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AND SOCIOTECHNICAL KNOWLEDGE-PRACTICES

Elemental problems, methodical solutions: expertise, ecology and entertainment in the study of marine mammals

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Abstract: This paper examines the development of socio-technical strategies and practices for the study and display of marine mammals. It considers how techniques initially developed for terrestrial use were deployed under marine conditions, not least through the adaptation of strategies and habits originating in industry, commerce and the military, in order to facilitate researchers' access to their subjects. In particular, it examines how these methodological developments intersected with the terrestrial display of marine mammals. Throughout, it shows how the agency of the animals under observation had a key role to play in the emergence of cetology as a profession and as a form of knowledge.

Keywords: agency; methodology; field science; marine mammals; popular science

In 2013, the film *Blackfish* premiered at the Sundance Film Festival. Written by Gabriela Cowperthwaite, distributed by CNN, and nominated for a BAFTA award for Best Documentary in 2014, the film took as its focus a series of tragic events which occurred at the SeaWorld Marine Life Park in Orlando, Florida. There, in 2010, an exhibition of human-orca interaction had culminated in the death of senior SeaWorld trainer Dawn Brancheau.¹ Drawing on a range of evidence, including the testimony of a range of marine animal behaviour experts, the documentary's message was clear. Brancheau had died as the result of deliberate actions by the captive orca Tilikum, who had also been involved with the death of two other humans. Tilikum was not, however, to be held responsible for the killings. These humans, and many more orcas, had suffered and died as a direct consequence of the decision to keep cetaceans in captivity and to profit by their capacity to entertain a human audience.

Understandably, *Blackfish* provoked considerable controversy. SeaWorld itself vehemently rejected its interpretation of what had happened at the Orlando park and refused to take part in the making of the film, as did several of its trainers and employees.² In its defence, it argued that the scholars who had criticised the company were in fact animal rights activists masquerading as researchers, and stressed its broader contributions to conservation and public education around marine mammals. Despite this, shortly after the film's release, corporate sponsors began to look askance at the company, attendance at its parks in Florida, California and Texas began to decline, and various US lawmakers proposed introducing or updating animal welfare legislation that would either ban or severely curtail the practice of keeping orcas captive and displaying them in public performance. The company's efforts to defend itself notwithstanding, by spring 2016, it seemed to have capitulated to public pressure: it announced that it would no longer breed orcas in captivity, nor would it teach them to perform.³ Ethics, it appeared, had trumped economics: when it came to human/cetacean interaction, if whales were to be examined by humans, then it would be by scientists striving to conserve the species, not at shows put on for public gratification.⁴

¹ <http://awards.bafta.org/award/2014/film/documentary> (accessed June 10, 2019).

² https://web.archive.org/web/20131227051903/http://seaworld.com/en/-/link.aspx?_id=9D0C956E74134E4AA34626AD43CC1F79&_z=z (accessed June 10, 2019).

³ Amber Jamieson, "Seaworld Decides to Stop Killer Whale Breeding Program," *The Guardian*, March 17, 2016 (<https://www.theguardian.com/us-news/2016/mar/17/seaworld-to-stop-breeding-killer-whales-orcas-blackfish>, accessed June 10, 2019).

⁴ Similar concerns have, of course, frequently been raised with regard to the relationship between entertainment, education and conservation/research in zoos more generally. See Elizabeth Hanson, *Animal Attractions: Nature on Display in American Zoos* (Princeton: Princeton University Press, 2002); Nigel Rothfels, *Savages and Beasts: the Birth of the Modern Zoo* (Baltimore: Johns Hopkins University Press, 2002); David Hancocks, *A Different Nature: the Paradoxical World of Zoos and their Uncertain Future* (Berkeley: University of California Press, 2001); Bob Mullan and Garry Marvin, *Zoo Culture* (Urbana: University of Illinois Press, 1999); Randy Malmud, *Reading Zoos: Representations of Animals and Captivity* (Basingstoke: Palgrave, 1998).

But from a historical perspective, the scientific study, commercial exploitation and public display of marine mammals have always been thoroughly intertwined with, and dependent on, each other. From the whalers of the nineteenth century, through the development of the world's first oceanarium in Florida in the 1930s, the establishment of Whale Overlook off San Diego in 1950 (the first public whale watching station), the emergence of "Flipper-friendly" tuna in the 1990s and the public debates about oceans and plastics sparked by the broadcast of Sir David Attenborough's *Blue Planet II* in 2017, scientific research has been reliant on the access to animals provided by corporate interests, and on the willingness of the public to support marine mammal research, both individually and collectively. This point is not made to defend SeaWorld, or to justify the events chronicled in *Blackfish* – but to emphasise that the performances of Tilikum and his peers, sits firmly in this centuries-old tradition. Science and economics, ethics and entertainment have always been entangled in the study and display of wild animals: if the viewer finds the one unacceptable, then they must also consider the consequences of that revulsion for the other.

As with all the field sciences, researchers have used commercial activities not just as a vector to access their subject/s, but as a source of methodological and historical expertise.⁵ Ocean science research has been facilitated by the capacity of practitioners to draw on the technologies and skills of anglers (both commercial and leisure), sailors and divers (whether military or civilian), as well as pilots, film-makers, polar explorers, hunters, and ordinary people (whether indigenous or migrant).⁶ For scientists studying marine mammals, the roles played by the navies of various countries, as well as the fishing and tourism industries, have been particularly important – even to the point where these *mammals* were studied and managed by officials, companies, departments and individuals who otherwise dealt wholly with *fish*. The animals' habitat – the world's seas and oceans – clearly trumped their phylogeny when it came to examining and understanding their bodies and behaviour.

Does it still? This article will examine the development of the socio-technical strategies and

⁵ See, for example, Jeremy Vetter, ed., *Knowing Global Environments: New Historical Perspectives in the Field Sciences* (New Jersey: Rutgers University Press, 2011); Robert E. Kohler, *All Creatures: Naturalists, Collectors and Biodiversity* (Princeton NJ: Princeton University Press, 2006); David Livingstone, *Putting Science in its Place: Geographies of Scientific Knowledge* (Chicago: University of Chicago Press, 2003); Henrika Kuklick and Robert Kohler, eds., "Science In the Field," Special issue, *Osiris* 11 (1996); Amanda Rees, "Exploring nature: Geographies of the History of Science," in *Oxford Illustrated History of Science*, ed. Iwan Rhys Morus, 246-79 (Oxford: Oxford University Press, 2017).

⁶ See, among others, Sam Robinson, *Ocean Science and the British Cold War State* (London: Palgrave Macmillan, 2018); Gary Kroll, *America's Ocean Wilderness: a Cultural History of 20th Century Exploration* (Lawrence, KA: University Press of Kansas, 2008); Helen Rozwadowski and David K. van Keuren, eds., *The Machine in Neptune's Garden: Historical Perspectives on Technology and the Marine Environment* (Sagamore Beach, MA: Science History Publications, 2004); Helen Rozwadowski, *Fathoming the Ocean: the Discovery and Exploration of the Deep Sea* (Cambridge MA: Harvard University Press, 2005); Philip E Steinberg, *The Social Construction of the Ocean* (Cambridge: Cambridge University Press, 2001).

practices that made the scientific study of marine mammals possible, focusing in particular on the period between the late 1950s and the late 1970s, when the modern period of field studies of animal behaviour began.⁷ It will show that these processes involved experts and laypeople who shared interests in understanding the biology, psychology, ecology and sociology of marine mammals, and in order to further them, also pooled techniques, approaches and skills to enable them to manage the unfamiliar, and often hostile, environment in which the animals were found. It will review the history of human/mammal interaction at sea, from the whalers of the nineteenth century (and earlier) to the long-term field studies of habituated cetaceans that were established by the late twentieth/early twenty-first century. It will briefly touch on the key figures and influences that prefigured the first efforts to study free-living marine mammals in the second half of the twentieth century – in particular, the emergence of new institutions and scientific disciplines such as mammalogy, ethology and wildlife management. It will examine the construction of the live sea-science toolkit: the tools (theodolites, cameras, ethograms and tags), the vehicles (the ship, the scuba, the semi-submersible-seasick-machine), the techniques (individual identification, surveys, focal animal sampling, live-capture), as well as the often-tacit knowledge underlying each of these that required elucidation before successful operationalisation. It will consider the role played by individual animal agency in both facilitating and frustrating these developments. But before developing an account of cetology as a multi-species history of scientific and socio-technical practices, the paper will begin by considering the nature of the elemental problems faced by marine mammalogists.

All at sea?

Unsurprisingly, the fact that marine mammals live in the world's oceans, in an element where human beings can quickly find themselves quite literally out of their depth, was historically cited as a reason why they were much harder to study than terrestrial creatures. What Evans et al. have called the “cryptic nature of cetaceans at sea” has meant that whales and dolphins in particular are difficult to access – only readily identified at the ocean surface, hard to follow if they decide to dive to the depths, and with migration patterns that can range from the poles to the equator.⁸ As Richard Connor and his colleagues noted as recently as the year 2000, “whales and dolphins are long-lived, reproduce slowly and spend most of their lives hidden” – it should

⁷ Amanda Rees, “Wildlife Agencies: Practice, Intentionality and History in 20th C Animal Field Studies”, *BJHS Themes* 2 (2017): 127-49; Etienne Benson, *Wired Wilderness: Technologies of Tracking and the Making of Modern Wildlife* (Baltimore: Johns Hopkins University Press, 2010); Amanda Rees, *The Infanticide Controversy: Primatology and the Art of Field Science* (Chicago: University of Chicago Press, 2009); Richard W Burkhardt Jr., *Patterns of Behaviour: Konrad Lorenz, Niko Tinbergen and the Founding of Ethology* (Chicago: University of Chicago Press, 2005).

⁸ Peter G. H. Evans, Graham J. Pierce, and Andrew J. Wright, “Marine Mammal Studies to Address Future Challenges in Conservation Management,” *Journal of the Marine Biological Association of the UK* 92, no. 8 (2012): 1639-44, on 1639.

come as no surprise, then, that the study of their behaviour, development and social structure has lagged behind that of land mammals.⁹ Connor et al., writing at the turn of the millennium, believed that cetology still lagged behind other branches of behavioural ecology, remaining oriented to description rather than analysis, generally asking “how” or “what” questions, rather than specifically targeting “why.” But of course, whales and dolphins are not the only marine mammals – and as Burney LeBoeuf, pioneering elephant seal researcher, pointed out in 1972, not all marine mammals are hard to follow. Some beaches, for example, are much easier to access than are in-land forests or deserts. LeBoeuf argued that the distinction should really be drawn instead between the ease of observing domestic animals and the difficulty of watching wild ones, “since dugongs, sperm whales, black-footed ferrets, ant eaters and rock hyraxes, to name a few, are difficult to locate, let alone observe at the right time and long enough to record mating behaviour.”¹⁰ Thirty years later, Janet Mann agreed, suggesting that some marine species “may not be that much more difficult to study than forest creatures, which also go in and out of view, or elusive animals occupying less dense habitats.”¹¹

Was it really so difficult for scientists to study animals at sea? Clearly, the nature of the habitat posed tremendous challenges – but in some ways, the tremendous successes of certain areas of terrestrial work could overshadow the achievements of water-work. The situation was exacerbated by the immense cultural and conceptual significance attaching, for different reasons to the figures of the “chimpanzee,” the “dolphin” and the “whale” in the interpretation of the origins and ethics of human behaviour by the late twentieth century. Jane Goodall, Dian Fossey and others had had a dramatic influence on the public’s understanding of the human place in the natural world, and together with the tremendous contributions made to the understanding of evolutionary ecology by figures like Richard Wrangham, Sarah Hrdy and Joan Silk, meant that primatology had developed a notable intellectual and popular profile.¹² By the turn of the twenty-first century, this was based on half a century of fieldwork, much of

⁹ Richard C. Connor, Janet Mann, Peter L. Tyack, and Hal Whitehead, “Introduction: The Social Life of Whales and Dolphins,” in *Cetacean Societies: field studies of whales and dolphins*, eds. Janet Mann, Richard C. Connor, Peter L. Tyack, and Hal Whitehead, 1-9 (Chicago: University of Chicago Press, 2000), 1.

¹⁰ Burney J. LeBoeuf, “Sexual Behaviour in the Northern Elephant Seal,” *Behaviour* 41, no. 1/2 (1972): 1-26, on 1.

¹¹ Janet Mann, “Unravelling the Dynamics of Social Life: Long-term Studies and Observational Methods,” *Cetacean Societies*, eds. Mann et al., 45-64, on 45.

¹² Georgina Montgomery, *Primates in the Real World: Escaping Primate Folklore and Creating Primate Science* (Charlottesville: University of Virginia Press, 2015); Amanda Rees, “Anthropomorphism, Anthropocentrism and Anecdote: Primatologists on Primatology,” *Science, Technology and Human Values* 26, no. 2 (2001): 227-47; Donna Haraway, *Primate Visions: Gender, Race and Nature in the World of Modern Science* (London: Routledge, 1989).

which was at long-term field sites.¹³ Cetologists measured their work against the achievements of primatologists and found themselves lacking: Janet Mann and her colleagues, for example, explicitly acknowledge the debt that their volume *Cetacean Societies*, appearing in the year 2000, owed to the 1987 synthesis of primate life, *Primate Societies*, and wondered when their discipline would achieve the same firm empirical grounding.¹⁴ But over the course of the last hundred years or so, tremendous progress had been made, not just in the understanding of the behaviour of whales and dolphins, but with respect to seals, sea lions, walrus and even polar bears. Two caveats needed to be made here: first, that work continued to focus on species that tended either to live or to range on the coasts; and second, despite the fact that cetaceans are active at night, almost all observations were still undertaken in daylight. Nevertheless, by the second decade of the twenty-first century, a number of long-term studies of whales, dolphins and seals in particular were in progress, revealing a fascinating range of life-history characteristics which carried implications for both human and non-human behavioural ecology.¹⁵

For much of human history, however, marine mammals represented an economic, rather than an intellectual resource, and this has had implications for the ways in which scientists have worked on and with the animals. The scientific study of marine mammals is often thought to begin, for example, with the whaling industry, a modern incarnation of a practice with roots deep in human prehistory. The relationship between whales and industrialisation began in the late 1860s, with Svend Foyn's invention of the "harpoon cannon." This innovation precipitated a period in which whale oil lubricated the socio-economic mechanisms of modernity and commodity capitalism. Scientists seized the opportunity, and went along for the ride.¹⁶ Accompanying the whaling ships as they worked the Antarctic and other oceans, biologists gleaned what information they could from the bodies of the whales as they were

¹³ Rees, *Infanticide*; Amanda Rees "A Place that Answers Questions: Primatological Field Sites and the Making of Authentic Observations," *Studies in the History and Philosophy of Science C*, 37, no. 2 (2006): 311-33; Montgomery, *Primates*; Georgina Montgomery, "Place, Practice and Primatology: Clarence Ray Carpenter, Primate Communication and the Development of Field Methodology, 1931-1945," *Journal of the History of Biology* 38, no. 3 (2005): 495-533; Greg Radick, *The Simian Tongue: the Long Debate about Animal Language* (Chicago: University of Chicago Press, 2007); Shirley Strum and Linda Fedigan, eds., *Primate Encounters: Models of Science, Gender and Society* (Chicago: University of Chicago Press, 2002).

¹⁴ Mann et al., *Cetacean Societies*, referring to Barbara B. Smuts, Dorothy L. Cheney, Robert M. Seyfarth, Richard W. Wrangham and Thomas T. Struhsaker, eds., *Primate Societies* (Chicago: University of Chicago Press, 1987). See also Karen Pryor and Kenneth Norris, eds., *Dolphin Societies: Discoveries and Puzzles* (Berkeley: University of California Press, 1991).

¹⁵ Janet Mann and Caitlin Karniski, "Diving Beneath the Surface: Long Term Studies of Dolphins and Whales," *Journal of Mammalogy* 98, no. 3 (2017): 621-30.

¹⁶ Johan Tonnessen and Arne Johnsen, *The History of Modern Whaling* (Berkeley: University of California Press, 1982); D. Graham Burnett, *The Sounding of the Whale: Science and Cetaceans in the Twentieth Century* (Chicago: University of Chicago Press, 2012).

flensed and dismembered, as the American biologist Victor Blanchard Scheffer remembered. Scheffer had worked first for the United States Bureau of Biological Survey, and then for the Fish and Wildlife Service, and would eventually play a key role in the implementation of the Marine Mammal Protection Act (1972).¹⁷ His book, *The Year of the Whale*, became a popular classic of marine biology, and provided readers with a vivid and sometimes anguished account of working on whalers, waiting on the permission of the foreman before intervening in the slippery, bloody process of rendering profitability from the whale carcass.¹⁸ They were, of course, not the only mammals to be targeted in this way: also valued for the oil that could be made from their blubber, as well as their fur, several species of seals were similarly hunted almost to extinction by the beginning of the twentieth century.¹⁹ But while bodies were the source of profit, the behaviour of marine mammals could also represent a commercial threat. Seals and sea-lions in particular were demonised, in North America, the United Kingdom and elsewhere, for the damage they allegedly did to the fishing industry.²⁰ On land and sea alike, species thought to prey on animals valued for human food or leisure had bounties placed on them and were killed wholesale, even as other members of the same species were directly utilised for food and fashion – and in both cases, scientists were able to derive information from these deaths.²¹

It's important here to note that this commercially supported science through slaughter was not confined to ocean work, and that there are, in fact, important parallels between land and sea during this early period of marine mammal science. Tracy Storer's presidential address to the American Society of Mammalogists in 1969, for example, makes this clear, both in terms of the relationship between science and capitalism, and with regard to the ethical standards that pertained at that time with respect to animal treatment. Storer's address reviewed the Society's

¹⁷ Victor B. Scheffer, "Exploring with Olaus Murie: the Aleutian Expedition," *Living Wilderness* 44 (1980): 11-7; Benson, *Wired Wilderness*, 148-51.

¹⁸ Victor B. Scheffer, *The Year of the Whale* (New York: Scribner, 1969). Lewis Radcliffe gives another vivid picture of the impact that the "factory ships" of the 1930s had on whale populations on his "Status of International Convention for Protection of Whales," *Journal of Mammalogy* 13, no. 3 (1932): 251-55.

¹⁹ A. W. Anthony, "Notes on the present Status of the Northern Elephant Seal," *Journal of Mammalogy* 5, no. 3 (1924): 145-52; Daniel K. Odell, "Seasonal Occurrence of the Northern Elephant Seal on San Nicholas Island CA," *Journal of Mammalogy* 55, no. 1 (1974): 81-95.

²⁰ Clifford Fiscus and Gary Baines, "Food and Feeding Behaviour of Stellar and California Sea Lions," *Journal of Mammalogy* 47, no. 2 (1966):195-200; Grace Hickling, *Grey Seals and the Farne Islands* (London: Routledge & Kegan Paul, 1962); Victor B. Scheffer, *The Year of the Seal* (New York: Scribner, 1970).

²¹ Charles Adams, "The Conservation of Predatory Mammals," *Journal of Mammalogy* 6, no. 2 (1925): 83-96; Vernon Bailey, Joseph Dixon, E. A. Goldman, Edmund Heller, and Charles C. Adams, "Report of the Committee on Wildlife Sanctuaries, Including Provision for Predatory Mammals," *Journal of Mammalogy* 9, no. 4 (1928): 354-8. Also see Sam Alberti, ed., *The Afterlives of Animals: a Museum Menagerie* (Charlottesville: University of Virginia Press, 2011) for an analysis of the contribution of animal corpses to scientific research.

activities since its founding in 1919, focusing mostly on the period between 1930 and 1960. He saw no reason to distinguish between the study of marine and terrestrial mammals – and clearly felt that both killing and live capture were key methodologies to be used on and in both terrains. As he made clear, just as whale scientists existed in symbiosis with the whaling industry, so terrestrial biologists depended, at least in relation to the American West, on a relationship with the engineers and policy makers responsible for the Pacific Railroad Survey and all the other federal surveys of North American geology, botany and zoology.²² There were other parallels between land and sea work - airplanes, for example, were used by both to survey and census populations, or to enable potential zoo/aquaria exhibits to be “shipped from afar with a minimum of care or feeding en route.”²³ In both spaces, the work could sometimes be characterised as “salvage science,” with scientists staying one step ahead of the flensing knife or the railroad track in their efforts to record information before it was lost forever, “in the hope that someone may [one day] be able to use” it.²⁴

Managing interest

Corporations and governments were not the only groups with which scientists interested in wild animals, whether terrestrial or aquatic, had to deal. Throughout the twentieth century, the general public continued to manifest curiosity and engagement with wild animal life – sometimes more directly than others. So, for example, at the same time as American mammalogy and European ethology began to establish themselves institutionally in the 1930s, the American profession of “wildlife-management” emerged.²⁵ While these individuals were interested in establishing theoretical knowledge of animal behaviour that could be tested through examination and scholarship, their ultimate aim, as Aldo Leopold pointed out in his presidential address to the Wildlife Society, was that of “producing something to shoot.”²⁶ Hunting, both as leisure activity and a way of life, continued to play a vital economic role in the USA – and hunters were very clear that their knowledge of animal behaviour, based

²² John A. Moore, “Zoology of the Pacific Railroad Surveys,” *American Zoologist* 26, no. 2 (1986): 331-41.

²³ Tracey Storer, “Mammalogy and the American Society of Mammalogists,” *Journal of Mammology* 50, no. 4 (1969): 785-93, on 790. Storer did, however, deplore the use of planes by “trigger happy and misguided sportsmen for wanton pursuit of large mammals” (790).

²⁴ Karen Pryor, “Mortal Remains: Studying Dead Animals,” in *Dolphin Societies*, eds. Pryor and Norris, 245-50, on 248.

²⁵ Burkhardt, *Patterns of Behaviour*; John R. Durant, “The Making of Ethology: the Association for the Study of Animal Behaviour, 1936-86,” *Animal Behaviour* 34, no. 6 (1986): 1601-6; Solly Zuckerman, *From Apes to Warlords, 1904-46* (London: Hamish Hamilton, 1978); William Thorpe, *The Origins and Rise of Ethology: the Science of the Natural Behaviour of Animals* (London: Heinemann, 1979).

²⁶ Aldo Leopold, “The State of the Profession,” *Journal of Wildlife Management* 4, no. 3 (1940): 33-46, on 46.

in close, intimate, empirical experience, could easily trump book-learning. As Justin Leonard ruefully commented in 1949, there “is perhaps no other field of human endeavour where the lay public so freely arrogates to itself the privilege of passing judgements on accomplishments as in the field of wildlife conservation.”²⁷ But besides the potential conflict between the drive to establish general laws of ecology/ecology on the one hand, and the detailed in-depth knowledge of particular places and populations on the other, there was another aspect of “consuming” animals at work here. Even those who were not themselves hunters or woodsfolk found that they could experience animals at a distance – through the accounts of individual animal lives written by naturalists. The “nature-fakers” controversy of the early twentieth century was a case in point: scholars such as John Burroughs were horrified by the anecdotal accounts of animal ingenuity and creativity found in the stories of Ernest Seton and William J Long.²⁸ But the appetite of the public for these books turned them into best sellers.

Crucial to this experience was – and is – the sense of intimate engagement with wild animal individuals. By the early twentieth century, film and cinema, and by mid-century, television, were also providing the public with visual resources through which mass audiences could witness the life – and death – of wild animals, often accompanied by textual accounts of the filming.²⁹ By the late fifties, a steady stream of semi-autobiographical histories of watching wild animals were being published, stories which now stood firmly within a decades-long tradition of describing encounters with free-living animals undertaken in the search for enlightenment. In the 1950s, writers such as Armand and Michela Denis, Ada Kearton, Lois Crisler, David Attenborough and Bernhard Grzimek described their experiences in collecting specimens for zoos and – often at the same time – filming animals in South America, Africa and Asia.³⁰ Intriguingly, while these books were overwhelmingly written by zookeepers and film-makers – that is, professionals whose aim it was to display wild animals in some form or another – they were also the forerunners for the later explosion in accounts of long term field work published

²⁷ Justin Leonard, “Research Man vs Administrator: the Research Man’s Viewpoint,” *Journal of Wildlife Management* 13, no. 3 (1949): 237-244, on 241.

²⁸ See Ralph Lutz, *Nature Fakers: Wildlife, Science and Sentiment* (Colorado: Fulcrum Publishing, 1990).

²⁹ For accounts of the histories of animals in film, see Derek Bousé, *Wildlife Films* (Philadelphia: University of Pennsylvania Press, 2000); Jonathan Burt, *Animals in Film* (London: Reaktion Books, 2002); Jean-Baptiste Gouyon, “The BBC Natural History Unit: Instituting Natural-History Film-Making in Britain,” *History of Science* 49, no. 4 (2011): 425-51, and “From Kearton to Attenborough – Fashioning the Telenaturalist’s Identity,” *History of Science* 49, no. 1 (2011): 25-60; Gregg Mitman, *Reel Nature: America’s Romance with Wildlife on Films* (Cambridge MA: Harvard University Press, 1999), Chris Palmer, *Shooting in the Wild: an Insider’s Account of Making Movies in the Animal Kingdom* (San Francisco: Sierra Club Books, 2010).

³⁰ Armand Denis, *On Safari: The Story of My Life* (London: Harper Collins, 1963); Michela Denis, *Leopard in My Lap* (London: W H Allen, 1955), Ada Kearton, *On Safari* (London: Hale, 1956), Lois Crisler, *Arctic Wild* (New York: Secker & Warburg, 1959); David Attenborough, *Zoo Quest to Guiana* (London: Lutterworth Press, 1956); Bernhard Grzimek and Michael Grzimek, *Serengeti Shall Not Die* (London: Harper Collins, 1965).

by Goodall, George Schaller, David Mech, Cynthia Moss among many others.³¹ These books provided their readers with a sense of authentic immediacy, a highly-valued virtual witnessing of the encounter between the researcher/film-maker and the natural world. Hardly surprising then, that some writers and film-makers resorted to skilful techniques of camouflage, traps and cages to heighten that sense of intimacy.

This tension between intimacy and authenticity was not new – Cherry Kearton, who in 1895 had proudly proclaimed himself as “the world’s first free-lance photographer of wild-life” was dismissive of the “trip wires, telephoto and wide angle lenses” that are now at the photographer’s disposal, while Michaela Denis describes meeting a retired Colonel who refused to use a camera with a long lens, describing it as “hardly sporting,” since viewers of the photograph “would think I’d been very much closer to the animal than I actually was, you know.”³² Lois Crisler, who worked with her husband Herb on Disney’s “True Life Adventures” in Alaska, gives an account of raising wolf cubs captured from the wild in order to get close-up “baby” pictures impossible to obtain from the wild.³³ Some film-makers went a step further – for example, during the Second World War, Armand Denis tried to collect a family of gorillas from French Equatorial Africa, hoping to set up a breeding population in North America that could be used both for exhibition and for natural history films.³⁴ This was dramatically unsuccessful: the captive gorillas all sickened and died before they could be shipped – but the notion that the public desire for authentic intimacy with nature could be satiated by filming close-encounters with captive beasts remained alive and well. In particular, these socio-technological strategies for both film and text created the impression that the animals were choosing to engage, embracing the opportunity to interact. Film makers and writers elided the constraints on animal action in order to present the animal as a free agent: the audience could thus feel that they were experiencing “real,” rather than “reel” nature.³⁵

It is precisely here that the motivation for the creation of a fundamental ocean-science institution can be found. In 1938, Marine Studios – now Marineland Florida – was created by three men – W. Douglas Burden, C. V. Whitney and Ilia Tolstoy. Their initial notion had been to establish the facility as an underwater motion picture studio, to ensure that their films got the close-up shots they needed. Huge tanks ringed with large windows had initially been

³¹ Jane Goodall, *Through A Window: Thirty Years with the Chimpanzees of Gombe* (London: Weidenfeld & Nicolson, 1990); George Schaller, *A Naturalist and Other Beasts: tales from a life in the field* (New York: Counterpoint, 2010); David Mech, *The Arctic Wolf: Ten Years With the Pack* (Shrewsbury: Swan Hill Press, 1997); Cynthia Moss, *Elephant Memories: Thirteen Years in the Life of an Elephant Family* (London: Elm Tree Books, 1988).

³² Kearton, *On Safari*, 47, 49; Denis, *Leopard*, 86.

³³ Crisler, *Arctic*.

³⁴ Denis, *On Safari*.

³⁵ This pun is originally Gregg Mitman’s – *Reel Nature*.

constructed, to enable animals to be filmed without walls, cages or cameras being obvious to the audiences. But very soon, they realised that they could also make money by selling tickets to people who wanted an even more direct and personal encounter with the oceanarium's inhabitants. When the cameras weren't filming, the "movie makers found, to their surprise, that they were in the public exhibition business."³⁶ Ironically, at the same time as the citizens of Florida realised that there was something interesting going on at the new studio, so did the scientific community. Arthur McBride, a bio-psychologist who had been appointed as one of the initial caretakers, had begun to record the varied social behaviour of the dolphins, and soon other scientists – D. O. Hebb, William and Barbara Schevill, John Lilly, all of whom were to become key figures in marine mammal science – took up positions at the park/studio.³⁷ Why build your own research facility if you can take advantage of one already in existence, after all?

Burden – who was also involved with the American Museum of Natural History – and his colleagues had thus crystallised what was to become one of the key institutional strategies through which scientific research on marine mammals would take place. Marine Studios was one of the first in a long tradition of facilities that would combine scientific research with public entertainment and leisure facilities, tying economic profit (and often animal abuse) tightly to intellectual endeavour, education and – eventually – conservation. Critical to this process were the ways in which socio-technological strategies of observation, experimentation and recording were tied to broader anthropomorphic presumptions and perceptions of animal agency. As the science of cetology developed, so too did the relationship between agency and practice, creating what could at times be regarded as a multispecies history – at least from an anthropocentric perspective.

Elemental problems

As with terrestrial field studies of animal behaviour, studies of dolphins and other marine mammals began to thrive in the 1960s. The first concerted effort to observe free-swimming dolphins, for example, had begun in that decade. Graham Saayman and C. K. Taylor, who were based and worked at the Port Elizabeth Snake Park and Oceanarium combined the systematic record of behaviour in a dolphin pool where "dolphins took part in daily public

³⁶ Kenneth Norris, *The Porpoise Watcher* (London: John Murray, 1974), 294.

³⁷ Arthur McBride, "Meet Mr Porpoise," *Natural History* 45 (1940): 16-29; A. F. McBride and D. O. Hebb, "Behavior of the Captive Bottle-nose Dolphin, *Tursiops truncatus*," *Journal of Comparative and Physiological Psychology* 41 (1948):111-23. Other early researchers included David and Melba Caldwell, who were the first to notice that individual dolphins gave individual calls – see M. C. Caldwell and D. K. Caldwell, "Individualized Whistle Contours in Bottle-nosed Dolphins (*Tursiops truncatus*)," *Nature* 207, no. 4995 (1965): 434-35.

displays” with observations of free ranging dolphins in three different areas along South Africa’s Cape Coast.³⁸ In 1967, Burney LeBoeuf began a tagging programme on the northern elephant seals of Ano Nuevo and other islands off the California coast.³⁹ Roger Payne, the discoverer (with Scott McVay) of humpback whale song, and at that point working for the New York Zoological Society, began a study of right whales off the coast of Patagonia in 1970, working with the help of Bernd and Melany Wursig.⁴⁰ In the same year, Michael Biggs, the head of marine mammal research at the Pacific Biological Station on Vancouver Island, was asked to conduct a census of the killer whales off the coast of British Columbia, which grew into a long-term study.⁴¹ Also in 1970, Blair Irvine, working for Mote Marine Laboratory in Florida, and Randall Wells began to tag dolphins that swam off the coast, a project which eventually became the Sarasota Dolphin Research Programme.⁴² Experimental and captive work, however, continued to persist alongside each other, in a way that sharply contrasted with land-based experiences.

Many, if not most, of the key figures in 1960s and 1970s cetology came from, or never left, oceanarium work. Ken Norris, for example, took up his first position in 1952 as curator for a new oceanarium being built near Los Angeles, Marineland of the Pacific, which was eventually be bought out by Tilikum’s SeaWorld.⁴³ A decade later, Karen Pryor, with her colleague and husband Taylor (known as “Tap”), established Sea Life Park in Oahu, Hawaii, an oceanarium “designed by biologists, not businessmen.” Wary of “horror stories of precious research animals being pressed into public shows just when the data collection was getting good,” the Pryors intended to create a facility that would make it possible to get the best of both worlds, one

³⁸ C. K. Tayler and G. S. Saayman, “The Social Organisation and Behaviour of Dolphins and Baboons: Some Comparisons and Assessments,” *Annals of the Cape Provincial Museums* 9 (1972): 11-49; G. S. Saayman and C. K. Tayler, “Social Organisation of Inshore Dolphins in the Indian Ocean,” *Journal of Mammalogy* 54, no. 4 (1973): 993-6; G. S. Saayman and C. K. Tayler, “Diurnal Activity Cycles in Captive and Free-ranging Indian Ocean Bottle-nose Dolphins,” *Behaviour* 44, no. 3-4 (1973): 212-33.

³⁹ Burney LeBoeuf and Richard Petersen, “Social Status and Mating Activity in Elephant Seals,” *Science* 163, no. 3862 (1969): 91-3; Burney LeBoeuf, “Sexual Behaviour in the Northern Elephant Seal,” *Behaviour* 41, no. 1-2 (1972): 1-26; Burney J. LeBoeuf, David G. Ainley, and T. James Lewis, “Elephant Seals on the Farallones: Population Structure of an Incipient Colony,” *Journal of Mammalogy* 55, no. 2 (1974): 370-85.

⁴⁰ Roger Payne, *Among Whales* (New York: Delta, 1995), Bernd Wursig and Melany Wursig, “The Photographic Determination of Group Size, Composition and Stability of Coastal Porpoises,” *Science*, 198, no. 4318 (1977): 755-6, Bernd Wursig, “Dolphins,” *Scientific American* 240, no. 3 (1979): 136-48.

⁴¹ Michael A. Bigg, Graeme M. Ellis, John K. B. Ford, and Kenneth C. Balcomb, *Killer Whales: A Study of Their Identification, Genealogy & Natural History in British Columbia and Washington State* (Nanaimo, B.C.: Phantom Press, 1987).

⁴² A. B. Irvine and R. S. Wells, “Results of Attempts to tag Atlantic Bottlenose Dolphins,” *Cetology* 13, no. 1 (1972):1-5; Blair Irvine and Randall S. Wells, “Conditioning an Atlantic Bottlenose Dolphin to Repel Various Species of Sharks,” *Journal of Mammalogy* 54, no. 2 (1973): 503-5.

⁴³ Norris, *The Porpoise Watcher*.

that would not just display animals, but also showcase the process of doing scientific research. That is to say, the public would be awed by the performances of the animals, but would also be able to see the science that made the spectacle possible.⁴⁴ The centrality of captive animal-work for marine mammals at this mid-century period is clearly shown in the discussions at the first International Symposium on Cetacean Research, held in Washington, DC, August 1963. Norris' editorial preface, for example, pointed to the role of public oceanariums in focusing "both public and scientific attention upon the remarkable attributes" of the smaller cetaceans, and thus creating the sudden upsurge in interest in cetaceans.⁴⁵ The papers and discussions included in the edited conference collection clearly reflect the substantial role played by captive and experimental research in these early years of marine mammal work. Indeed, even three or four decades later, researchers continued to stress the significance of captive work, not least because of the oft-cited difficulty of observing animals at sea. As Norris and Pryor insisted in 1991, captive studies are essential in making sense of free-living cetacean behaviour: as they put it, "our cooperative captives show us whole levels and kinds of information we simply have not been able to approach in the wild, from bioacoustics to cognition."⁴⁶ The use of the word "cooperative" is key here: as with the animals on display in Marine Studios, the presumption of animal consent is clearly present.

This continued persistence of captive work contrasts with key aspects of the history of terrestrial wild animal research. In the latter case, the possibilities of naturalistic experiments, or even manipulative work that materially altered the conditions of animal life, had been enthusiastically embraced historically – the 1948 New York conference on "Methodology and Technique," sponsored by the Committee for the Study of Animal Societies under Natural Conditions" had discussed these questions in detail, for example.⁴⁷ But within a relatively short period, such overt interventions in free-living animal life were much less popular: the stress, particularly for primates, was on the significance of watching *natural* animal behaviour. But the primatologist's dream of effectually effacing oneself from the communities under observation, of habituating a free-living group to human presence, was much more difficult to achieve at sea. Researchers continued to depend on serendipitous observations, both from within the scientific community – as with the observation of dolphins apparently cooperating to herd fish

⁴⁴ Karen Pryor, *Lads Before the Wind* (New York: Harper and Row, 1975).

⁴⁵ Kenneth Norris, ed., *Whales, Dolphins and Porpoises* (Berkeley: University of California Press, 1966), v. The other two reasons were the whaling industry's realisation that the whale population was not inexhaustible and the tendency of "civilised society" to become "scientifically minded."

⁴⁶ Pryor and Norris, *Dolphin Societies*, 2.

⁴⁷ J. P. Scott, "Introduction," *Annals of the New York Academy of Sciences* 51, no. 6 (1950): 1003-5.

on land – and from members of the public.⁴⁸ But they also remained much more willing to use experimental, sometimes invasive, interventions in the lives of their research subjects – and in so doing, found themselves drawing on a range of different professional skills and resources, as well as some that could appear considerably “un”- professional.

Consider, for example, the frontispiece of Pryor and Norris’s *Dolphin Societies*. It is a photograph of the two editors earlier in their careers, and it shows them on the deck of a fishing boat in Hawaii. The title informs the reader that they are “creating an instrument belt for a trained dolphin to wear during open ocean diving tests.”⁴⁹ But what the picture shows is Norris, lying on his stomach writing with his legs kicked up in the air, while Pryor sits cross-legged across from him fiddling with a piece of tape. The picture is black and white, but their clothes look bright and summery – Pryor wears a straw hat and dark glasses, Norris is in shorts, and both wear short-sleeved patterned shirts. Between them is what looks like a teaspoon and a shopping bag. In her account of her work at Sea Life Park, Pryor gives an account of what they were trying to do – essentially to find out whether, and by how much, dolphin lungs become compressed during deep dives. To do this, they had visited a local hardware store and had constructed “a scientific instrument out of a plastic ruler, two measuring spoons, a hacksaw blade, some wide elastic and dental floss.”⁵⁰ Despite their ostensive engagement in serious scientific inquiry, the picture shows two people who look relaxed and happy – perhaps even at leisure.

As it happens, this experiment didn’t work: Pryor explains that while the dolphin might begin its dive with the belt firmly attached to its chest, the nature of delphinic response to pressure change was such that the contrapted equipment invariably ended the dive dangling around the animal’s tail. But it symbolises the problems that scientists had to overcome when studying aquatic mammals. Since part of the reason why scientists found these animals so fascinating lay in their ability to exploit an environment alien to humans, and to do so using senses and capacities that humanity simply did not possess, it seemed inevitable that humans would turn to technology to help them overcome their physical incapacities. That 1963 Washington conference on the study of marine mammals was not just unusual because it was the first on marine mammals: it also stood out amongst conferences on animal behaviour because it drew on the skills and collaborations between both physical and biological scientists. The

⁴⁸ H. D. Hoese, “Dolphin Feeding Out of Water in a Salt Marsh,” *Journal of Mammology* 51, no. 1 (1971): 222-3. Michael Bigg’s initial census of the Vancouver orcas had, of course, been based on a survey of sightings made by local people, and other studies also relied on the observations of the captains and crews of ferries and tuna seiners. See, for example, D. J. Neave and B. S. Wright, “Seasonal Migrations of the Harbour Porpoise and Other Cetaceans in the Bay of Fundy,” *Journal of Mammology* 49, no. 2 (1968): 259-64.

⁴⁹ Pryor and Norris, *Dolphin Societies*, frontispiece.

⁵⁰ Pryor, *Lads*, 202.

list of attendees certainly contained zoologists and anatomists, alongside fisheries officials and individuals from the US's two key oceanographic institutes, Woods Hole and Scripps. But it also included people from Lockheed-California Corporation, the Head of the Listening Division of the US Navy Electronics Laboratory, the Naval Ordnance Test Station, professors of physics and medical physics, individuals from American Electronics Laboratories, and representatives from Berkeley's Space Sciences Laboratory.⁵¹ This represented another distinct contrast to terrestrial conferences, where ethologists, evolutionists and ecologists dominated: marine life required a different approach. What is fascinating, however, is the ways in which the techniques and approaches initially outlined or investigated here gradually began to coalesce into the marine-mammal skill-set. This can be seen, for example, in the discussion of tools for field science, whether instrumental or conceptual in orientation, in the prospects for utilising particular vehicles in specific ways, and in the development of distinctive techniques for using these instruments to extend human physical limitations.

Tooling up?

The use of boats or planes, for example, might seem unproblematic – merely means of moving more effectively through or across different terrains. But different environments provoked the deployment of distinctive skills in handling and adapting vehicles. Planes, for example, were used for photographic aerial censuses on both land and sea: both terrains required cameras capable of taking high resolution pictures at speed, as well as pilots and planes that could travel relatively slowly without risking disaster. But when it came to ships – particularly as researchers realised the importance of recording sounds as well as actions – a complex combination of mechanical and physical skills were needed. William Watkins, who with William Schevill was one of the founders of marine bioacoustics, made the point that while research could not proceed without technological assists, skilled people remained fundamental to the process. As he put it,

Probably the most important operation in a listening cruise is the establishment of a trained watch. Personnel on watch should include those who know how to spot whales at sea ... The use of trained personnel on watch makes it possible to find many cetaceans that would otherwise be bypassed, or would go unnoticed by those who are listening. [Once spotted] the ship must be brought near them so as to disturb them as little as possible ... a trained crew can stop the ship so as to leave on just enough way to float the hydrophone quickly away from the vessel, and yet to keep the vessel moving slowly enough not to create disturbances that

⁵¹ Norris, *Whales*, ix-xi. The involvement of US and other national militaries with marine mammal research is, of course, closely tied to the realisation that the sea was not just a means over which to move troops, but a medium through which warfare could take place. See the references in footnote 6, especially Robinson, *Ocean Science*, for a discussion of the military use of the oceans.

would interfere with the whales or the listening process itself.⁵²

In order to observe and record, the vessel must use “silent ship” mode, where all equipment “including pumps and refrigerators” is switched off: otherwise the noise of the machinery will overwhelm any ocean sounds. The degree of silencing can depend on weather conditions, but “in calm seas even the scraping of a shoe on deck may be intolerable.” Careful preparation and planning are essential in order not to disrupt listening and recording – the hydrophone cable, for example, “should be flaked out on deck (in a figure eight) so that it can be put into the water quickly in order to keep the phone in place if the ship drifts.” Someone must monitor the power supply and be prepared to control or compensate as necessary, since “signal amplification, distortion levels and bias currents ... will change as the voltage supply varies.”⁵³ In this article and in the discussion that followed it, Watkins was willing to give advice on brands, specification and sources for marine equipment – but was clear that it was the sailor’s skill that was of greatest importance in studying at sea.

Some encounters with marine mammals were mediated by off the shelf equipment – the occasional meetings between divers and whales, for example, or – as with the old whalers – the use of tuna seiners either to collect information or to make observations.⁵⁴ More often than not, equipment – as with Norris and Pryor’s dolphin depth recorder – either had to be repurposed or created from scratch. Perhaps the most interesting – certainly one of the most memorably named – examples of this strategy was Ken Norris’ “Semi-Submersible-Seasick-Machine.” Norris, at this point working with Pryor in Hawaii, wanted to be able to watch wild dolphins at close range, to actually be amongst the school as they swam. He and his colleague Jimmie Okudara, a Honolulu engineer, created a new kind of vehicle to enable him to do this, using as a base one of the two-man submarines developed in World War II. As Norris remembered in his autobiography, the “ship that emerged from Jimmie’s welding torch was a little boy’s dream (both his and mine). It was a fantastic craft in which a junior-grade Captain Nemo could explore.”⁵⁵ Using it clearly had a deeply emotional impact on the researcher. “This, I thought, is what a porpoise sees ... a world bounded by the dark blue of the depths below, a silver mirror above, and on every side the impalpable fading of vision into the blue.”⁵⁶ It also, however, had a markedly less poetic impact: as the air became stale, “My stomach constricted, my bowels writhed. I gulped for air and felt frantic at the closeness and

⁵² William Watkins, “Listening to Cetaceans,” in *Whales*, ed. Norris, 471-6, on 471-2.

⁵³ Watkins, “Listening,” 472-3.

⁵⁴ William Perrin and William Walker, “The Rough-toothed Porpoise in the Eastern Tropics,” *Journal of Mammalogy* 56, no. 4 (1975): 905-7, describes the captain of a tuna seiner collecting dolphin remains for aid in identifying ranges, while in other cases it was possible for observers in the water to help dolphins escape over the net corkline into the open sea.

⁵⁵ Norris, *The Porpoise Watcher*, 168.

⁵⁶ *Ibid.*, 169.

at the locked hatch above.” As the machine surfaced, he leapt “onto the deck while another unsuspecting comrade took my place in that at once sainted and cursed seat below the air-water surface.”⁵⁷ But once its operators had learnt to manage their physiological responses to the SSSM, it enabled them “to appreciate how little time a wild porpoise spends at the surface. No wonder we had so much trouble observing them from shipboard.”⁵⁸ Additionally, it meant that the observer could “see other dolphins as a dolphin sees them... we understand them only if we look sideways too, not down from above.”⁵⁹ This stress on “taking the role of the other,” in the sense of adopting the dolphin’s point of view is common in accounts of cetacean research, and often implies an implicit acknowledgement of animal agency accessed through technical adaptation.⁶⁰

Most observers, however, still had to watch either from ship or shore, and a number of tools could be deployed to make this possible. The hydrophone, as the emphasis on the skill needed to deploy the instrument shows, was one key strategy for studying behaviour. Hal Whitehead’s autobiography describes the difficulties – and the delights – of using hydrophones to follow sperm whales in their deep dives. Sitting with the hydrophone “on deck, under a sky almost as deep black as the whale’s world below,” he felt as if the ship was “an extension of my body. The sails are my clumsy flukes, the rudder becomes coarse flippers, as I join the whales in their wandering.”⁶¹ Experience enabled the operator to use clicks of different types to distinguish classes of animals, if not individuals. It was, he remembered, obvious when an adult male approached, since “his slow click was lower and more intense than the clicks of the females. After the long suspenseful pause, it drove through the hydrophone like a slammed jailhouse door.”⁶² Other researchers, rather than becoming one with their equipment, tried to create cyborgs out of their research subjects. From the original discussions at the Washington conference until the present day, the costs and benefits of attaching telemetry to marine mammals was hotly debated, initially with attention to the pragmatics (how to design and attach the instrumentation) and – later – with an eye to the ethical consequences of such modifications, both for the individual and the ecology. Techniques used in studying human physiology, tested on the researcher and his students, were canvassed for possibilities in relation to cetacean anatomy, and the question

⁵⁷ Ibid., 171.

⁵⁸ Ibid., 172.

⁵⁹ Pryor and Norris, *Dolphin Societies*, 12.

⁶⁰ See the discussions in Rees, “Wildlife agencies.”

⁶¹ Hal Whitehead, *Voyage to the Whales* (Vermont: Chelsea Green Publishing, 1990), 124.

⁶² Ibid., 160.

of whether equipment needed to be pressure protected or pressure equalised was considered.⁶³ But the question of how to affix the equipment to the subject remained, and required much experiment with captive animals: harnesses which could be used to transmit telemetry had been satisfactorily developed for pigeons, but remained elusive for porpoises.

Tags, which could be used to both identify individuals and to track animal movements, were generally harder to develop for cetaceans, although researchers had less problem using them for seals and sealions who reproduced on land. Tags used by agriculturalists to keep track of cattle and sheep were used when the animals were caught onshore, often using a combination of metal and colourful plastic tags that both identified the individual animal to the researchers and identified the animal as a research subject to members of the public. The hope was that any carcasses might be returned to the relevant institution, thus extending the animal's contribution to science into its afterlife.⁶⁴ But both catching animals and attaching tags was problematic for whales and dolphins. As Harrison Matthews pointed out at the Washington conference, "recently large numbers of gray seals have been branded on the English coast. But it takes two men to hold down a little pup seal to get a brand on it. Who is going to hold down a whale, and how many people will be needed?"⁶⁵ In the same debate, William Schevill asked directly if "anyone know[s] a paint or dye that will stick to a wet porpoise, so that you can throw it at an animal and have the animal optically marked for a while?" In response Gilmore told him that in the San Diego study of gray whales,

We thought of throwing paint bombs. The California police use a technique to mark automobiles going by so rapidly that the licence plate can't be read. This technique involved shooting an object that burst and marked the side of the car ... [Eventually] we abandoned all these ideas and instead shot into the back of the whale an arrow point around which was wound a piece of plastic material that unfurled on the animal's back. The only trouble – we never saw our marked whale again.⁶⁶

Apparently, "all the great longbow men in the neighbourhood" had been invited to try

⁶³ R. Stuart McKay, "Telemetering Physiological Information From Within Cetaceans and the Applicability of Ultrasound to Understanding In Vivo Structure and Performance," in *Whales*, ed. Norris, 445-70; James Snodgrass, "Instrument Packaging and Telemetry," in *Whales*, ed. Norris, 482-488; Winston H. Starks, "Instrumentation for Ecological Studies," in *Whales*, ed. Norris, 497-500; and see also William Evans, "Orientation Behaviour of Delphinids: Radio Telemetric Studies," *Annals of the New York Academy of Sciences* 188, no. 1 (1971): 142-60.

⁶⁴ William O. Wurtz, "Reproduction, Growth and Development and Juvenile Mortality in the Hawaiian Monk Seal," *Journal of Mammalogy* 49, no. 2 (1968): 229-38; Ian Stirling, "Observations on the Behaviour of the New Zealand Fur Seal," *Journal of Mammalogy* 51, no. 4 (1970): 766-78; H. P. Kilaan and Ian Stirling, "Observations on Overwintering Walrus in the Eastern Canadian High Arctic," *Journal of Mammalogy* 59, no. 1 (1978): 197-200. Also LeBoeuf et al., "Elephant seals" and LeBoeuf and Petersen, "Social status."

⁶⁵ Norris, *Whales*, 488.

⁶⁶ *Ibid.*, 487.

shooting flag-tags into whales – but

strangely enough, the rocking boat and the motion of the whale made it almost impossible to hit the animal. I have some wonderful motion pictures of men going through the frustrating actions of shooting arrows at whales within 30 feet and missing.⁶⁷

But assuming that the animals could in fact be caught, then techniques and instruments for tracking them were in development. William Evans, for example, who was responsible for developing the delphinic radio tag, described the construction of a tracking beacon package designed to be “essentially buoyant in its final form,” pinned to the dorsal fin where “it would have least effect on the animal’s hydrodynamics and also ... the longest time exposure of the antenna during respiration cycle.”⁶⁸ In order to test the impact this might have on behaviour, three female dolphins were captured and taken to Marineland of the Pacific to be fitted with the apparatus. Using two animals as controls, Evans and his co-workers were satisfied that their test subjects soon adjusted to the presence of the package.

Other researchers preferred to use alternative strategies that seemed less invasive – strategies that became even more relevant after the US passed the Marine Mammals Protection Act in 1972, which made capture or “harassment” of marine mammals illegal.⁶⁹ While invasive studies did continue – the work begun on Florida’s west coast by Blair Irvine in the early 1970s tagged dolphins and took physical samples and measurement, for example – other studies began to focus on the use of natural markings and distance observation to monitor activities.⁷⁰ Roger Payne’s Patagonian study, for example, relied on the use of theodolite tracking. As with the studies of Graham Saayman and C. K. Taylor in South Africa, Payne and the Wursigs observed dolphins from cliff-tops, where the height above sea level was known. Using the theodolite to measure the angle formed at the sea surface meant that the dolphins’ position in the water could be calculated and plotted, and their movements around the coast tracked. But the Wursigs made a further methodological innovation when Bernd used a camera to photograph each dolphin school. From this, they built a dossier of animals that could reliably

⁶⁷ Ibid. Also see, however, a Japanese paper which appeared a few years later on using bow and arrows to tag dolphins: Toshio Kasuya and Nobuo Oguro, “A new tagging method of dolphins,” *Scientific Reports of the Whales Research Institute* 24 (1972): 81-85.

⁶⁸ Evans, “Orientation,” 150.

⁶⁹ See Benson, *Wired Wilderness*, for the initial impact that the passing of the Act had – pages 139-88 in particular.

⁷⁰ Contrast this, for example, with Tracey Storer’s account of the role of the live trap for mammalogy – it was, he argued, “the most important single method in mammalogy because it gives access to the living individual, often repeatedly. Tags, bands, paint marks, branding and toe clipping are the means used to make the individual recognisable when seen after release or upon recapture” – to the point where “in one study ... a certain ground squirrel was caught seventy times, anaesthetised, combed for fleas then released” (Storer, “Mammalogy,” 793). One does rather wonder what the squirrel made of it all.

be recognised on the basis of their individual scars and marks, meaning that the fortunes of individuals could be followed over time. Biggs' study of Vancouver Island – adopted a similar approach – which meant that by the early 1990s, it was possible to say that “every individual in these waters can be recognised and allocated to a given pod and dialect group. When a new baby is born, or an animal disappears, researchers not only know that this has happened, but which individual it is, its family and its lineage, sometimes to three generations.”⁷¹

But while ensuring that animals can be observed is a fundamental part of any ecological or behavioural study, knowing what you're looking for and why looms almost as large in significance. Once individuals could be identified with reasonable regularity, researchers had to figure out how to quantify the behaviour of those individuals – to decide which behavioural sequences were significant and how social life was to be defined. Species ethograms had to be established as the building blocks of that social life, and once defined, decisions about how and when to sample activities so as to record a representative range of social interactions had to be taken. And experimentation continued to be a crucial conceptual and practical resource. Kooyman, for example, with considerable help from the US Navy, carried out a series of field experiments on the depth and timing of seal dives. Working in McMurdo Sound, his team captured seals and brought them to an artificially created hole in the sea ice, far from any natural cracks or fissures. They then observed from hiding as the seals – with no other options – used the artificial hole to feed. Unfortunately, it transpired that the seals were much better at finding cracks in the sea ice than humans were: despite moving location at least once to a more isolated site, the experiments “ended when the seals found other breathing holes.”⁷² As previously discussed, the prospects for attaching equipment to dolphins and other small marine mammals increased as humans became more skilled at keeping animals alive in captivity.⁷³ Other projects involved experimental work at sea, sometimes with animals held captive in fish weirs or other temporary field enclosures – but much more interestingly, with animals that their handlers trusted to cooperate in free-swimming open sea work.

⁷¹ Pryor and Norris, *Dolphin Societies*, 14.

⁷² G. L. Kooyman, “A comparison between night and day diving in the Weddell seal,” *Journal of Mammalogy* 56, no. 3 (1975): 563-74.

⁷³ As Norris put it in *Whales*, “the biologist now finds he can deal directly with a porpoise as an experimental subject while, however much he might wish, he cannot yet handle a full-sized baleen whale” (v), a thought echoed by Starks in the same volume.

A kind of floating hobbit:⁷⁴

Crucial here were the contributions of Pryor and Norris, who worked closely with the US Navy. The cognitive capacities of dolphins – in particular, the potential for human-animal communication – had the focus for both science fiction and science fact from the late 1950s onwards, and had played a role in the development of the search for extra-terrestrial intelligence.⁷⁵ John C. Lilly’s popular accounts of his research – *Man and Dolphin* (1961) and *The Mind of a Dolphin* (1967) had a major impact on a fascinated public audience, even as it repelled significant sections of the scientific community.⁷⁶ In 1963, Arthur C Clark published a children’s SF novel, *Dolphin Island*, which dealt with an isolated, but integrated, dolphin-human community, while the 1973 film *Day of the Dolphin* featured a scientist loosely based on Lilly’s work.⁷⁷ As noted earlier, while chimps could be studied as a means of better understanding human nature, dolphins were increasingly used as a means of apprehending aliens – or at least, as a symbol of the alienation from corporate culture that characterised key social movements during the 1960s and 70s.

What Norris and Pryor were doing, however, was something different. Pryor and her husband had opened their oceanarium on Hawaii with the intent of combining effective scientific research on cetaceans with public display. Fundamental to their project was the idea that the research would be a key part of the entertainment on offer, with the dolphins showcasing not just their physical talents, but demonstrating their cognitive abilities to their audiences. As Pryor put it, this was what made the show interesting – everything each performer did “taught the audience something about [them], and about porpoises and maybe about biology in general.”⁷⁸ Pryor and her team used operant conditioning to both investigate dolphin cognition

⁷⁴ This is reference to Pryor and Norris’ weary comment to the effect that the “publicity and speculation” surrounding dolphin research, especially in the aftermath of Lilly’s work, had “turned the dolphin into a mythic beast, a sort of floating hobbit” (Pryor and Norris, *Dolphin Societies*, 2).

⁷⁵ Burnett, *Sounding*. See also D. Graham Burnett, “Adult Swim: How John C. Lilly Got Groovy (and Took the Dolphin with Him), 1958–1968,” in *Groovy Science: knowledge, innovation and American counterculture*, eds. David Kaiser and Patrick McCray, 13–50 (Chicago: University of Chicago Press, 2016). In the same year as Lilly’s *Man and Dolphin* appeared, a meeting of scientists interested in ET intelligence was held at the Green Bank Observatory in West Virginia. In order to honour Lilly’s work on interspecies communication, the attendees formed themselves into “The Order of the Dolphin.”

⁷⁶ The first book was described by a *Science* reviewer, H. O. Bull, as coming “white hot from the furnace of experience,” before going on to make it clear that it was also “one of the frankest and most egotistical accounts of a research project ever placed before a sensation-loving public,” “Tursiops-side-down World,” *Science* 134, no. 3483 (1961): 938–9, on 938.

⁷⁷ The film was based on a novel by Robert Merle, *Un animal doué de raison* (1967), appearing in English in 1969 as *The Day of the Dolphin*. Other science fiction writers such as Larry Niven and David Brin, as well as Anne McCaffery, have featured intelligent dolphins as key agents in their novels, while William Gibson’s 1981 short story “Johnny Mnemonic,” made into film in 1995, included cybernetically enhanced dolphins kept loyal to their Navy handlers by drugs.

⁷⁸ Pryor, *Lads*, 104.

and train them in performances, discovering in the process that dolphins also seemed pretty good at using operant conditioning on humans. Their initial training programme was a failure: three months before they opened “panic struck... there was no porpoise show. The porpoises had, in fact, trained their trainers to give them fish for nothing.”⁷⁹ In other cases, trainers had simply been too enthusiastic:

Gary, in his zeal, had been blowing his whistle to encourage Makua when he *thought* Makua was going to press the paddle. Makua had thus been reinforced many times for a behaviour which might be described as: “Make Gary *think* you are going to press the paddle.”⁸⁰

In their shows, they would explain to the audience

where we’d stopped last time in a particular shaping session, what we were hoping for this time, what the problems might be, and what the animal was doing and perhaps thinking. It put the audience on the edge of their seats, all right, and when an untrained behaviour was first done right, to the obvious exhilaration of both trainer and animal, it made a thrilling show.⁸¹

In a thinly veiled dig at Lilly, Pryor pointed out that – if you made it clear what they needed to look for, the audience could see “porpoise communication in real life, not science fiction.”⁸²

The trouble was that the better Pryor’s trainers got at shaping animal behaviour, the keener either the Navy or some other oceanarium was to poach them. In fact, the US Navy were interested in using Pryor and Norris’ dolphins to explore a number of issues. Sailors had noticed, for example, that dolphins could often be seen swimming alongside or just in front of ships that were travelling as fast as forty knots. This was astonishing: if they really were swimming that fast, then dolphins “presumably knew something about the laws of hydrodynamics which the Navy didn’t know and would like to find out.”⁸³ Pryor and Norris figured out a way to test this by building a dolphin racecourse and by creating “an animal that could be reliably released, free and unencumbered, in the open sea, asked to do a variety of scientific tasks, and then brought back into captivity.”⁸⁴ Dolphins like Keiko, Tuffy and Pono could – after training – be used to perform “all sorts of tasks, such as carrying bottom samples to the tender vessel above, bringing new scuba gas bottles to the men working on the bottom, carrying messages and even allowing divers to hold onto his dorsal fin while he towed them to

⁷⁹ Ibid., 4.

⁸⁰ Ibid., 29 (italics in the original).

⁸¹ Ibid., 106.

⁸² Ibid.

⁸³ Ibid., 175.

⁸⁴ Norris, *The Porpoise Watcher*, 138.

the surface.”⁸⁵ Dolphins would even work for “wages” – plastic disks that divers would give to the animals as a reward, which could then be exchanged for fish at the surface.

All this depended fundamentally on delphinic cooperation. If they chose to escape, as some did, then nothing could be done to stop them: they were swimming in the open sea. If they chose not to extend the full range of their capacity, then researchers could not force them. Tuffy, for example, refused to go deeper than 125 feet, to the point where the team assumed that was his limit – till “one day he broke off from diving to a 125-foot target to go down to 200 feet to hobnob with a scuba diver working on the bottom.”⁸⁶ Eventually, they persuaded the dolphin to go five times that deep. Both scientists and military speculated on the prospects that could be opened up by a domestic dolphin that could be taught “to ‘ride fences’ in search of predators or poachers, or to bring back samples from undersea pastures” and to cooperate more broadly in the creating of a manned undersea habitat – or at the very least, transport tools and messages between diver and surface much more quickly than humans could manage.⁸⁷ Such relationships would, however, depend on the establishment of close relationships between individuals, in much the same way that dogs and horses orient to their handler, who is reciprocally attuned to their needs and reactions.⁸⁸

This sense of cooperative communication between dolphin and human is central to the accounts given by Norris and Pryor. While other researchers have described similar sensations of intimacy during open water field work with wild cetaceans, Norris and Pryor’s work is different precisely because it is based on close daily contact with animals who – like Tilikum – had been captured from the wild and were being taught to turn tricks for humans. Pryor’s account of how the operant conditioning system was used at Sea Life Park draws deeply on emotional responses – frustrated trainers, sulky porpoises – and what is portrayed as a shared joy in success. At what point, she asked, does

the artificial communication system of operant conditioning begin to give way to some genuine social communication, to that feeling that trainers call rapport? It is a golden feeling when the trainer really begins to feel as if he *is* reading the animal’s mind, or when the animal begins to respond to the trainer’s voice and emotions ... It is really an eerie thrill when the animal turns the training system round and uses it to communicate with you.⁸⁹

Pryor lists numerous occasions when trainers suddenly realised that their own behaviour

⁸⁵ Ibid., 146.

⁸⁶ Pryor, *Lads*, 205.

⁸⁷ Ibid., 148.

⁸⁸ See, for example, Chris Pearson, “‘Four-legged Poilus’: French army dogs, emotional practices and the creation of militarized human-dog bonds, 1871–1918,” *Journal of Social History* 52, no. 3 (2019): 731–60, as well as “Does History Need Animals?,” Special issue, *History and Theory* 52, no. 4 (2013).

⁸⁹ Pryor, *Lads*, 124.

was being “shaped” by the animals, or when animals used the training situation to tell the humans what was wrong (bad fish, poor commands). Perhaps most spectacularly, at least two dolphins were trained to demonstrate creativity on demand – that is, on a given signal, to produce a behaviour or display that they had never done before. Again, the Navy was deeply interested and made a film of the training process – with a “downright poetic ending speculating about the possibilities of man-porpoise interaction in which the porpoise was an equal, an initiator, not just an obedient subject.”⁹⁰ Pryor was sceptical – but noted that the animals trained to be creative also showed changes of personality, “from a docile inactive animal to an active observant animal full of initiative,” a change which seemed, at least in the medium term, to be permanent.⁹¹ Here again, you see technological practice – in this instance, the application of operant conditioning – facilitating the identification, or perhaps the emergence, of agency within a multispecies relationship. Again, however, this is what we see from the anthropocentric perspective.

Conclusion

Pryor’s account of her active, creative, eager animals is a far cry from the scenes shown in *Blackfish* – the despairing misery of the sounds made by orca mothers whose calves have been transferred to other oceanariums, the drooping dorsal fins of the captive animals, and the concern and guilt shown by those trainers who participated in the film. But they are both rooted in the same tradition, as this article has shown. Scientific research into the behaviour and ecology of cetaceans and other marine mammals is firmly tied to the commercial practices of oceanic exploitation and expropriation that characterised the extractive animal industries of the late nineteenth and early twentieth centuries, and to the desire of an urbanised public to make contact – even if mediated through a screen – with the idea of nature. It’s no accident that the most expensive seats at Sea World and other marine parks are in the “splash zone,” where ticket holders can feel as if they are themselves “playing” with the animals.

As this article has demonstrated, different professional groups, from tuna seiner captains to professors of medical physics, provided key skills, equipment and conceptual resources to the researchers who were absorbed by the “cryptic” nature of marine mammals. This did not mean that marine work followed a wholly different trajectory: again, as we have seen, despite the different elements, land and sea field studies often used the same basic techniques and patterns and were aimed at similar audiences. The most important difference is, however, the degree of intervention into animal life that was used by marine mammalogists. Again, this was not universal – by the early twenty-first century, there existed studies, such as that in Australia’s

⁹⁰ Ibid., 247.

⁹¹ Ibid.

Shark Bay, that have not only managed to identify individual animals, but have also habituated at least some of them to the presence of human beings.⁹² But broadly speaking, the use of tags and the reliance on captive studies in the analysis of creatures as socially complex as cetaceans could be considered surprising, particularly compared to the approach taken with chimpanzees, where even provisioning free living animals with bananas could mean that the population was considered hopelessly contaminated by human influence. This article has shown why it was considered intellectually necessary, although the ethical issues, as the case of *Blackfish* and Tilikum shows, are still a matter for considerable public debate. From the perspective of the history of science, however, the key point about the use of captive, manipulative work here is that it makes it possible to tell a multispecies history of scientific and socio-technical knowledge practices, and one that must, of necessity, make space for the role of animal agency in creating knowledge about the natural world. It is instructive to compare the accounts of dolphin free-sea work with the work of scholars who have considered the cases of dogs and horses, and have considered their capacity to extend our anthropocentric (and historically contingent) understanding of what counts as “agency” for the humanities.⁹³

Finally, however, in many ways, what’s most interesting about the history of cetology is the role played by trainers like Karen Pryor. Clicker training and operant conditioning can sit uneasily with the notion of animal agency: the fact that pigeons can be trained to peck out complex sentences was historically used to great effect in the debates about ape language, cognition and communication. But Pryor’s work – her use of operant conditioning on both humans and dolphins, in order to facilitate both public performance and scientific research – seemed, at least for a moment, to open out the possibilities of developing a different understanding of how agency could operate in the absence of a shared orientation to logic or verbally based reasoning. It is fascinating to speculate on what might have developed had that project continued. It takes us from the realms of the history of science to the domain of science fiction – and as long as empirical boundaries are carefully monitored, that may be a very useful historiographical innovation.

⁹² Rachel Smolker, *To Touch a Wild Dolphin: a journey of discovery with the sea’s most intelligent creatures* (London: Souvenir Press, 2002).

⁹³ For a discussion of this work, see Amanda Rees, “Animal agents? Historiography, theory and the history of science in the Anthropocene,” *BJHS Themes* 2 (2017): 1-10.

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