

## Doc 04: Consolidating the Science of Aquatic Wild Meat in West and Central Africa

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1. Globally, especially in the tropics and subtropics, wild animals are captured or taken opportunistically and the meat, body parts, and/or eggs are consumed as food or used for traditional remedies, cultural purposes, and religious ceremonies (**Alves and Albuquerque, 2017; Ingram et al., 2021**). Increasingly, products are sold locally, nationally, regionally, and internationally, providing income to many communities (**Coad et al., 2019; Ingram, 2020**). When harvests of wildlife are unsustainable, they cause population declines and pose a threat to species' survival (**McCauley et al., 2015; Benítez-López et al., 2017; He et al., 2017; Ripple et al., 2019**). Over the past few decades, a vast literature has amassed on the harvest of wild-caught fish and terrestrial animals, which includes quantitative studies of the magnitude and spatial extent of harvests in some regions, sustainability assessments, the human dimensions of wildlife use, and the impact of overexploitation on ecosystems (**Worm et al., 2009; Lynch et al., 2016; Coad et al., 2019; Dobson et al., 2019; Ingram et al., 2021**). While the commercial targeting of some taxa has raised serious international concerns (e.g., whaling), there has been limited focus on the exploitation of most freshwater and marine (hereafter “aquatic”) non-fish animals used for food and other purposes.
2. For both terrestrial and aquatic wildlife, the terminology used to discuss harvest (also called “takes” in the wildlife management literature, and “catches” in the fisheries literature), consumption, and trade has changed over the past few decades. In 2000, and largely focussing on terrestrial species, the International Union for Conservation of Nature (IUCN) adopted the term “wild meat” to describe the “meat and other products derived from wild animals for human consumption,” whether legal or illegal, to harmonise terminology across regions (**Mainka and Trivedi, 2002**). In 2017, both the International Whaling Commission (IWC) and the Convention on the Conservation of Migratory Species of Wild Animals (CMS) adopted the term “aquatic wild meat,” defined as “*products obtained through all forms of take, including unregulated, legal, or illegal hunts as well as deliberate or opportunistic catches from stranded (dead or alive) and/or bycaught (also known as incidental catch) individuals*” to similarly harmonise this issue for aquatic non-fish species (**CMS, 2017a,b; IWC, 2018**).
3. The consumption of aquatic animals is widespread, and is an important source of nutrition, income, and cultural identity for many communities (**Robards and Reeves, 2011**). Harvest levels may be high or low, but many are unregulated and unmanaged. Growing human populations, improved animal hunting and capture methods, expanded market access, and an escalating demand for animal-sourced proteins, has increased exploitation levels and, in some areas for at least some species, unsustainable harvests are now evident (**Milner-Gulland et al., 2003; Cawthorn and Hoffman, 2015; Coad et al., 2019**). Overarching guidance regarding aquatic wild meat in international policy remains limited for most species. Understanding the scope and potential threat of overexploitation of aquatic wild

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All available references are provided as hyperlinks within the document.

meat species is an important first step toward developing effective international and domestic policy.

4. The CMS has provided some guidance on the use of *migratory species*, defined in the Convention text as “the entire population or any geographically separate part of the population of any species or lower taxon of wild animals, a significant proportion of whose members cyclically and predictably cross one or more national jurisdictional boundaries.” CMS provides a way for countries to cooperate to ensure species’ migrations can still continue without barriers, and to address issues such as habitat destruction and exploitation. In 2017, the CMS Scientific Council established an Aquatic Wild Meat Working Group to focus on the exploitation of aquatic animals (CMS, 2017b).

## Aquatic Wild Meat Harvest of CMS-listed Species in West and Central Africa

### Cetaceans

5. There is evidence of the use of cetaceans in most countries in tropical Africa, with meat and other body parts used for human consumption, shark bait, traditional medicine, and other purposes (Van Waerebeek et al., 2003; Clapham and Van Waerebeek, 2007; Weir et al., 2010; Robards and Reeves, 2011; Weir and Pierce, 2012; Cosentino and Fisher, 2016). Dolphins are both intentionally hunted and landed as bycatch in artisanal gillnets, drift gillnets, beach seines, and other fishing gear.
6. The available data from West and Central Africa are limited, but recent records indicate small cetaceans are consumed as food in Benin (Sohou et al., 2013), Cameroon (Ayissi et al., 2011, 2014), Guinea (especially Atlantic humpback dolphin, *Sousa teuszii*, and common bottlenose dolphin; Van Waerebeek et al., 2003, 2017; Bamy et al., 2021), Guinea-Bissau (Leeney et al., 2015), Nigeria (Uwagbae and Van Waerebeek, 2010; Van Waerebeek et al., 2017), Republic of the Congo (Collins et al., 2010, 2019), Democratic Republic of the Congo (Collins et al., 2019), São Tomé and Príncipe (Nuno et al., 2023), Senegal and The Gambia (Maigret, 1994; Murphy et al., 1997; Van Waerebeek et al., 2000, 2003; Leeney et al., 2015; Keith-Diagne et al., 2017), and Togo (Segniagbeto et al., 2014). Historically whaling was important on the Cape Verde Islands (Brito et al., 2016), and some consumption of cetacean meat remains. However, while a recent review (Segniagbeto et al., 2019) indicates instances of consumption of pilot whales and stranded melon-headed whales, and use of teeth for manufacture of local jewellery, there are no signs of any systematic utilisation on the Cape Verde Islands. This conclusion coincides with Hazevoet et al. (2010) who stated that only few bycatches or purposeful catches had come to their attention. Recent evidence also suggests that opportunistic harvest of whales occurs on Annobón (Equatorial Guinea), although rarely, and includes large cetaceans (preferentially calves), such as humpback whales (Fielding and Barrientos, 2021), and São Tomé and Príncipe (Brito et al., 2010; Nuno et al., 2023). In Ghana at least 16 cetacean species are used as aquatic wild meat and, in some years, more than one thousand individuals are landed (Ofori-Danson et al., 2003; Van Waerebeek et al., 2009, 2014; Debrah et al., 2010). In some countries, including Ghana, as demand increased for dolphin meat, for human consumption or shark bait, bycatch gradually transformed into targeted harvesting (Ofori-Danson et al., 2003). Ghanaian artisanal fishers, operating in Togolese coastal waters, are thought to promote trade and consumption of cetacean meat (Segniagbeto et al., 2014). Smoked cetacean meat from coastal Togo is traded far from the coast as wild meat in northern Togo, Burkina Faso, Niger, and Mali (Segniagbeto et al., 2014). In the western most countries, The Gambia and Senegal, dolphin meat and oil is also used in traditional remedies (Madge, 1998; Leeney et al., 2015). It is likely that cetaceans are consumed

throughout the Gulf of Guinea, despite the lack of specific records (**Clapham and Van Waerebeek, 2007; Collins et al., 2010; Robards and Reeves, 2011; Van Waerebeek et al., 2017**). The Atlantic humpback dolphin is considered disproportionately impacted by wild meat harvest, because of its small population size (**IWC, 2019**), inshore habitat use, and high vulnerability to capture in small-scale coastal fisheries (**Van Waerebeek et al., 2017; Bamy et al., 2021**).

### Sirenians

7. African manatees (*Trichechus senegalensis*), distributed exclusively in West and Central Africa, are legally protected in all 21 countries in which they occur. Domestic trade for food, traditional medicine, and other purposes has been recorded historically and continues to some degree in all countries (**Reeves et al., 1988; Powell, 1996; Akoi, 2004; Dodman et al., 2008; Keith Diagne, 2014, 2015; Bachand et al., 2015; Mayaka et al., 2015, 2019; Kamla, 2019**). In the past, manatee hunting was conducted by specialised hunters, but more recently also by fishers and generalist hunters. Consumption of bycaught animals also occurs widely in both coastal and inland regions, largely driven by poverty (**Dodman et al., 2008; Bachand et al., 2015; Keith Diagne, 2015; Kamla, 2019**). Manatee meat is also sold in markets and restaurants in urban centres, which has increased its commercial value (**Thibault and Blaney, 2003; Fa et al., 2006; Mvele and Arrowood, 2013**). Recent surveys show that manatees are used for predominantly for food, but also traditional medicine and medico-magical purposes in the Ouémé Delta wetlands in Benin (**Djondo et al., In Review; Djondo et al., In Review**).

### Chelonians

8. Marine turtles are also harvested to different degrees for food and traditional remedies along the West and Central African coast, including The Gambia, Gabon, Guinea-Bissau, Sierra Leone, Ghana, Togo, Mauritania, Benin, Cape Verde, Senegal, Côte d'Ivoire, Guinea, and the Republic of Congo (**CMS, 2000; Thibault and Blaney, 2003; Bal et al., 2007; Fretey et al., 2007; Catry et al., 2009; Hancock et al., 2017; Djondo et al., In Review**). Marine turtle exploitation (both illegal, and legal for Urekan people permitted with a quota) is particularly intensive on Bioko Island, Equatorial Guinea (*Lepidochelys olivacea*, *Chelonia mydas*, *Dermochelys coriacea*, *Eretmochelys imbricata*), with products sold at local and urban markets (**Tomás et al., 2010**), São Tomé and Príncipe (*C. mydas*, *L. olivacea*; **Veríssimo et al., 2020**), and Senegal (**McGovern et al., 2021**). For example, in São Tomé and Príncipe, 25% of rural and 32% of urban respondents in a survey had consumed marine turtle meat in the past year (**Veríssimo et al., 2020**). Catch of marine turtles in Nigeria is estimated to be in the thousands of individuals annually, and high numbers of turtle eggs are harvested (**Lewison and Moore, 2012**). Reductions in turtle exploitation in Bioko Island occurred in years when beach patrols were implemented, but this requires consistent funding (**Tomás et al., 2010**).

### Chondrichthyans (sharks, rays, and chimaeras)

9. There has been insufficient time to formally review the harvest of Chondrichthyans in West and Central Africa, but harvest is likely considerable and an assessment should be prioritised.

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## Human Dimensions and Drivers of Aquatic Wild Meat Use

10. The drivers of aquatic wild meat consumption and trade are varied and changing. For some IPLCs, consumption of aquatic wild meat may have high socio-cultural significance (**Delisle et al., 2018**), and is a right bestowed under UNDRIP. Food is an important driver of low-level aquatic wild meat harvests in many places yet its nutritional contribution relative to alternatives is rarely quantified (**Olmedo and Farnés, 2004**). Increasing market access and integration into cash-based economies changes the dynamics of aquatic wild meat consumption and trade in some areas, and as such the gradient between subsistence use and commercial trade becomes hazy (**Frazier, 1980; Ingram et al., 2021**). Subsistence and commercial uses merge insensibly in many of the examples of human consumption reviewed here.
11. The dynamics of aquatic wild meat harvests, use, and trade may change in response to climate change influences on food security and habitats. Declines of fish stocks and terrestrial wild meat may increase dependence on aquatic megafauna in coastal communities with few alternatives, for example cetaceans in West Africa (**Leeney et al., 2015; Van Waerebeek et al., 2017**). Fisheries catch potential is predicted to decline over the 21st century under all emissions scenarios, especially in the tropics (**Bindoff et al., 2019**), and livelihoods and food security of communities currently dependent on marine resources are predicted to be adversely affected. An interaction between declining fish stocks and use of terrestrial wild meat has occurred in West Africa (**Brashares et al., 2004; Rowcliffe et al., 2005**), hence increased monitoring of the extent of aquatic wild meat use in local contexts could be important.

## Potential Implications for Human Health

12. Most research investigating the human health impacts of consuming wildlife deal with terrestrial wild meat, but some apply to aquatic wild meat. Food and nutrition, often provided to people in relative poverty by wild meat, is fundamental to their health and well-being, and a basic right (Article 25) within the UN Universal Declaration of Human Rights. However, there are clearly health risks associated with wild meat that are context-specific, and include zoonotic pathogens (viruses, bacteria, parasites) and excessive human consumption of heavy metals and pollutants. Recorded Emerging Infectious Disease (EIDs) events, which can influence economies and public health, nationally and internationally, were 60.3% zoonoses (**Jones et al., 2008**), with 71.8% originating in terrestrial wildlife, and increasing over time (**Jones et al., 2008**). Ebola virus disease (**Greatorex et al., 2016**), Avian Influenza A (**Poovorawan et al., 2013**), and Middle East Respiratory Syndrome (MERS) (**Cauchemez et al., 2014**) are all examples. None of these have been attributed to aquatic wild meat, but they exist side-by-side in many cultures.
13. Fundamental hygiene is a risk factor with all meat consumption, wild or domestic. The consumption of raw or undercooked pinniped or cetacean meat has resulted in bacterial (e.g., salmonellosis and botulism) and parasite (trichinellosis and toxoplasmosis) infections in people (**Bender et al., 1972; Tryland, 2000; McLaughlin et al., 2004; Van Bresseem et al., 2009; Tryland et al., 2014**). Reptile meat and eggs, if not subject to inspection and hygienic treatment, can cause bacterial (*Salmonella* spp., *Vibrio* spp.) and potentially parasite infections (*Spirometra*, *Trichinella*, *Gnathostoma*, pentastomids) and biotoxin problems (**Magnino et al., 2009; Cantlay et al., 2017**). Heavy metals and pollutants in some chelonian life stages (**Frías-Espéricueta et al., 2006**), cetaceans (**Fielding and**

- Evans, 2014**), and sirenians (**Marsh et al., 2002, 2011**) exceed international food safety standards, and a growing list of bacterial, viral, and fungal agents in marine mammals (**Waltzek et al., 2012**) could be problematic. Viable substitutes for wild meat, if they can be afforded, also have a multitude of health risk implications (**Tomley and Shirley, 2009**), and clearly further research is needed.
14. The use of aquatic wild meat has definitive health risks that exceed those of substitute meat. Strategies for reducing aquatic wild meat use and consumption may be possible through partnerships between local people, governments, public health professions, veterinarians, and both wildlife managers and ecologists.

## Conservation Concerns

15. Given that the extent of use relative to the size and trends (increasing, decreasing or stable) in the wild source population and rates of immigration and emigration are seldom known accurately, the impact of harvests for aquatic wild meat on the conservation status of source populations can seldom be quantified with any scientific certainty. For example, the harvest of migratory small cetaceans for aquatic wild meat in the Gulf of Guinea, in particular Atlantic humpback dolphin, which meet IUCN Red List criteria for Critically Endangered (**Collins et al., 2017**), are assumed to be threatening despite limited information on harvest levels, population size, trends and distribution.
16. For depleted sirenian populations, even a modest harvest for human consumption may constrain the rate of recovery of populations, which are highly sensitive to changes in adult survival (**Marsh et al., 2011**). Most local populations cannot withstand human-induced mortality. In Senegal, The Gambia, Nigeria, Cameroon, and Democratic Republic of the Congo, more than 1,000 manatees have been killed by illegal hunting, bycatch, dams and watercraft between 2017 and 2019 (**Keith-Diagne et al., 2019**). Aquatic wild meat is a major motivation for this loss, impacting negatively on most populations.
17. Risks to riverine megafauna from harvest may be particularly high, even if opportunistic, because the risks are compounded by unique threats to riverine species, such as dams, intensive fishing, and pollution where human population density is high (**He et al., 2017**). African manatees are considered sensitive to any harvest given low reproductive output and generally small local population sizes, making their use for aquatic wild meat potentially problematic. Riverine megafauna may suffer from a lack of management and research as they are seen as neither terrestrial species nor fish, and the case for increased research and management of riverine and freshwater megafauna is a strong one.
18. Finally, the use of aquatic megafauna for aquatic wild meat is likely to be far more widespread in terms of frequency and species than reported here, especially amongst IPLCs. Monitoring and reporting are limited, and because many of the species are protected by national law, or are charismatic, their use is secretive. The trans-boundary nature of harvests and associated trade of these oceanic, coastal, and riverine species requires international attention and cooperation to be increased. Despite the wisdom of adopting a precautionary approach in the absence of quantitative data on harvest levels, population sizes, and trends for most species used for aquatic wild meat, the case for researching in more depth the harvests that do appear sustainable is a strong one. There is a fundamental difference between assembling information on isolated population dynamics, and studying “dynamic populations” – how populations compensate to sustain uses (**Webb, 2015**). CMS has taken an early step, agreeing to progress the development of a sub-regional Aquatic Wild Meat Action Plan for West Africa for consideration by CMS COP14 (Decision 13.64, COP13; **CMS, 2020**).

## Conclusion

19. Aquatic wild meat use has been vastly under-researched, despite its critical importance to the conservation, welfare, and sustainable management of aquatic megafauna. The use of aquatic wild meat, especially by IPLCs, has often fallen between the cracks of conservation and fisheries management agencies. Aquatic wild meat is clearly an issue of concern that needs to be addressed openly and transparently, as an important step toward achieving sustainability for both conservation and the many communities across West Africa who depend on it.

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