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OPINION PIECE

From science only to science for conservation: a personal journey

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ABSTRACT: Long-term studies of whales, dolphins, and porpoises (the cetaceans) in nature abruptly began about 50 yr ago, preceded by several decades of terrestrial animal studies, often of charismatic large mammals. Fifty years ago, intensive whaling was still occurring, and arguments against whaling largely centered around impending extinctions due to over-hunting, not the idea that cetaceans should not be killed due to natural or inherent goodness. In the 1970s, several USA and other government agencies promulgated rules to help control pollution and other insults to nature, often effective in the short term but not in stopping an overall decline in the health of nature. While there appeared a general societal awakening towards greater appreciation of nature and intrinsic animal rights, researchers largely stayed focused on their research, with little attention to using knowledge to increase ecosystem and animal health. Attitudes of direct scientific involvement in calling for environmental action have changed, as it is becoming increasingly (but not universally) appreciated that researchers who know the problems are well-suited to alert governments, industry, and society to them, and loudly call for action. I have no good answers for how to accomplish large-scale rapid reversals of environmental declines. One laudable action is to be an active vocal part of appropriate web-based conservation advocacy groups. Involving the young of all genders and races for a groundswell of support is likely most effective in generating a new world view of so much respect for nature that we radically alter our present ways of subjugating and diminishing it in the name of supposed human progress. Above all, we scientists must no longer dither with opinions on environmental problems and urgent needs for action; we must proclaim them intelligently, forcefully, and as broadly as possible.

KEY WORDS: Environmentalism · Cetacean research · Whaling · Attitudes · Inherent goodness · Advocacy · Biophilia

1. PREFACE, WITH A BIT OF HISTORY

When Melany Carballeira Würsig and I started field research under the guidance of Roger and Katharine 'Katy' Boynton Payne in Patagonia, Argentina in 1972, there were not many long-term field biologists studying any marine mammal. Most literature was of behavior in aquaria, as well as some (excellent) physiological studies and aspects of taxonomy and systematics from largely bone, especially skull, anatomy. There was also much reliance on field behavioral data as seen from behind a gun or harpoon, and while there was arguably more information on pinnipeds than other types, the lives of toothed and baleen cetaceans were especially unstudied. Roger and Katy had the foresight, and the gumption, to start a project on southern right whale *Eubalaena australis* occurrence and behavior patterns, with hopes of also beginning to elucidate aspects of behavior, behavioral ecology, and sociobi-

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ology (Payne 1995). Their prescience proved correct, for we now know more about the lives of baleen and other whales and dolphins than could ever have been imagined in the early 1970s. Back then, I was mainly thinking of learning more about our study animals in nature (and concerned about obtaining enough good data for a PhD dissertation!). A deep concern for marine mammal and all life—for their and their ecosystems' health—did not come until much later. It is this dawning and what led up to it that I chronicle here.

In 1972, large-scale commercial whaling was still going on, albeit by only a handful of countries and no longer with the large size of commercial whaling fleets as 20 to 30 yr earlier (Clapham & Baker 2018). Most of the great whales were gone at the hands and explosives of humans, and plastics had replaced the use of baleen plates that hang as sieves from the roof of the mouth of live whales, petroleum products had replaced whale oil, and a chemical compound from a *Salvia* plant was beginning to replace ambergris (a sebacious substance formed in the digestive system of some sperm whales) as a perfume base. The few remaining whales were now hunted for meat, continuing today with skeletal fleets in Japan, Norway, and Iceland, and as subsistence whaling by largely Indigenous Peoples from those and several other countries (see International Whaling Commission; IWC 2020). The Year of the Whale (Scheffer 1969) chronicling the imagined life of a sperm whale *Physeter macrocephalus* calf was a recently printed heart-tugging novel, and many more popular publications decrying the slaughter of cetaceans would follow (Forestell 2018).

In 1972, the United Nations Conference on the Human Environment (UNCHE) proposed that a 10 yr moratorium on whaling be internationally adopted 'to allow whale stocks to replenish'. This moratorium finally passed the IWC in the early 1980s, and was proclaimed (and reasonably well carried out) in 1986. The UNCHE and IWC resolutions did not recommend cessation of whaling on humanitarian grounds, i.e. their inherent goodness (Foot 2001), but instead on economic ones. The UNCHE was a conference 'on the human environment', not that of whales and all of nature per se. In other words, there was a human-centric view of why to change behaviors, why to stop whaling. Today, whale and dolphin watching have largely replaced whaling, with the uneasy occurrence of both in several parts of the world (with Iceland, Norway, and Japan as prime examples; IWC 2020). There are also strange juxtapositions of attitudes and dangers, with (for example) Pacific Ocean gray whales *Eschrichtius robustus* visited and loved by thousands of humans in the whales' Baja California Mexico calving grounds and along most of their long migratory route to and from the Bering, Chukchi, and Beaufort Seas. Some of those same whales, approached by whale watching vessels and enjoyed from shores, are hunted and killed in their far-north feeding grounds (IWC 2020). If whales think, and they might, they may be wondering what is going on in the minds and the actions of humanity.

2. A NEW APPRECIATION OF NATURE

This essay was begun to share a marvel that we, 'humanity', have gone so very quickly from thinking of whales and dolphins as brutish beasts (Melville 1851, Twain 1872 provide early examples in the western literature) to elegant beautiful wonders to behold. But then, biological evolution and that of human culture is not a steady state of progression; it is punctuated now and then by a large step, or series of smaller ones, in between those plodding steady times. Melany and I were fortunate to be young adults when such a wonderful step took place, as nicely chronicled by Lavigne et al. (1999) and Reynolds et al. (2005) largely from a North American perspective, Bearzi et al. (2010) largely from a European perspective, Gambell (1999) internationally, and others. Joan McIntyre (1974) edited one of the finest early compendiums of this new beginning mind-set. Many (but not all) biologists and nature-minded others now think of cetaceans as not only bright and social (that has been recognized for quite some time), but as likely sentient, with intrinsic rights, and a human concept of compassion rivaling that for our fellow humans. Marino & Colvin (2015) and Marino & Merskin (2019) explain this especially well, including for domestic pigs *Sus domesticus* and sheep *Ovis aries*, respectively. We can still marvel at the rather rapid change in perception of cetaceans by a large part of humanity, but we also realize that this rapid recent change was actually a long time—centuries—in coming. Our present view is not perfect, is largely still anthropocentric (i.e. human exceptionalist), and is not universally helping individuals, populations, or species of most mammals of seas, near shores, and in several mighty rivers.

When Roger and Katy invited us to join them in Argentina in 1972, there had already commenced a remarkable flowering of behavioral ecology studies on land, by David Mech with wolves *Canis lupus* of North America (begun 1958; Mech 1970), George

Schaller with mountain gorillas *Gorilla beringei* in east Africa commencing in 1959 (Schaller 1963), Jane Goodall with chimpanzees *Pan troglodytes* at Gombe Stream in Tanzania (begun 1960; van Lawick-Goodall 1968), and Ian and Oria Douglas-Hamilton with African bush elephants *Loxodonta africana* at Lake Manyara (begun by Ian in 1965; Douglas-Hamilton & Douglas-Hamilton 1975). It is a personal delight to know that at this writing, these great scientists and conservation biologists are still with us on Earth, still advocating for nature.

Studies of whales and dolphins in nature lagged a bit behind the beginnings of long-term work on land, and their 'flowering' did not hit full stride until the late 1970s–early 1980s. Perhaps this lateness was due to the fact that it was perceived more difficult to be close to whales and dolphins than terrestrial mega-fauna on land; but in weather-secluded coves and other areas near shore, it is (arguably) easier to study cetaceans than mountain gorillas. There were the beginnings of what would prove to be remarkable long-term studies: Bill Schevill and Bill Watkins were making use of US Navy hydrophones to begin systematic descriptions of whale and dolphin sounds, even as early as the 1950s (Sayigh et al. 2016); Michael Bigg and colleagues began to work with killer whales *Orcinus orca* in and near Puget Sound, USA, and Canada in the late 1960s (Bigg 1982); as did Blair Irvine, Michael Scott, and Randy Wells with Atlantic bottlenose dolphins *Tursiops truncatus* of the Gulf of Mexico at about the same time (Wells et al. 1980). This latter study is now the longest continuing one on social ecology (and much else) of any cetacean, still ongoing, still strong (Wells & Scott 2018). But behavioral work with sperm, humpback *Megaptera novaeangliae*, gray, and other whales; work with spinner *Stenella longirostris*, Atlantic spotted *S. frontalis*) and other dolphins would commence a bit later, into the 1980s (Würsig et al. 2018).

There are times of intellectual awakening in human cultures, and the birth (and re-birth) of arts and sciences of Chinese, Egyptian, Greek, and Roman societies at different times several millennia ago—and the renaissance of 'western' and Arabian societies more recently than that—show amazing, not fully understood synchronicities of intellectual activities and often, but not always, increasingly aware concepts of humaneness and kindness, in relatively little space and short time (Pinker 2011). The 'awakening' of our biological concept of evolution was not merely by Charles Darwin and Alfred Russell Wallace (Darwin 1859, Wallace 1870), but by a wonderful host of others coming to similar conclusions at approximately the same time. It was perhaps Darwin, however, who early-on best articulated that many animals are thoughtful beings, unlike the belief of them as mindless automata before (and quite a bit after) the great masters of evolutionary thought (Darwin 1872).

The most recent intellectual awakening of ability to study and appreciate animals (and plants and ecosystems) in nature had just begun when Melany and I entered the field, and is now in full flower, with its own seeds and sprigs. Aldo Leopold (1949) and Rachel Carson (1941, 1951) had helped to lead a deeper appreciation of nature in the 1940s–1950s. As one result of such earlier writings of the beauty and fragility of nature, as well as Carson's hard-hitting exposé of the dangers of large-scale use of industrial pesticides in Silent Spring (Carson 1962), the United States Environmental Protection Agency was formed in 1970. The United States Marine Mammal Protection Act (MMPA) of 1972 became a logical extension of a Zeitgeist of environmental activism, spurred on by the knowledge that hundreds of thousands of Eastern Tropical Pacific dolphins were dying in nets set for (largely) yellowfin tuna *Thunnus albacares* (Perrin 1970, 2009). The MMPA has led to other official protection agencies in other areas of the 'westernized world' and has, by and large, done much good. The US Endangered Species Act (what a wonderful time to be young and alive!) was passed in 1973, and while it is unfortunately being gutted at this time, it too has done much good, and may yet again in future.

3. DESPITE APPRECIATION, A DOGGED CONTINUATION OF SCIENCE AS USUAL

In 1972, I knew very little of any of this. As a young graduate student, I was accepted as a research assistant by the Paynes only because of some (it turned out, very little) boating and diving experience, and the real reason we got to go on the expedition to Patagonia, Argentina, was because Melany spoke excellent Spanish, and could serve as translator and in-camp teacher for the 4 young Payne children. I was the lucky stow-away. I was also eager and ambitious, with a rather ignorant love of nature and marine mammals, and the then-strong belief that dolphins, which Melany and I came to study (Würsig & Würsig 1979, 1980), are immensely intelligent (a credo engendered by Lilly 1962). While it might be true that dolphins are 'immensely intelligent' (we have no such proof, nor truly know how to define intelligence; Wür-

sig 2018a), we soon learned that social mammals (at the very least) all show immense variability of behaviors and complex ways. The works of G. C. Williams (1966), E. O. Wilson (1975), and R. Dawkins (1976) helped my own young mind to mature, and to realize that there is much more afoot for an appreciation of animals and nature than 'intelligence'.

So, life continued, with the desire to learn more about marine mammals, and with only cursory and somewhat peripheral attention to the plights of so many of them and their ecosystems. My graduate students and I have studied animal behavior and behavioral ecology largely to learn more about them in nature, with the vague and somewhat peripheral belief that the more we know about them and their ecosystems, the better we are able to help preserve them. This expression of knowing more science relative to saving animals and their ecosystems has been, for many others and me, a rather steady, predictable, mention in the ending paragraph of a science paper, chapter, popular note or movie. It is only rather recently and very late in (my) life, that the realization has dawned (has 'hit') that our kind of research needs to be attuned directly to an understanding of the problems of nature (Würsig 2010, 2018b, 2019). In other words, we researchers should not simply study and write about the animals, their behavioral ways, their lives. We need to appreciate their fragility and incorporate this appreciation into our understanding of them, and become advocates for them and their undisturbed ways of living.

The IWC formed in 1946, and operated for many years to 'provide for the proper conservation of whale stocks and thus make possible the orderly development of the whaling industry' (IWC 2020). That is, the IWC was formed to promote sustained killing of whales! Much of the world and the majority of IWC members have moved away from this early dictum, and now argue for saving whales relative to species and populations, not for the continued existence of a destructive (and cruel) industry; not for us, the humans, but for the whales, and for all of nature. Much of this change in attitudes had to do with concepts of large brains, probable 'sentience', sophisticated societies, and inter-generational cultural ways. But a new underpinning of conservation has developed that has little to do with large brains, sentience, intelligence, sophistication of societies. Humans, whales, dolphins, lizards, trees, and grasses all fit into this more recent iteration of inherent goodness, perhaps best known as the ancient Indian Jains who attempted to practice a form of Ahimsā, the idea that to hurt another being is to hurt oneself. Therefore, a concept of seeing all of life (and nature?) as sacred is not really new at all. Regan (2004) summarized the general concepts quite well, as did E. O. Wilson with his description of a basic human sense of being tied to nature, biophilia, from the 1980s (Wilson 1984), but timely today.

4. SCIENCE INFORMS SCIENCE, BUT ALSO INFORMS OUR NEEDS TO CHANGE HABITS

A 'personal journey' from the (human) age of early 20s into the 70s has taken this biologist from knowing little about whales, dolphins, and conservation, to realizing that we still know little. Perhaps a more important realization, to which I came quite recently (and later than many peers and youngsters), is that our science should not rely on only knowing so much more about animals and ecosystems, but should also and foremost rely on using our accreting knowledge as vehicles for true appreciation of living and nonliving natural things, and attempt to wrestle with how to not just save whales, but save as many aspects as absolutely possible of all of nature. This is of necessity a bit anthropocentric, as it asks, pleads with, the modern researcher to be not just a researcher, but a conservation biologist in all quests and actions. While all new information is good, amidst a biodiversity crisis referred to as the 6th mass extinction (Ceballos et al. 2017), it makes little sense to travel into nature only to find out 'even more' about, say, sexual strategies, ways of diving, foraging, and calf rearing. At the same time, we need to consider how aspects of our degradation of the natural world change the well-being of species, populations, societal structures and ways, and individuals. We need to take our knowledge of animals and ecosystems and not necessarily gather ever more data, but use it to assess their status, and how to help. At first blush, such a stance might seem above and beyond 'the call of moral duty' (the concept of supererogation), but it seems that it is not — it is our (new?) moral imperative to be so involved (Guevara 1999 may lead us here, and Safina 2020 may take us further).

What good can our involvement do? After all, there was much intellectual hand wringing before, during, and after the Yangtze River dolphin, baiji *Lipotes vexillifer*, died out as not only a species, a genus, but an entire taxonomic family, on our, the scientists' watch (Wang et al. 2006, Turvey et al. 2007). There is presently much hand wringing about 'the next' most endangered odontocete, the Gulf of California har-

bor porpoise, vaquita *Phocoena sinus*, and all efforts, writings, and international intentions seem unable to stop their demise (Jaramillo-Legorreta et al. 2007, 2019).

The biggest overall dangers for animals and plants of seas and oceans are surely those of rapid climate change and attendant ocean acidification (Reeves 2018), plastification, and extraction, including for populations that are presently perceived as doing well. McCauley et al. (2015) aptly call this the Anthropocene ocean. A recent depressing fact has been brought to my attention regarding Australian waters: the smooth handfish *Sympterichthys unipennis* is the first marine fish (in our modern era) to be formally listed as extinct by the IUCN (Last et al. 2020).

Our most-wonderful population biologists and leaders of conservation strategies do not seem to have satisfying answers of how to reverse Anthropocene impacts on land and sea, although most have valiantly tried. Safina (2020) points out some of the many failures of acting that have led to extinction or are rapidly leading there, even of 'human-loved' charismatic mega-fauna such as majestic Bengal tigers *Panthera tigris tigris* and that tallest of terrestrial herbivores, the giraffe *Giraffa camelopardis* (and its numerous subspecies). But, then, when all seems woe, Safina (2020) pivots and expresses how wonderfully a few dedicated humans have managed to save quite a few species that were destined to almost-sure extinction in nature by — after all — human action. Not all are 'charismatic' to most humans: the California condor *Gymnogyps californianus*, bald eagle *Haliaeetus leucocephalus*, humpback and gray whales, yes, but also a little kestrel *Falco punctatus*, petrel *Pterodroma cahow*, and perhaps (not out of the woods yet, my addition) Archey's ancient tree frog *Leiopelma archeyi* of New Zealand (www.edgeofexistence.org/species/archeys-frog/).

Mother Teresa said something like, 'When I look at the masses of humans, I cannot act; but when I look at one person, I can'. This is part of what has been termed 'psychic numbing' due to the onslaught of bad news (Slovic 2007), in our case of about one million species dying within this decade (IPBES 2019), due to human action of one kind or many, including ever-acceleration of rapid climate change, compounded in the oceans by plastification and overexploitation. So, it is up to all of us, but scientists especially, to not be numbed by the onslaught of bad news, but to act in our individual and collective small to large ways. Helping with reintroductions to nature is one way, but we also need to help land to be reforested, reefs to be re-established with coral, the Mediterranean Sea to become a sustainable healthy ecosystem again, rhinoceros (family Rhinocerotidae) to become safe from poaching. The realization of such turn arounds in states of nature can occur at all levels, from individual and group (as one example) beach clean-ups to lobbying local and national governments to educate and to assess fines on people and industries that foul the beaches in the first place. We can use knowledge and perceptions of intelligences and culture (of such creatures as great apes and dolphins and whales) as vehicles to get messages of conservation across, as it is practical to do so. However, it seems better that we advance to simply regarding nature as being worthy of saving no matter the human perceptions of charismas involved, in line with Philippa Foot's (2001) concept of natural (or inherent) goodness, of ethics and morality.

5. AVENUES OF CONSERVATION FOR ALL: MOVIES, BOOKS, WEBSITES, AND INVOLVING THE YOUNG

I have no proper ('real') answers to solving our many crises of environmental damage that we — humans individually and en masse — have caused and are causing. The idea that scientists must be able to better communicate with each other and the public in general is receiving ever-more credence (Barron 2017). Boon (2018) puts the pro and con arguments particularly well, and ends up recommending that scientists should indeed be a part of careful advocacy and activism. Bearzi (2020) provides meaningful suggestions: develop compelling narratives to engage humans, avoid self-serving complaisance, advocate for constructive changes in markets, support environmental activism at all levels, encourage (often ancient) spiritual efforts of equality and sustainability.

It is worrisome when contemplating that an excellent film by a famous person, former Vice-President of the USA Albert Gore, has made only a small blip in the international conscientiousness regarding global climate change. It seems that we love the most recent popularly-presented material, including the increasing reliance on 'fake news' or 'post truths', and forget about the excellent descriptions and warnings we were given only a few short years ago (Gore 2006). I implore all of you to go back and look up Gore (2006), and pass it on. It appears that web-based activism can be particularly helpful, as when (for example) a scientist write-in campaign

was instrumental in allowing a major USA-sponsored organization, the Marine Mammal Commission, to survive (B. Würsig unpubl. data). The evidence-based work of the Union for Concerned Scientists (https://www.ucsusa.org/) has brought the plight of much of nature, especially that of global warming, to the attention of millions, with Brower & Leon (1999) and Hayes & Grossman (2006) but 2 of many examples. An up-to-date analysis of some conservation effectiveness is found at https://news.mongabay.com/series/conservation-effectiveness/, and the Goldman Prize winners have been particularly effective at getting across their urgent messages of championing the environment (https://www.goldmanprize.org/).

A ground-swell of human action is needed, especially engendered by the young who have seen us oldsters be poor stewards of life on Earth for so very long. Greta Thunberg's (https://en.wikipedia.org/wiki/Greta_Thunberg, accessed 20 March 2020) actions in speaking out at all levels relative to curbing human burning of carbon fuels represent such an example of teaching (and reminding, exhorting) others that swift actions are needed. Our teaching can be from as simple as holding classes about the beauty and fragility of nature (for students at all levels, from under 5 to well over 80 years old), to demonstrating and voting to help persuade industry leaders and governments. I am in favor of the kind of demonstration of leadership and compassion espoused by Rao (2020), that may help generally under-represented (in our 'western' world-view) parts of societies learn about, understand, and appreciate, the dangers of environmentally related 'business as usual', and exhort especially those who are not listened to on a daily basis to manage to do better than the rest of us have done in the past.

There is an unfortunate conundrum inherent to this essay, the quite wonderful essay of my colleague Giovanni Bearzi (2020), and potentially to all other essays of this series. We are 'speaking (writing) to the converted', i.e. we are addressing concerns and requests for actions to those who are already concerned, and inclined to act. We need to step out of our 'ivory towers' of peer-reviewed papers and reports accessible only to fellow scientists, and engender activism within the science community that makes our results and opinions directly accessible to all. Interfacing with — perhaps this means educating — the young is definitely a powerful way to proceed. But, by all, including the young, we truly must mean all. While much (not all) of humanity has made good strides in finally (and quite recently) including women scientists and conservationists at this table of desperately needed help, there are still too many brown and black people of our lovely human races who are not yet at the table, for a mix of social, societal, and racial reasons not fully understood. To succeed, it is not enough that the charge of understanding is led mainly by white men. It is not enough that it is led by white women and men. It must be led by people of all races, and cultural and socio-economic backgrounds. Those of us presently most-representative of the science and conservation ethics need to work hard to make sure that roadblocks to inclusion for and by all are removed, and that science and conservation is enjoyed and enacted upon by all; all, who wish to do so, who wish to be included.

I tend to dislike statements of 'need to be', 'they must', 'you must', etc. That is top-down commanding that is unlikely to do anybody any good (when was the last time you agreed to a demand that 'you must', especially if angrily ordered?). Instead of 'we must', it is infinitely more helpful to say 'we can'. Lung cancer is complicated, but the strong clear message on each box of cigarettes (and other public relations messaging) in many countries that smoking is a major cause of lung cancer has greatly reduced smoking and its attendant ill effects. Oceans and ocean problems are also complex, but scientists' clear message that we can set aside huge parts of them with properly designated, accepted, and policed (as necessary) marine parks or reserves — marine protected areas — begins to address many (but not all) Anthropocene ocean problems (Roberts & Hawkins 2000, Hoyt 2011, Notarbartolo et al. 2016). We will be better off — and more helpful — with arguments for sustainability of ocean life if we allow ourselves into the perceptions of the lives of others, and to have empathy with their (and our own) worries, frustrations, and meager, it often seems, attempts to help. Again, an approach 'bottom up' such as that by Rao (2020) might be most useful, especially if inculcated with our scientific knowledge and a perception and belief in the powers of capability emanating from such knowledge. Then we can advise on how to help.

It helps if we come prepared with knowledge of our animals, plants, and ecosystems. It helps if we know and describe what is being done to harm life and its ecosystems. It helps if we then elucidate what needs to be done now to begin to redress many grievous insults. Above all, it helps when we care, and we attempt to help further through education, involvement with grass roots and political endeavors, and — as researchers — strongly and unequivocally, demonstrate that we know, acknowledge, and care.

While I wish the above statements could be the final words to this manuscript, they cannot be. It does not help when we are politically guided by (too often) macho belligerence, deniers of climate change and the human causes of it, or those in politics and industry who argue that another 3% of yearly 'economic growth' is the correct way to go. They forget, or do not wish to know, that such potentially exponential growth is unsustainable (see https://en.wikipedia.org/wiki/Exponential_growth#Biology), and while it may provide jobs in the present, does not provide jobs or sustainable lives for our children and theirs. It does not help when we have leaders of major nations who do not believe in good science or conservation for the long term, and it does not help when we continue to elect such supposed leadership that is worse than no leadership at all.

But, let's end on a positive note. We — scientists and conservation biologists, teachers and students who have already absorbed much and understand a bit of this — are on the front lines of helping to correct an abundant epidemic of ignorance and misunderstandings of science. Nobody is to blame but ourselves if we do not get a progressive and (slightly) hopeful message across: 'We can do better'; as a unified culture of genders and races, and by gumption and proper communication and follow-through, we will.

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