a humpback whale was observed using its pectoral fins to flip an overturned sea turtle [24]. The drivers for these interspecific interactions remain elusive, and we cannot rule out the possibility that the jellyfish-associated behavior as reported here was another example of a whale engaging in play with an animal object. However, we note that if the interaction detailed here were indeed simply play (i.e., there was no function for the object use), prolonged contact with a large jellyfish in the manner described would result in the whale needlessly exposing the sensitive areas of

its body to stinging nematocysts. Previously observed interactions between humpback whales with seaweed [11], cargo netting and rope [12], were different in that the objects themselves presented no biological threats to the whales, and thus it seems unlikely that our interaction merely represented an opportunity for tactile stimulation or self-training in object manipulation.

Taken together, the novelty of this interspecies interaction (despite decades of frequent observation by whale watch ecotourism and naturalists) and the health status of the individual whale combine to suggest that the observed jellyfish-associated behavior was innovative and may have been an attempt to assist with observed injuries. As such, we encourage researchers to collaborate with naturalists and whale watching operators to document additional examples in other areas. While we do not discount this behavior as potential “play,” we find it difficult to rationalize the benefits since the jellyfish could have negatively affected whale health by stinging sensitive areas such as the whale’s eyes and blowhole. Whether the function of this behavior was an attempted removal of parasites or wound healing, it adds a novel example of object manipulation in cetaceans and adds to existing questions regarding humpback whale behavior and cognition.

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**Conflicts of Interest:** The authors declare no conflict of interest.

## References

1. Patterson, E.M.; Mann, J. Cetacean Innovation. In *Animal Creativity and Innovation*; Elsevier BV: Amsterdam, The Netherlands, 2015; pp. 73–125.
2. Paulos, R.D.; Trone, M.; Kuczaj, S.A., II. Play in wild and captive cetaceans. *Int. J. Compar. Psychol.* **2010**, *23*, 701–722.
3. Würsig, B. Playful Behavior. In *Encyclopedia of Marine Mammals*; Elsevier BV: Amsterdam, The Netherlands, 2018; pp. 741–743.
4. Parra, G.J. Observations of an Indo-Pacific humpback dolphin carrying a sponge: Object play or tool use? *Mammals* **2007**, *71*, 147–149. [\[CrossRef\]](#)
5. Whitehead, H.; Rendell, L.; Osborne, R.W.; Würsig, B. Culture and conservation of non-humans with reference to whales and dolphins: Review and new directions. *Biol. Conserv.* **2004**, *120*, 427–437. [\[CrossRef\]](#)
6. Würsig, B.; Dorsey, E.M.; Richardson, W.J.; Wells, R.S. Feeding, aerial and play behavior of the bowhead whale, *Balaena mysticetus*, summering in the Beaufort Sea. *Aquat. Mammal.* **1989**, *15*, 27–37.
7. Payne, R. Swimming with Patagonia’s right whales. *Nat. Geogr.* **1972**, *142*, 576–587.
8. Clapham, P.J. Humpback Whale. In *Encyclopedia of Marine Mammals*; Elsevier BV: Amsterdam, The Netherlands, 2009; pp. 582–585.
9. Cooke, J.G.; IUCN Megaptera Novaehollandiae. IUCN Red List of Threatened Species. 2018. Available online: <https://www.iucnredlist.org/species/13006/50362794> (accessed on 20 May 2021).
10. Hoyt, E. *Whale Watching 2001: Worldwide Tourism Numbers, Expenditures, and Expanding Socioeconomic Benefits*; International Fund for Animal Welfare: Yarmouth, MA, USA, 2001; pp. i–vi; 1–158.
11. Owen, K. Short Note: Seaweed Interactions by Humpback Whales (*Megaptera novaeangliae*): A Form of Object Play? *Aquat. Mammal.* **2012**, *38*, 418–422. [\[CrossRef\]](#)
12. Deakos, M.H.; Branstetter, B.K.; Mazzuca, L.; Fertl, D.; Mobley, J.R. Two Unusual Interactions Between a Bottlenose Dolphin (*Tursiops truncatus*) and a Humpback Whale (*Megaptera novaeangliae*) in Hawaiian Waters. *Aquat. Mammal.* **2010**, *36*, 121–128. [\[CrossRef\]](#)
13. O’Connor, S.; Campbell, R.; Cortez, H.; Knowles, T. *Whale Watching Worldwide: Tourism Numbers, Expenditures and Expanding Economic Benefits*; International Fund for Animal Welfare: Yarmouth, MA, USA, 2009.
14. Jurasz, C.M.; Jurasz, V.P. Feeding Modes of the Humpback Whale, *Megaptera Novaehollandiae*, in Southeast Alaska. *Sci. Rep. Whales Res. Inst.* **1979**, *31*, 69–83.

15. Kosma, M.M.; Werth, A.J.; Szabo, A.R.; Straley, J.M. Pectoral herding: An innovative tactic for humpback whale foraging. *R. Soc. Open Sci.* **2019**, *6*, 191104. [[CrossRef](#)] [[PubMed](#)]
16. Fortune, S.M.E.; Koski, W.R.; Higdon, J.W.; Trites, A.W.; Baumgartner, M.F.; Ferguson, S.H. Evidence of molting and the function of “rock-nosing” behavior in bowhead whales in the eastern Canadian Arctic. *PLoS ONE* **2017**, *12*, e0186156. [[CrossRef](#)] [[PubMed](#)]
17. Rowntree, V.J. Feeding, distribution, and reproductive behavior of cyamids (Crustacea: Amphipoda) living on humpback and right whales. *Can. J. Zool.* **1996**, *74*, 103–109. [[CrossRef](#)]
18. Osmond, M.G.; Kaufman, G.D. A heavily parasitized humpback whale (megaptera novaeangliae). *Mar. Mammal. Sci.* **1998**, *14*, 146–149. [[CrossRef](#)]
19. Apprill, A.; Mooney, T.A.; Lyman, E.; Stimpert, A.K.; Rappé, M.S. Humpback whales harbour a combination of specific and variable skin bacteria. *Environ. Microbiol. Rep.* **2010**, *3*, 223–232. [[CrossRef](#)] [[PubMed](#)]
20. Hain, J.H.W.; Ellis, S.L.; Kenney, R.D.; Clapham, P.J.; Gray, B.K.; Weinrich, M.T.; Babb, I.G. APPARENT BOTTOM FEEDING BY HUMPBACK WHALES ON STELLWAGEN BANK. *Mar. Mammal. Sci.* **1995**, *11*, 464–479. [[CrossRef](#)]
21. Ware, C.; Wiley, D.N.; Friedlaender, A.S.; Weinrich, M.; Hazen, E.L.; Bocconcelli, A.; Parks, S.E.; Stimpert, A.K.; Thompson, M.A.; Abernathy, K. Bottom side-roll feeding by humpback whales (Megaptera novaeangliae) in the southern Gulf of Maine, U.S.A. *Mar. Mammal. Sci.* **2013**, *30*, 494–511. [[CrossRef](#)]
22. Cartwright, R.; Sullivan, M. Behavioral ontogeny in humpback whale (Megaptera novaeangliae) calves during their residence in Hawaiian waters. *Mar. Mammal. Sci.* **2009**, *25*, 659–680. [[CrossRef](#)]
23. Zoidis, A. Effects of Sex, Seasonal Period, and Sea State on Calf Behavior in Hawaiian Humpback Whales (Megaptera novaeangliae). *Aquat. Mammal.* **2014**, *40*, 44–58. [[CrossRef](#)]
24. Fertl, D.; Fulling, G.L. Interactions between marine mammals and turtles. *Mar. Turt. Newslett.* **2007**, *115*, 4–8.