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Whalers in "A Post-Whaling World": Sustainable Conservation of Marine Mammals and Sustainable Development of Whaling Communities—With a Case Study from the Eastern Caribbean

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Abstract: The sustainable conservation of marine mammals depends not only upon considerations made for the marine mammals themselves. In many parts of the world, human societies have developed a deep reliance upon marine mammals as a food source. The sustainability and the equitable, sustainable development of these communities should be considered alongside efforts to conserve the marine mammals upon which people rely. As an example of the complexity inherent to simultaneous efforts on both fronts, this paper reviews and synthesizes two lines of research related to a small-scale whaling operation for odontocetes (dolphins and toothed whales) based in the Eastern Caribbean. The first considers the patterns of consumption and demand by the local public. The second analyzes the presence of mercury and other environmental contaminants in the tissues of the odontocetes. The results of this synthesis suggest that odontocete-based food products in the Eastern Caribbean are both highly popular and heavily contaminated, thus complicating an already-complex system in need of efforts toward both sustainability and sustainable development. The paper concludes with recommendations for both future research and future policy considerations.

Keywords: mercury; odontocetes; pollution; small cetaceans; SDGs; St. Vincent & the Grenadines; United Nations Sustainable Development Goals; whaling

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1. Introduction

On 27 April 2016, marine mammologist Phil Clapham delivered the 17th annual Roger Revelle Commemorative Lecture at the US National Academy of Sciences [1]. The topic of the lecture was cetacean conservation, particularly the challenges facing conservationists in what Clapham called "a post-whaling world." This phrase, of course, was not intended to mean a world in which all whaling had ceased; ours has indeed been a whaling world since at least the time of the Neolithic cave artists at Bangu-dae and remains so today [2]. While industrialized, commercial whaling occurs only as a relict activity in certain stubborn states such as Iceland, Japan, and Norway, where it is often heavily subsidized and the subject of significant international opposition, whaling as a traditional part of local livelihoods, or as a newly emerged strategy to alleviate food insecurity, remains widespread [3–6]. A global survey of marine mammal consumption produced by Martin Robards and Randy Reeves in 2011 mapped the intensity of exploitation along the world's coastlines and major inland waterways and remains largely actual [7].

Many of these contemporary whaling societies are facing their own sustainability crises and have held onto, or turned to, whaling as a way to address challenges that stem from causes such as climate change; the collapse of fisheries; the degradation, fragmentation, and loss of terrestrial habitats; overpopulation; poverty; and the SARS-CoV-2 pandemic [6]. In doing so, some human societies have become integrated with the cetacean populations upon which they rely to the extent that any successful effort to promote the sustainable conservation of marine mammals must necessarily address more than just the wellbeing of cetacean populations themselves. Viewed through the lens of the UN Sustainable

Development Goals [8], this means that sustainable marine mammal conservation in the 21st century should address more than just Goal 14 (Life Below Water) and, instead, should view cetacean populations and the human societies that rely upon them as integrated socio-environmental systems in need of holistic sustainability strategies. We should seek sustainability for the whales *and* for the whalers.

As an example of the complexity involved in pursuing sustainable conservation of marine mammals and sustainable development of the communities that rely upon them for food, this paper reviews and synthesizes two lines of research related to a small-scale whaling operation for odontocetes (dolphins and toothed whales) based in St. Vincent & the Grenadines (SVG) [9]. SVG is a small, independent Eastern Caribbean country consisting of one relatively large island (St. Vincent); five smaller, inhabited islands; and numerous uninhabited or resort islands (Figure 1). Whales are hunted from small, open, wooden boats, each normally crewed by three whalers. A harpooner stands in the bow of the boat and strikes whales with hand-thrown harpoons or, if the distance between the boat and the whale is greater than a few meters, fires harpoons from a modified shotgun mounted on the bow. Harpooned whales are hauled alongside or into the boat and brought to shore to be processed into food for human consumption.

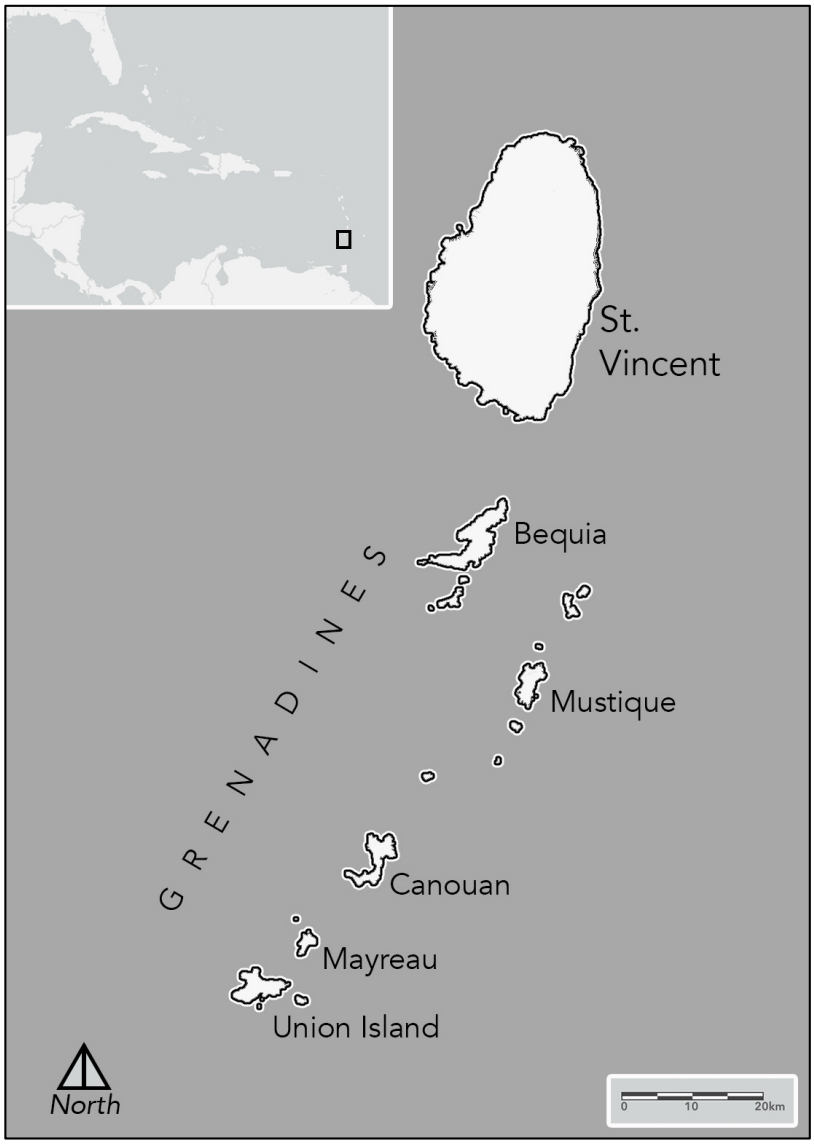

Figure 1. A map of St. Vincent & the Grenadines with an inset map showing the country's location in the Eastern Caribbean. Cartography: R. Fielding.

The whaling operation based in SVG that shall be considered here can best be understood as a case representing many small operations targeting small cetaceans around the world [7,10]. In several of these cases (most notably the Canadian Arctic, the Faroe Islands, and Japan), the continuation of traditional whaling operations targeting odontocetes to produce food for human consumption has faced various challenges, including shifting cultural and dietary preferences resulting from globalization and modernization; reduced catches resulting from declining populations of odontocetes in response to overextraction; conflicts with anti-whaling environmentalist groups; and the presence of environmental contaminants in the tissues of odontocetes taken for food, which presents health risks to consumers. Whaling communities worldwide have responded to these challenges differently, and these responses can be instructive for our consideration of Caribbean whaling communities, which, as shall be discussed, may soon need to confront similar threats.

The first line of research to be discussed here considers the patterns of consumption of, and demand for, odontocete-based food products within the SVG public; these patterns of consumption and demand drive current levels of exploitation [11]. It is noted, though, that the impact of this exploitation on regional odontocete populations is difficult to determine in the absence of baseline data on the size and structure of the odontocete populations [9]. The second line of research discussed here analyzes the presence of mercury and other environmental contaminants in the edible tissues of the odontocetes, which may pose a major threat to human health, especially with regard to children's neurological development [12,13]. The results of this synthesis suggest that odontocete-based food products in SVG are both highly popular and heavily contaminated and that the needs for action under the broad mandate of sustainability should encompass efforts targeted both at odontocete and human populations.

2. Background

Scholarly interest in Caribbean whaling, from the perspectives of both sustainable management and public health, is limited and has been thoroughly reviewed elsewhere [9,14]. Table 1 provides a summary of previously published literature on the subject. Following limited initial interest from (mainly) British fisheries administrators, for example [15], scholarly interest began to turn toward Caribbean whaling, led primarily by US- and Caribbean-based fisheries scientists [16–18]. During the 1970s, representatives of two additional academic fields began to investigate the subject: an American historical geographer who approached the subject through the lenses of both environmental history and contemporary human-environment interactions [19] and a team of Canadian ecotoxicologists led by a zoologist who carried out the first investigation into the presence of environmental contaminants in the tissues of whales caught for human consumption in the Caribbean [20]. During the 1990s and early 2000s, research was led by a local Vincentian graduate student [21] who investigated the management policies that governed whaling activities and by a Japanese scholar who produced a largely descriptive study of whaling methods and catch records [22]. In 2008, the present author began a long-term study that resulted in his 2010 doctoral thesis and a 2018 monograph comparing Vincentian whaling with another operation focusing on pilot whales in the Faroe Islands [14,23], as well as several journal articles on more specific topics.

The narrow aim of this paper is to analyze and synthesize two distinct but related lines of research that my collaborators and I have previously published and to make recommendations for future research and policy regarding the sustainable management of cetaceans in the region. The first focuses upon the concentrations of environmental pollutants, primarily mercury, in cetacean tissues processed for food and consumed in SVG. The second focuses upon the popularity of those food products in SVG and the attendant risks to human health presented by such frequent and widespread consumption. This paper presents and discusses previously published data and considers the implications of those data for both the sustainable management of Caribbean cetacean populations and

the sustainable development of the community most closely associated with Caribbean cetaceans, with a primary focus on the promotion of public health.

Table 1. List of background literature concerning whaling in St. Vincent and the Grenadines.

Author(s)	Publication Date(s)	Scope	Number(s) in References List
Rack	1952	Report on St. Vincent-based whaling for a fisheries conference held in Trinidad	[15]
Rathjen & Sullivan	1970	A review of whaling activities throughout the Caribbean with particular focus on the operation based at St. Vincent	[16]
Caldwell & Caldwell	1971, 1975	Two academic papers focused on St. Vincent whaling methods and catch statistics	[17,18]
Adams	1973	Historical geographical analysis of the origins and contemporary practice of whaling in St. Vincent	[19]
Gaskin, et al.	1974	The only previous ecotoxicological study of tissues of whales taken in the Caribbean (St. Lucia, specifically) for human consumption	[20]
Scott	1995	MSc thesis completed by a Vincentian graduate student, focused on management policies related to St. Vincent-based whaling	[21]
Hamaguchi	2002	A short summary of the St. Vincent-based whaling operation	[22]
Fielding	2010, 2018	PhD thesis and monograph that compared Vincentian whaling with whaling in the Faroe Islands, considering conservation implications, cultural meaning, conflict with international environmental activists, and contamination of odontocete-based food products through environmental pollution	[14,23]

To investigate the issue of ecotoxicology, particularly the high concentrations of mercury in food products derived from odontocetes taken in this whaling operation, the research discussed here relied upon the collection and analysis of tissue samples from the edible portions of odontocetes taken for food by SVG whalers, as well as a project that collected dietary- and health-history data via questionnaires and written surveys. Cetacean tissue sampling took place for two months in 2009 [24] and for 12 months during 2015–2016 [12]. This line of research traces its history to a paper published in 1974 that analyzed tissue samples collected from odontocetes taken in a whaling operation based on the nearby island of St. Lucia [20]. More recent and relevant research on this topic was published in 2014 and 2020 [12,24]. To date, however, very little official public communication of these findings has occurred, and consumers of foods produced through whaling in St. Vincent remain generally unaware of the health risks presented by these contaminants. This gap in communication is addressed in my recommendations below.

To analyze the rates of production and consumption of odontocete-based food products, or the general sustainability of the whaling operation, this paper reviews recent studies that used multiple methods, including analyses of catch records and estimates; dietary surveys conducted among the public; direct observation of whaling and related food-production activities; elicitation of traditional ecological knowledge from whalers; and stakeholder interviews conducted with whalers, food processors and vendors, consumers, and personnel of the SVG Ministry of Agriculture, Forestry, Fisheries, Rural Transformation, Industry, and Labour [9,11].

Following the synthesis and discussion of these two lines of research, some recommendations are made for both future research and future policy considerations. The explicit goals of these recommendations are to increase scientific understanding of the cetacean populations that occur in the Eastern Caribbean region, thus allowing for more sustainable management, and to protect consumers of odontocete-based food products within the region from the negative health effects of exposure to toxins found in the cetacean tissue.

3. Discussion

Very little is known about the size and structure of Caribbean odontocete populations [9,25,26]. As such, the biological sustainability of the SVG-based whaling operation targeting odontocetes is difficult to determine. There exists no centralized repository of records related to the catch of small cetaceans in SVG, either government-directed or otherwise [14]. Most boat owners do not keep detailed records of their own boats' catches. The few that do keep detailed records generally do not distinguish the species caught beyond the coarse identification of "whitefish" (killer whale, *Orcinus orca*), "blackfish" (short-finned pilot whale, *Globicephala macrorhynchus*, but the term is also occasionally applied to other species with a similar appearance [27]), and "porpoise" (any other odontocete species). Owing to this lack of detailed record-keeping, catch statistics are generally known only for periods of time when researchers have been active in the area. For years that data are available, wide fluctuations in catch numbers are the norm. An analysis of the 2007 to 2017 records of one boat owner revealed an annual average catch of 85 "blackfish," 3 "whitefish", and 251 "porpoises" [9]. Table 2 summarizes the catch of the one monitored whaling boat for this period. Based as they were on the records of only one boat owner (the total number of active whaling boats fluctuates but generally remains between two and six [14]), these averages certainly represent only a portion of the total SVG catch.

Table 2. Reported catch of pilot whales, killer whales, and other small cetaceans from one monitored whaling boat in SVG, 2007–2017. Summarized from data presented in a recent study [9].

Year	Short-Finned Pilot Whales (*Globicephala macrorhychus*)	Killer Whales (*Orcinus orca*)	Other Small Cetaceans	All Cetaceans
2007	64	1	288	353
2008	84	11	182	277
2009	203	0	724	927
2010	37	0	242	279
2011	66	2	138	206
2012	100	2	248	350
2013		No data		
2014		No data		
2015	51	4	156	211
2016	89	3	160	252
2017	72	6	125	203

Based upon an earlier analysis of whaling records, specifically noting the relatively consistent catch by unit of effort, along with findings related to the traditional management strategies that serve to limit the total catch, I concluded—though without much certainty—that the whaling operation targeting odontocetes in SVG, "provisionally appears to be sustainable" [14]. I make specific recommendations to address the vagueness of this assessment below. At present, much more is known about the consumption of odontocete-based food products in SVG than about the ecological impact of their production.

Food products derived from odontocetes are consumed by a majority (66%) of adult SVG residents, according to a recent dietary survey conducted throughout the country [11]. Previous dietary surveys had found "blackfish", as the meat of odontocetes is colloquially called, to be a popular food product in SVG, but the large sample size of this recent survey

(n = 921; cf. SVG 2012 adult population = 72,962) allows for more generalizable and nuanced findings.

Certain demographic and geographic consumption trends exist within the SVG population. Males and people living in or near the town where the whaling operation is based are most likely to consume odontocete-based food products than females and people living elsewhere within the country. Insignificant predictors of consumption included age and socioeconomic level (the latter proxied by occupation). In the 2018 survey, 13% of respondents reported not consuming odontocete-based food products at all—some consume only food products derived from humpback whales (*Megaptera novaeangliae*), which are hunted by whalers based on the island of Bequia in an International Whaling Commission-sanctioned and strictly limited aboriginal subsistence whaling operation [9]. Of those that do consume foods derived from odontocetes, the largest contingent was found to consume "blackfish" more often than once per month but less often than once per week; one meal per two weeks is a reasonable estimate of the average frequency with which odontocete-based food products are consumed in SVG. Nine percent of the respondents reported consuming blackfish once per week or more frequently [11].

As long-lived apex predators in the marine food web, odontocetes accumulate high concentrations of environmental pollutants through bioaccumulation and biomagnification [28]. Recent studies have found that the muscle tissues of odontocetes caught for food in SVG contains alarmingly high concentrations of mercury [12,24]. While other contaminants have not been measured in Caribbean odontocetes recently, it is reasonable to expect that substances other than mercury, such as persistent organic pollutants (POPs), are likely to be found in high concentrations as well, as they have been in odontocetes studied in other geographical areas [29]. The Food and Agricultural Organization of the United Nations (FAO) and World Health Organization (WHO) jointly recommend that seafood derived from predatory fishes with concentrations of mercury greater than 1.0 μg/g, wet-weight, not be consumed [30] (no FAO/WHO recommendation exists for cetaceans). Two studies conducted in 2014 and 2020 on tissue samples collected from odontocetes taken for human consumption in SVG reveal that mercury levels in the muscle tissue of six commonly caught species range from 0.68 μg/g to 202 μg/g, wet-weight [12,24]. The 2014 study found that the muscle tissue of the two cetacean species represented consisted of 75.4% methyl-mercury (MeHg) on average [24].

At the point of retail sale, odontocete-based food products in SVG generally do not retain any identifying link to the species of origin; meat from a variety of odontocete species is typically marketed only as "blackfish" [27]. Thus, consumers of odontocete-based food products are generally not aware of the species from which the food they are consuming was derived. As such, species-based measurements of contaminants may be of interest to the scientific community, but they hold less value for public health. More relevant for consumers or public health advocates would be the separation of pollutant concentrations by tissue type, which is readily distinguishable at the point of sale or consumption. In SVG, cetacean muscle tissue and blubber are sold widely at markets based throughout the country and by mobile vendors. Livers and kidneys are also consumed, but their distribution is mostly limited to the area immediately surrounding the country's main whaling port. Table 3 presents average mercury concentrations determined in the 2014 and 2020 studies by species and tissue type.

Owing to inconsistent portion size, estimating the amount of odontocete-based foods consumed per unit time is difficult. Based upon the concentrations of mercury measured in the tissue samples [12] and the joint FAO/WHO provisional tolerable weekly intake limit for mercury (1.6 μg per kg body weight), it was determined that a 60-kg adult could safely consume approximately 52 g of "blackfish" meat (muscle tissue) per week. Blackfish meat is typically sold in "bundles" that range from 113–227 g, and consumers typically report their portion size with reference to the number of these bundles they consume [11].

Table 3. Mean total mercury (THg) concentrations in odontocete tissues, arranged by species and tissue type, as presented in two recent studies [12,24]. Units are μg/g, wet-weight.

	Muscle	Blubber	Liver	Kidney
Short-finned pilot whale (*Globicephala macrorhynchus*)	20.5	1.35	35.7	4.15
Killer whale(*Orcinus orca*)	48.4	5.04	472	357
False killer whale (*Pseudorca crassidens*)	4.35	2.72	632	60.0
Risso's dolphin(*Grampus griseus*)	11.0	0.27	-	-
Atlantic spotted dolphin (*Stenella frontalis*)	1.57	1.42	-	-
Spinner dolphin(*Stenella longirostris*)	1.14	0.92	-	-
Unknown dolphin (*Stenella* sp.)	3.22	3.79	10.2	94.8
Mean of means, by tissue type	12.9	2.22	287	129

The mean value of all mercury concentrations across the entire sample set in the 2020 study was 19.4 μg/g [12]. The highest concentrations were found in two species: killer whales and short-finned pilot whales. Regarding the former, the 2020 study included the highest concentration of mercury in killer whales ever yet reported in the scientific literature. Personally, I struggle to reconcile the fact that after the small (approximately 1 cm^3) tissue sample, which would later reveal this record-breaking mercury concentration, was collected, the rest of the individual killer whale carcass from which the sample came was apparently processed as food and taken to market. In all likelihood, the single most contaminated killer whale ever known became a meal for many people. Recently published results from a stable isotope analysis of these tissue samples provide some context: killer whales in the Eastern Caribbean feed mainly on odontocetes and sharks, placing them at a trophic position commensurate with the high mercury concentrations found [31]. Local whalers in SVG have long viewed killer whales as their main competitor in the hunt for other odontocetes [14]; the correctness of this traditional ecological knowledge, confirmed by stable isotope analysis, supports marine ecologist Robert Pitman's designation of the killer whale as the ocean's "top, top predator" [32]. If we were, in our analysis, to remove all samples of killer whales from the dataset, we would find the mean mercury concentration across all remaining muscle tissue samples reduced to 11.9 μg/g, wet-weight, which is still far above the FAO/WHO advisory level for predatory fishes but significantly lower than the present average concentration for odontocetes caught, processed, and marketed in SVG.

A recently reported study found experimental evidence for a novel, low-cost, low-technology method to reduce the mercury concentration in odontocete tissue [33]. Normally, the muscle tissue of odontocetes taken in SVG for human consumption is dried in the sun for several days as a method of preservation [14]. The meat is then rehydrated before being prepared for consumption. This recent study found that the liberal application of salt to the surface of the muscle tissue during the drying process, and the subsequent removal of the salt before preparation, resulted in the reduction of mercury by an average of about 30%. Both locally-produced sea salt and commercially-available table salt were tested; no significant difference in mercury reduction was found. Major questions remain, however, about both the mechanism of this observed effect and the practicality of its broad implementation as a method to reduce mercury exposure within the SVG whaling community.

4. Recommendations

The situation described here, in which odontocete-based food products consumed in SVG are both highly popular and heavily polluted is not sustainable: possibly not in terms of marine mammal conservation and certainly not in terms of human health. The link

between mercury exposure and negative health outcomes is well-established [34]. Infants and unborn children face a particularly high risk for negative health effects of mercury exposure [13,30]. While it may seem simple, and reasonable, to call for the immediate abandonment of food products derived from whales, for reasons related to both public health and sustainability, lessons learned from similar cases of traditional foods being replaced in response to pollution indicate that such action can result in even worse health and environmental outcomes, owing to the risks and impacts associated with the specific alternative food products that arose to replace those that had been abandoned [35]. Owing to the popularity of odontocete-based food products in SVG, it is unlikely that such a call for abandonment would even be effective. Many questions remain for scientists to address through research, but there are some practical steps that policymakers could take now (or soon, pending the results of ongoing and recommended research) that would improve the sustainability of the SVG whaling operation, for both marine mammals and human society.

Here, I present a set of recommendations for scientists and policymakers, based upon the findings discussed above and expanded from a recent conference presentation [36]. To promote better health outcomes for the SVG population and to ensure the sustainable conservation of marine mammals there, the following recommendations should be considered for future research.

1. **Mercury pathways.** The source(s) and movements of mercury into and within the Eastern Caribbean should be further studied, modeled, and mapped. Mercury enters the marine environment from myriad sources, both anthropogenic and geological [37]. Understanding the specific pathways taken from the original source(s) to the Eastern Caribbean marine food web will aid efforts to reduce human and nonhuman exposure to mercury.
2. **Cetacean population size, structure, and movements.** Populations of odontocetes in the Eastern Caribbean should be studied to better understand their sizes and structures. This will aid in determining their conservation status and quantifying the impact of whaling upon odontocete populations in the region. Ship-based sighting surveys, drone-based surveys, the collection of traditional ecological knowledge from Caribbean-based whalers and fishers, and genetic analysis of biological tissue (either newly-collected or from existing sample archives) can all contribute toward this goal. Movements of odontocetes within the Eastern Caribbean and to/from other regions should be studied through observation and satellite-aided tracking. This will help to determine the geographical range of area in which odontocetes feed and, thereby, are exposed to environmental contaminants.
3. **Contaminants other than mercury.** The concentrations of environmental contaminants besides mercury, specifically POPs, in Caribbean odontocetes should be measured.
4. **Food safety: mercury reduction.** The practical applicability of the observed effect by which the application of salt during the drying process reduces mercury concentrations in odontocete muscle tissue [33] should be assessed.

To promote better health outcomes for the SVG human population, as a component of broader sustainable development efforts in the region, and to promote better conservation outcomes for the region's marine mammal populations, the following recommendations should be considered for future policy.

1. **Polluter accountability.** Based upon the findings of the first research recommendation above, parties responsible for the presence of mercury in the Eastern Caribbean food system should be held accountable for the effects of the pollution. Because SVG supports virtually no mercury-polluting industries, this will almost certainly be a case of transnational pollution and, as such, will likely present difficulty in terms of international adjudication [38–40]. Internationally agreed-upon principles of environmental justice, however, would demand that accountability—particularly financial accountability—be sought [41,42].

2. **Catch limits and monitoring.** Based upon the findings of the second research recommendation above, the Fisheries Division of the SVG Ministry of Agriculture, Forestry, Fisheries, Rural Transformation, Industry, and Labor should establish quotas, by species, to limit the impact of Caribbean whaling upon local and regional odontocete populations to sustainable levels. Adherence to these quotas should be enforced, based upon the establishment of a monitoring system that accounts for every cetacean taken by SVG-based whalers. Within these catch limits, the quota for killer whales caught for human consumption should be set at zero. Based upon previous findings related to mercury concentrations in killer whale tissues, killer whales should no longer be hunted for food by Caribbean whalers. Because the species identification is not preserved through the entire food-production process, consumers can never be fully certain of which species they are consuming. The alarmingly high mercury concentrations in killer whale tissue raises the average concentration of the aggregated odontocete-based food supply. If killer whales were excluded from the pool from which odontocete-based foods are produced, the average mercury concentration in the entire odontocete-based food system would be reduced significantly. Short-finned pilot whales were found to have the second-highest concentration of mercury in their muscle tissues. While it may be reasonable from a human-health perspective to also forbid the hunting of this species, doing so may not prove to be a practical policy, owing to the cultural relevance of the pilot whale as the mainstay of the SVG whaling operation [14].
3. **Establishment of dietary recommendations.** Based upon the findings related to mercury concentrations in SVG-caught odontocetes in general, as well as the future anticipated findings related to the third research recommendation above, dietary guidelines should be written and communicated among the SVG public via the Ministry of Health, Wellness, and the Environment to offer evidence-based advice regarding the maximum amounts of odontocete-based food products that can safely be consumed. These guidelines should be adjustable for the consumer's age, sex, and body weight and should take into account the uncertainty of species-of-origin among consumers of odontocete-based food products as well as any underlying health conditions. The primary target audience for the communication of these recommendations should be young women, particularly mothers of small children. This suggestion is in acknowledgement of the disproportionate effect of mercury and other pollutants likely to be found in high concentrations upon the development of fetuses and children. To be effective, the recommendations must be realistic. On the one hand, recommendations perceived as "too extreme" may not be followed. For example, the 2008 recommendation, issued by public health officials in the Faroe Islands, that the entire population cease consumption of odontocete-based food products entirely [43] has been disregarded by a large portion of the Faroese population [44]. On the other hand, recommendations for total abstention may sometimes result in shifts toward replacement foods that carry their own environmental and health risks, as was seen in the Canadian Arctic when Indigenous communities were advised to abstain from traditional foods with high levels of environmental contamination [45]. A delicate balance between public health and public acceptance must be sought.
4. **Pollutant emission reduction.** Global mercury emissions should be reduced in accordance with the United Nations Environmental Program's Minamata Convention on Mercury [46].

The fact that odontocete-based food products are both heavily polluted and highly popular in SVG is not merely a local problem in this Eastern Caribbean country. It is a problem affecting both marine mammals and the humans who rely upon them for food and is indicative of a need for improved sustainability and sustainable development that spans the entire Caribbean region and reaches globally. Regional and global efforts, by both scientists and policymakers, are required to address this issue adequately, equitably, and sustainably.

5. Conclusions

A reasonable question posed by a reader of this journal's special issue dedicated to the sustainable conservation of marine mammals might be: why should we be concerned for whalers? I would suggest, in response, that *not* to have concern for whaling societies, especially those that, like SVG, are small-scale, localized, and traditional, would be to ignore a major component of the entire marine ecosystem, of which both whales and whalers are constituent parts.

Clapham acknowledged in his 2016 lecture on conserving whales in a "post-whaling world," that while "some whaling continues, the scale is greatly reduced . . . and . . . other threats to whales are more significant" [1]. Among these threats, he mentioned specifically ship-strikes, fishing gear entanglement, and ocean noise, to which many additional issues could be added, including the direct effects on cetaceans from environmental contamination by industrial chemicals like mercury and POPs. Clapham's point was that these threats now eclipse whaling in terms of the cumulative effect on marine mammals. As far back as 1983, even before the IWC's moratorium on commercial whaling came into force, marine mammalogists Stephen Leatherwood and Randy Reeves wrote that "the aspect of [cetacean] conservation that drives us closest to despair is pollution" [47].

When we consider the driving forces behind these threats to sustainable marine mammal conservation (ship-strikes, fishing gear entanglement, ocean noise, and industrial pollution), we cannot help but agree with Michael Moore, Director of the Marine Mammal Center at the Woods Hole Oceanographic Institution, that "we are all whalers" [48]. Moore's provocative assertion, of course, is that one's participation in systems responsible for the harm and death of marine mammals implicates one as complicit in the result. Our reliance upon international shipping of consumer goods, seafood from industrial-scale fisheries, and the products of myriad industries responsible for the chemical contamination of the atmosphere and ocean demands that we cease viewing ourselves as entirely separate from societies that rely upon the direct take of marine mammals for food; we are separated by degree, perhaps, but not by kind.

Ours is a "post-whaling world", in which "we are all whalers" [1,48]. This paradox should serve to encourage more honest and sympathetic interactions among whaling societies of various degrees: the direct and the indirect; the intentional and the incidental. The UN's Sustainable Development Goals were intended to apply to all human societies. Those of us privileged to spend our careers working toward the conservation of marine mammals must not view our subject in isolation, must not lose sight of the bigger picture in which whales and whalers are parts of the same integrated socio-environmental system, and must not succumb to the hubris that would excuse our participation in systems detrimental to the very conservation efforts we pursue. As an indirect whaler, in Moore's sense of the term, I feel compelled to work toward both sustainability for whales and sustainable development for societies supported by direct whaling.

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