Marine Mammals: Food or Cultural Resources? - Could they be both?

1. Why not Marine Mammals? 3

2. Marine Mammals, an Abundant and Logical Resource in the Arctic 4
2.1 An omnipresent resource in a world of scarcity. 4
2.2 An abundant resource 5
2.2.1 Pinnipeds 5
2.2.2 Cetaceans 5
2.3 A highly valued and therefore precautionary managed resource 6
2.3.1 Strict management of resources ensuring healthy stocks 6
2.3.2 A responsibly managed resource – welfare issues 9

3. Marine Mammals, a Green-Blue Resource 10
3.1 A Resource in good balance with the Environment 10
3.2 A Resource contributing to Blue Growth 11

4. Marine Mammals, Healthy Resource with Challenges 13
4.1 Nutritive value 13
4.2 Health benefits 13
4.3 Health drawbacks: contaminants 14

5. Marine Mammals, a Ressource Contributing to Food Security 15
5.1 Food Security – a growing concern 15
5.2 The status of Food Security in the Arctic 15
5.3 Marine Mammals as contributors to Food Security? 17
5.3.1 Stable availability 17
5.3.2 Stable access 17
5.3.3 Stable utilisation 18

6. Marine Mammals, a Source to Identity and Empowerment 19
6.1 A resource entwined with identity and social purpose: Greenland 20
6.2 A resource entwined with identity: Faroes 22
6.3 A resource entwined with conservation *avant l'heure*: Iceland 23
6.4 A resource entwined with small communities' viability: Norway 23
6.5 A resource empowering small coastal communities 24

7. Whaling and Sealing, Past and Present but Differently 25
7.1 Two different scales of hunting pressure 25
7.2 A strong incentive for sustainability 26

8. Marine Mammals, a Resource on Thin Ice **27**
8.1 A Changing Arctic as Background 27
8.2 Uncontrolled direct removals 27
8.2.1 Ship strikes *28*
8.2.2 By-catch and entanglement *28*
8.3 Insidious "underwater" anthropogenic stressors 28
8.3.1 Pollution by contaminants and microplastics *28*
8.3.2 Other anthropogenic disturbances *29*
8.4 Precautionary management needed and an appeal to joining forces 30

9. Marine Mammals, a Forgotten Resource? **30**
9.1 Is there a general attitude against using marine mammals as food resources? 31
9.2 Are marine mammals an endangered species? 32
9.3 Are marine mammal supra-mammals? 33
9.3.1 Fascinating animals *33*
9.3.2 Fascinating but not "innocent" *34*
9.4 An ethical issue? 34
9.5 Another side of ethic and a problematic focus with durable consequences 35

10. Conclusion: Marine Mammals – why not? **36**

Appendices **38**

References **38**

1. WHY NOT MARINE MAMMALS?[1]

Since pre-historical times, stranded or hunted marine mammals have represented resources, food and materials, for many coastal communities worldwide, as testified by their appearance in rock carvings, legends, writings, literature and art. In the Arctic, their abundance and omnipresence makes them the predominant component of the marine ecosystem. Now as in the past, they are a logical and compulsory food resource. Their overall year-round availability has enabled small remote and isolated Northern coastal communities to survive and to globally maintain a relatively high degree of self-sufficiency in food production. Small type coastal whaling and sealing were not only a source of food, commodities, trading currency and cash, but also represented a cultural and societal keystone and were the mainstay of many coastal communities, particularly in Greenland.

Subsistence/sustenance and coastal whaling and sealing were conducted in a largely sustainable manner, but became undermined as commercial whaling and sealing developed. The large scale systematic hunting for profit lead to serious declines in many of the world's populations of marine mammals, the collapse of most of the major whale stocks and the extinction of some pinniped species. As a result, marine mammal hunting became the symbol of mismanagement and abuse of natural resources.

The emergence of the modern environmental ethic coupled with the development of precautionary and effective management procedures (by population and stocks), as well as the demise of the demand for whale and seal oil, brought an end to large scale whaling and sealing by the mid-1980s. Although a few remain critically endangered, many stocks of marine mammals have since recovered from exploitation and are considered healthy (Gambell 1999, Clapham et al 1999, Costa et al 2006, Laidre et al 2015, Thomas et al 2015, Clapham 2016, IWC[2] 2016[3], Smith et al *in* UN[4] 2016) and are thus able to sustain control removals,

Today whaling and sealing are still a reality for many Northern coastal communities, simply because marine mammals are present, nearby and abundant, and therefore a logical resource in an environment of scarcity. They continue to represent an invaluable resource bringing food and/or money, as well as job opportunities in places where non marine resources are limited and/or job opportunities few.

Although the capacity for sustainable management has been built up through progress in development of precautionary management procedures, targeted stocks are healthy, and locally sustainably exploited marine mammals represent an ecosystem-friendly, low carbon footprint resource, the exploitation of marine mammals remains controversial and demonised, stamped as uncivilised and barbaric – barely acceptable as subsistence activities for those marginal "aboriginals" or "natives".

Food insecurity is recognised as one of the major risks concern of the 21st century and is, particularly in the Arctic, exacerbated by climate change. [Some] Marine mammals represent valuable potential contributors to food security in many places. Nevertheless, they are ignored as potential food resources in the general discourse on food security (Godfray et al 2010, UN 2014, 2015, FAO 2016, Potts et al 2016, WEF 2016). The UN General Assembly (UN 2014) recognises the important role played by seafood in global food security, it defines seafood as including "*all marine living resources used for food, including fish, shellfish, crustaceans, **marine mammals**, sea turtles and algae"* and underlines that *"this definition promotes a holistic view of the contribution of seafood to global food security*". It mentions marine mammals as a possible important source of nutrition, in particular for certain groups of indigenous peoples, notes that they are not as widely consumed for a variety of reasons, then simply do not examine further potential of marine mammals as contributor to food security.

[1] Though it might be argued that animals need not be killed for humans to feed, the starting point of the present discussion is that animals play a role in giving energy and nutrition to humans and contributing to food security.
[2] International Whaling Commission
[3] https://iwc.int/status, retrieved June 2016
[4] United Nations

With a focus on the Arctic, we examine the characteristics and potential of marine mammals as food resource in an environment, dietary and societal perspective in the light of Blue Economy and climate and environment changes. We look at their abundance, our ability to manage them sustainably, their ecological footprint and explore why marine mammal resources are ignored in the context of food security.

Norwegian petroglyph depicting a whale.

2. MARINE MAMMALS, AN ABUNDANT AND LOGICAL RESOURCE IN THE ARCTIC

Marine mammals have been/are consumed as human food all around the world (e.g., Shoemaker 2005, Robards and Reeves 2011). In the Northern latitudes, marine mammals have, however, acquired a special significance because of their abundance compared to the scantiness of land resources.

2.1 An omnipresent resource in a world of scarcity.

The Arctic environment, which surround the NAMMCO countries, is characterised by a barren and inhospitable environment and climate, with limited usable land resources - both flora and fauna, not only in diversity and quantity but also seasonally. In a sharp contrast, the marine environment bursts with diverse and abundant resources, including fish, crustaceans, sea birds and marine mammals. The fish fauna is, however, impoverished compared to lower latitudes, although a few important species abound in some areas. Sometimes these abundant fish species occur in deeper waters, which until relatively recently could not be effectively taken with indigenous fishing technology (e.g. Greenland halibut, shrimp and crab). In contrast, migratory warm-blooded animals (including birds and whales) arrive in abundance to feed on the seasonally available marine invertebrates (Freeman 2001).

Animal diets, including humans, reflects the resource availability within their specific environments, leading to geographical variation within and between species. Consequently, human diets in the Arctic have been and still are dominated by marine resources and technical limitation in fishing methods dictated that until recently they were heavily centred upon marine mammals. In addition, the limitation in transport infrastructure, because of large distances between settlements and/or harsh landscape reinforced the need and obligation of relying on locally available resources. In Greenland, for example, no roads connect towns on the mainland. Many communities are isolated for months of the year due to the sea ice and food shipments can't get through. As a result, the use of locally available wildlife, and in particular marine mammals, is enshrined in Arctic cultures, as reflected in cultural traditions and art.

By their abundance and omnipresence, marine mammals represent, now as in the past, an unavoidable and logical food resource in the Arctic.

2.2 An abundant resource

Twenty-three marine mammal species are permanent residents in the NAMMCO area, seven pinniped (seal) species and sixteen cetaceans (whale and dolphin) species. Polar bears are also residents, but the conservation of that species is not within the remit of NAMMCO.

All Arctic marine mammal species and many sub-Arctic species have been harvested at some points and many are today. Their population dynamic is driven by harvests, past and present. High historic levels of catches depleted a number of populations, but a reduction in harvest has allowed several species and stocks to increase and they are now able to sustain controlled level of removals. In other cases, declines triggered by harvest continue although harvest has ceased, likely due to other climate induced changes (e.g. hooded seals, Øigård et al. 2014). The abundance of species and stocks of the same species vary greatly, and consequently their conservation and exploitation status.

2.2.1 Pinnipeds

Of the seven pinniped (seal) species permanent residents in the NAMMCO management area, five species are so-called ice seals, i.e., species which are dependent on the presence of ice for several or all phases of their live cycle (e.g. breeding, moulting, whelping), and two species are coastal seals, i.e., not requiring ice in any phase of their live cycle. All seven species are subjected to some levels of removals, direct catch and by-catch, although at different levels for different stocks, and population trends vary between species and stocks (Table 1).

Most stocks hunted within the NAMMCO area are subject to regular monitoring and assessments. The exceptions are Arctic ringed seals and bearded seals, due in part to the difficulty in reliably estimating population sizes because of the wide, dispersed, patchy and remote habitat, which makes them very difficult to survey. Populations are, however, believed to count over a million for ringed seals and several 100,000s for bearded seals, and both species are listed as *Least Concern* by IUCN[5].

The conservation measures in place for pinnipeds within NAMMCO ensure a population increase for most previously depleted populations, as exemplified by the West Greenland stock of walruses (see figure 1 under point 2.3.1.2). Coastal seals (grey and harbour seals) are under different management regimes in Iceland and Norway, aiming at stabilising their population at a predefined level (e.g. NAMMCO 2016a). Strict protection is given to species or stocks of uncertain trend status or declining populations, as for example harbour seals and grey seals in Greenland, and North East Atlantic hooded seals.

2.2.2 Cetaceans

Six species of baleen whales and 10 species of toothed whales are common permanent residents in the NAMMCO area. Only a few of them are the target of direct removals, although many of them are subjected to some level of by-catch – both at different levels for different stocks. Table 2 below gives the abundance of the stocks in the NAMMCO area and their exploitation status, as well as the kind and size of removals and trend in population when assessed.

There are four species of baleen whales harvested in the NAMMCO area; fin, humpback, minke and bowhead whales, with population and growth rate estimated respectively in the North East Atlantic (i.e. excluding west Greenland) at over 35.000 and 4%; over 12.000 and up to 12% but levelling off, over 145.000 and different geographical trends; over 3500 and increasing. The stocks of the four species are regularly monitored and assessed. They are exploited under strict quota regimes and the populations of

[5] Ringed seal: http://www.iucnredlist.org/details/41672/0 and bearded seal: http://www.iucnredlist.org/details/8010/0

fin, humpback and bowhead whales are increasing (Heide-Jørgensen et al 2007, Víkingsson et al 2015, Víkingsson 2016, IWC[6]). The present levels of removals are considered to be under the maximum sustainable yield for all stocks (Clapham et al 1999, Thomas et al 1015). The trends for minke whales are less clear and vary according to areas, however there are no concerns at present, considering the present level of catch (IWC[7])

The overall conservation status is less well defined for the smaller cetaceans, such as pilot whales, dolphins and harbour porpoises. Although direct takes are at present believed to be sustainable, by-catches may be significant (especially for harbour porpoises) and not well estimated yet. Abundance data and by-catch estimates are presently being collected to allow a full assessment of these species. The NAMMCO Working Group on By-Catch will meet in April 2017 and will among other review by-catch estimates of harbour porpoises.

2.3 A highly valued and therefore precautionary managed resource

Abundance and conservation status of Arctic marine mammal species has varied in time and between stocks of the same species. The amount of historical and present information available to managers for each stocks also varies. Management measures must be precautionary and reflect how reliably the conservation status can be assessed, i.e., in other words how much and how reliable are trends in population, i.e., the data on stock structure, past and present abundance and removals, as well as potential impact of other stressors.

2.3.1 Strict management of resources ensuring healthy stocks

Following the over exploitation of many stocks and concerns related to animal welfare, the use of marine mammals has become controversial, resulting in a highly voiced opinion that marine mammals should not be hunted. As a very positive consequence, the management procedures developed and adopted by most hunting nations for assessing stock conservation status and the effect of direct catches have become highly complex and precautionary, and much more so than management procedures developed for fisheries. Management by population and stock, the only biologically relevant management level, was introduced in the mid-1970s by the IWC and "*led to the development of the present highly precautionary scientific management procedures developed by the International Whaling Commission's Scientific Committee for commercial and aboriginal subsistence whaling to ensure that past mistakes will not be repeated.*" (IWC 2015[8]).

2.3.1.1 IWC large whale management procedure

The IWC, an organisation which can hardly be accused of being pro-whaling, describes the IWC Revised Management Procedure for large whale as follows. *"The Revised Management Procedure or RMP is the rigorously-tested mechanism that the IWC's Scientific Committee has developed to allow it to provide advice on safe, risk-averse catch limits for commercial whaling of baleen whales" (IWC 2016[9]).* Catches are only allowed on abundant populations and then only at levels that will allow the stocks to remain healthy. Regular monitoring is an important/integral part of the RMP.

The RMP is considered a safeguard against depletion, with uncertainty included as an independent factor. The greater the uncertainty, the smaller the quotas are. Stock surveillance is embedded in the process with surveys required every five years or else quotas phase out. Catch and count data are entered in the model and the output is regularly adjusted. No hunting is permitted for depleted stocks (compared to historical data). Hunting is (meant to be) strictly regulated and controlled, so the numbers fed to the models are reliable.

[6] IWC - Status of whales, https://iwc.int/status; and population estimate, https://iwc.int/estimate
[7] Ibid
[8] Background information on the status of whales, International Whaling Commission. Retrieved September 2015. https://iwc.int/status
[9] The Revised Management Procedure - a detailed account, International Whaling Commission. Retrieved July 2016. https://iwc.int/rmp2

2.3.1.2 *Management in NAMMCO's framework*

Like a large number of international instruments[10], NAMMCO has adopted as the three fundaments of its management policy *Sustainability, Ecosystem-based Management (EBM)* and *Best practices.* The principle of sustainability has been established as one of the general principles of the UNCLOS 1982[11] and is defined as the "*Optimum sustainable utilisation of renewable resources".* It implies the use of resources at rates that do not exceed the capacity of Earth to replace them, i.e., a development *"that meets the needs of the present without compromising the ability of future generations to meet their own needs*" (WCED 1987). Key commitments with regard to the sustainable development[12] and use of the oceans have been agreed as part of the outcomes of the major summits on sustainable development the last 30 years[13]. EBM considers the use of resources, i.e. human activities, as an integral part of the ecosystem as a whole. Best practices entail using the best knowledge, methodology and technology at one's disposal to achieve the most efficient or prudent course of action to ensure success. It is also the commitment to keep abreast of improvements and developments as these appear.

Management advice in NAMMCO is based on safe and precautionary approaches processes which should ensure that only healthy stocks are exploited and at such levels that they remain healthy. It also attempts to take into account the likely consequences of climate change and the escalating anthropogenic impact on the environment. NAMMCO management advice is formulated as responses to requests from Council by the Scientific Committee of NAMMCO. The responses are normally developed by the Scientific Committee always in cooperation with external experts, i.e., scientists from research institutions from non-NAMMCO countries. It is supported by regular monitoring of marine mammal stocks providing regularly updated scientific data on stock size and status. Management measures taken by the countries as well as catch data are annually reported to the Commission. Although NAMMCO has only an advisory mandate, this reporting allows to see whether the advice given has been followed and to monitor the effectiveness of the management actions. The assessment of the stocks is done at regular intervals, the frequency depending on the species and the robustness of their conservation status. Management advices are regularly reviewed and adjusted as new information become available. Table 3 provides an overview of the management measures in place in NAMMCO countries. Some stocks are fully protected, some are harvested under a quota regime, while the harvest of others is open.

For seals, all quotas are set following the advice of the Scientific Committee of NAMMCO channelled through the Management Committee for Seals and Walruses. NAMMCO Scientific Committee bases its advice on the work of Expert/Working Groups always including scientists from research institutions from non-NAMMCO countries and sometimes in cooperation with other international management organisations (Harp and hooded seals quota are based on the advice of the Joint ICES-NAFO-NAMMCO Working Group on Harp and Hooded seals).

[The two sentences in blue may need re-writing according to FAC/Council decision]

For cetaceans the picture is more diverse. For the large cetaceans (fin, humpback, bowhead and minke whales), Greenland is following the scientific advice of the IWC for aboriginal subsistence whaling. If the IWC does not issue an advice for a specific year, then Greenland follows the advice of NAMMCO. For beluga and narwhal, Greenland follows the advice of the Greenland Canada Joint Commission on Narwhal and Beluga (JCNB), which bases its advice on the NAMMCO/JCNB Joint Working Group on Narwhal and Beluga. For the smaller cetaceans, Greenland has not implemented a quota system, the

[10] A large number of other international instruments also advocate an integrated/ecosystem-based/ecosystem approach to oceans management (e.g., the Law of the Sea, the Convention on Biological Diversity (CBD), the 1992 Agenda 21, the 2002 World Summit on Sustainable Development, UN General Assembly 2006 Resolution on Oceans and the Law of the Sea, the 2001 Reykjavik Declaration on Responsible Fisheries in the Marine Ecosystem, the OSPAR Convention, the Arctic Council (2013)).

[11] UN Convention on the Law of the Sea (UNCLOS) sets out the legal framework within which all activities in the oceans and seas must be carried out. Particularly relevant to marine mamals are articles 64 and 65.

[12] "*Successful sustainable development therefore requires integrated approaches that ensure sustained and inclusive economic growth, social development and environmental protection, or so-called "triple wins*"" (UN 2015).

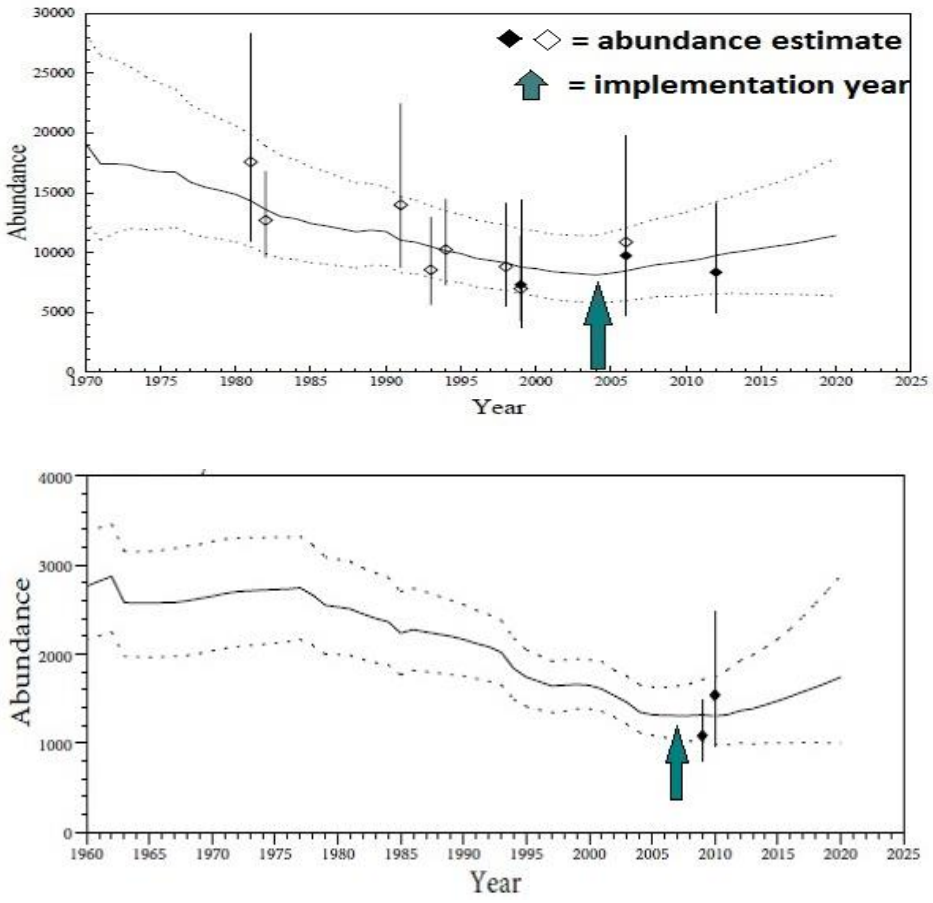
[13] The 1992 UN Conference on Environment and Development, the nineteenth special session of the General Assembly on the programme for the further implementation of Agenda 21, the 2000 Millennium Summit of the United Nations, the 2002 World Summit on Sustainable Development and the 2010 High-level Plenary Meeting of the General Assembly on the Millennium Development Goals.

sustainability of the catches is assessed by NAMMCO when/if required. Norway bases its hunting quota for minke whales on the scientific advice of both the IWC and NAMMCO. Iceland bases its hunting quota for fin and minke whales on the scientific advice of NAMMCO.

NAMMCO believes that regional management is more effective than global management, as it involves the resource-using communities, which is essential in successful conservation processes. Both marine mammal users and managers need to be committed to the conservation and sustainable use of marine mammals. It is easier to feel committed to an advice when it comes from peers as opposed to a top-down approach.

NAMMCO has established itself as an effective body and an appropriate organisation for the rational management, conservation and study of the North Atlantic Marine Mammals (e.g., Hardy 2006, Caddell 2013). A good example of this successful regional management is the case of Greenland, where harvest quotas were recommended by NAMMCO for belugas, narwhals and walruses, in some cases initially drastically reducing the harvests and therefore the livelihood and resources of the hunters and local communities (going from a yearly catch of 700 belugas to a recommended quota of 100 for example (NAMMCO 2001, p. 18 & 142)). Nevertheless, within a few years the recommended quotas were implemented (beluga in 2004, narwhal in 2004 for West Greenland and 2008 for East Greenland, walrus in 2007), resulting in population increase of the depleted stocks. Examples of this effective management is shown in Figure 1 which gives the population trajectories for West Greenland belugas and walruses and their inflexion after the implementation of quotas.

Figure 1. P*opulation trajectories for West Greenland belugas (top) and walruses (bottom).* Quotas for WG belugas were introduced in 2004 and for walruses in 2007 (green arrows).



NAMMCO promotes strict, effective and adaptive management procedures based on scientific knowledge informed by local knowledge, where monitoring and periodical assessment reviews are core elements, in order to

- obtain information on trends in the conservation status of the species concerned and thus examine the effectiveness of the management measures.
- adjust the measures to the diverse changes that may occur, either in response to the measures themselves or to changing external factors.

To evaluate the quality and reliability of the management advice provided to the Countries and the appropriateness of the responses, NAMMCO will undertake an external Performance Review in 2017.

2.3.2 A responsibly managed resource – welfare issues

People's right to utilise natural resources lies at the very core of NAMMCO, as does the obligation to hunt in a sustainable and responsible manner. For NAMMCO *the use of marine mammals is ethically defensible if it is sustainable and does not cause unnecessary suffering to animals*. This view is rooted in the ethical issues raised by any harvest of wild resources: the justification behind the harvest, the level of consumption/utilisation of the catch, the amount of fear/pain (chase and kill), and the efficiency of the hunt. In 2004, a Workshop on Hunting Methods for Seals and Walrus (NAMMCO 2005) recommended that "…hunters should make every effort to reduce unnecessary suffering by hunted animals, by minimizing killing times and avoiding letting injured animals escape. Such efforts should have priority for all hunts."

Hunters should strive for an instantaneous or quick kill and reduce chase time as much as possible. NAMMCO strongly believes that whichever hunting method generates the least animal suffering and is the most efficient should be chosen (and constantly improved), regardless of whether it is traditional or not, as it is *per definition* a question of animal welfare. Efficient hunting methods benefit the hunters and the animal. NAMMCO Committee on Hunting Methods provides advice on hunting methods for the marine mammals relevant to NAMMCO member countries. The advice given is based on the best available scientific findings, technological developments and traditional and local knowledge, with due consideration given to safety requirements, animal welfare concerns and efficiency of utilisation.

The increasing effectivity and efficiency in hunting methods following from the use of high-tech hunting gear, such as harpoon guns, penthrite grenades, rifles and outboard motors, contribute to decreasing the length of the chase and the time to death, thus accommodating concerns over welfare issues. Using those is in keeping with the Northerners tradition of flexibility and adaptability, which has enabled them to survive under changing conditions. There is no permanent cultural attachment of Inuit hunters too any form for technology, new technological traditions are created as the need arises (Caufield 1997). Efficiency is the word – not referring to the number killed but to the method used.

Highly successful improvements in hunting methods have been achieved within the remit of NAMMCO. The instant death rate in the Norwegian minke whaling has, for example, increased from 17% in 1982 to 82% in 2012 due to the development of the penthrite grenade. Efficient killing – with respect to time and pain - depends on the experience and education of the hunters. In NAMMCO there has always been a strong emphasis on the importance of hunters training. To this end NAMMCO has developed hunting manuals for the different whale hunts in NAMMCO. Training courses are mandatory for most kinds of hunt in NAMMCO countries (Icelandic and Norwegian whale hunts, Faroese pilot whaling, Norwegian sealing. Furthermore, NAMMCO has carried out shooting trials[14] to examine the effect of different rifle projectiles to make hunting safer and more effective.

In effect, NAMMCO is today the only international organisation consequently and succesfully working with the improvement of marine mammal hunting methods. NAMMCO is also the only international organisation that has implemented an Inspection and Observation Scheme for monitoring marine mammal hunting activities in its area, which - acting besides and independently from the national inspection schemes - supports transparency.

[14] http://www.nammco.no/about-nammco/committee-on-hunting-methods/guidelines-and-shooting-trials-for-ammunition/

3. MARINE MAMMALS, A GREEN-BLUE RESOURCE

3.1 A Resource in good balance with the Environment

When coastal whaling and sealing are carried out sustainably, the collateral environmental costs are restricted to the activities of the whaling/sealing boats, some sealing and whaling being actually conducted from land. There are not the myriad externalities associated with agriculture, farming and fishing, especially when those are conducting at an industrial scale.

Like other wild food sources, whaling and sealing are not connected to confinement and transport of live animals and the related animal welfare issues and lives waste. The animals develop and thrive in a natural way in the wild in their species-specific natural social units, with no humane interference. They grow naturally, healthy and undisturbed until they are killed. They move around freely and they are born, live and die in an environment that might be full of danger, but is their natural environment. The humane intrusiveness and the humane-caused suffering, if any, is only associated with the killing and only lasts a tiny fraction of the animal' life time. There is, however, a caveat of importance to this, the animals grow solely *healthy and undisturbed* – if the environment is *healthy and undisturbed*, their health and well-being reflecting the state of the environment.

Like other wild food sources, whaling and sealing require no intensive farming techniques. Recent agricultural practices that have greatly increased global food supply have had inadvertent, detrimental impacts on the environment and on ecosystem services (Tilmann et al 2002). The environmental nightmare represented by beef, pork, and poultry production is well documented (e.g., Steinfeld 2006, Goodland and Anhang 2009, UNESCO 2010). Today "the livestock sector emerges as one of the top two or three most significant contributors to the most serious environmental problems, at every scale from local to global" (Steinfeld et al. 2006). It includes deforestation, land degradation and desertification[15], contamination of ground water, pollution of soil and air, unsustainable use of water and groundwater extraction, use of fossil fuel, release of greenhouse gases, loss of wildlife habitat and biodiversity, reduction of genetic diversity, release of chemical additives – pesticide, herbicides, hormones, and antibiotics. Cattle excrete polluting nutrients and the largest share of GHG (Green House Gas) emissions is from methane (CH4) and nitrous oxide (N2O), which emanate from the enteric fermentation of ruminants and releases from stored manure (e.g., GEAS 2012). Such concerning issues directly led to the question whether intensive agricultural practices were ethically sound (e.g. Lal et al 1988).

Commercial fishing also generates collateral concerns. Bottom trawling is associated with large scale bottom/habitat destruction. Fishing is furthermore associated with – so far largely uncontrolled and sometimes quite high – by-catch and discard of non-target species, including protected and threatened ones, among those a concerning number of marine mammals (e.g. Alverson et al 1994, Read et al 2006, Sims et al 2008, Reeves et al 2013). The role of fishery bycatch as a factor hindering the recovery of marine mammal population is increasingly recognised (e.g. Read 2008, Reeves et al 2013). In contrast, whaling and sealing are highly selective food production techniques, with no coincidental bycatch and "waste" of non-target species. Furthermore, targeted animals can be selected by species, but also by size and for some species by sex, which allows selective management measures and can help reducing the threat to the reproductively active component of the population (e.g., Freeman et al 1998).

The carbon footprint of locally exploited and consumed marine resources is clearly much less than that of any alternative often flown-in imported resources, with the carbon footprint of the transport adding to that of the production. A survey[16] by a pro-whaling lobby organisation covering eight of Norway's 30 whaling vessels in 2007, showed that the average emission of carbon dioxide was 1.9 kilos per kilo of

[15] http://www.un.org/en/events/desertificationday/background.shtml
[16] Reuters, Environment, Mar 4, 2008; http://uk.reuters.com/article/2008/03/04/environment-climate-whaling-dc-idUKL0340706220080304

whale meat, compared with 15.8 for beef, 6.4 for pork and 4.6 for chicken. The "carbon footprint" was calculated up to the first sale -- for whales the landing point and for livestock the farm gate, neither included processing nor transport costs to shops.

As long as harvests do not exceed the reproductive capacity of stocks, local whaling and sealing provide an environmentally friendly contribution to the planet's food supply. Locally hunting marine mammals is one of the environmentally-sound ways of acquiring food for human consumption today: the environment remains unaffected, energy use is low in relation to yield, and there is no pollution from fertilisers, pesticides or other chemicals.

The sustainable, energy-efficient, low carbon footprint and non-polluting use of local renewable resources could be seen as an ecological ideal. In an ecological perspective, it is better that the Faroese, Greenlanders, Icelanders and Norwegians sustainably hunt whales and seals locally rather than import food from far abroad, using non-renewable fossil fuel. The environmental cost of replacing marine mammal meat in the diet of marine mammal-using people is not negligible in the Arctic, when locally produced alternative meat or greens are not available or very limited. Although whaling and sealing contribute little to food production in global terms, they do contribute to reducing pollution of the land and seas that result from chemically intensive and high carbon footprint modern agricultural and fishery practices. Also, ensuring food security through the use of local food resources limits transport and transformation needs, which is in line with the existing limited infrastructure in the Arctic, the development of which would likely be environmentally costly.

The awareness of the ecological benefits and sustainable character of coastal whaling and sealing (including indigenous practices), besides their societal importance, is increasing. Martin Lidegaard, former foreign minister of Denmark said in 2015 to Deutche Welle[17] during a visit in Greenland: "The seals up here have lived a very good life, they are hunted in a very sustainable way. The meat is eaten by the Greenlanders and the fur is then sold. That's as sustainable as it gets… I don't see any fur being more sustainable than that which comes from seals." Eva Garde, biologist at WWF[18], says [19]: "*It [the hunt] is a lifestyle still based on finding food just outside one's door and the WWF prefers that Greenlanders trap seals than import chicken and increase the world's carbon dioxide footprint*." In November 2013, both the WWF and Greenpeace came out in favour of Greenland's seal hunt**,** which they labelled sustainable, and of the people of Greenland being allowed to continue hunting seals[20,21,22].

3.2 A Resource contributing to Blue Growth

Coastal nations around the world talk about "Blue Economy" or "Blue Growth". The blue economy initiative seeks to promote global sustainability by focusing on the planet's single largest resource, the oceans. It seeks to generate as much economic value from the marine environment as possible based on new technologies and thus securing more sustainable livelihoods in coastal areas, but doing it in a sustainable way that conserves and protects the sea's resources and ecosystems.

Blue Economy offers an integrated approach to the increasing need for cooperation and coordination among all stakeholders and at all levels for more sustainable fisheries management and more effective conservation (Norden 2015). Blue Economy is the maritime concept parallel to the Rio+20[23] Green Economy initiative and espouses the same desired outcome, namely: "improved human well-being and

[17] http://www.dw.com/en/greenlanders-way-of-life-heads-for-extinction/a-18377697
[18] World Wildlife Fund
[19] http://arcticjournal.com/culture/241/environment-groups-ok-greenland-seal-hunt
[20] http://arcticjournal.com/culture/environment-groups-ok-greenland-seal-hunt
[21] http://sermdev.umlaut.revealit.dk/politics/308/sealskin-all-rage-copenhagen
[22] https://www.theguardian.com/world/2015/may/16/greenland-inuits-urge-eu-reverse-seal-ban-save-way-of-life
[23] 2012 UN summit on sustainable development in Rio de Janeiro

social equity, while significantly reducing environmental risks and ecological scarcities" and it endorses the same principles of low carbon, resource efficiency and social inclusion (UNEP[24] 2013).

In the absence of a widely accepted definition, the WWF (2015[25]) has developed a set of "Principles for a Sustainable Blue Economy". Whaling and sealing under NAMMCO's umbrella meet many of the relevant criteria. Besides the elements given above, the processes leading to the management advice in NAMMCO are inclusive, well informed, transparent, holistic, cross sectoral, as well as innovative and proactive. Management advices are based on scientifically sound information and an ecosystem approach, adaptive and precautionary. Furthermore, NAMMCO pro-actively support the sharing of information, knowledge and lesson learned with other countries conducting the same activities.

By contributing to food security, generating job and cash opportunities and supporting familial, societal and cultural ties (see point 6), whaling and sealing do contribute to improving human wellbeing and at the same time represent low carbon and resource efficient activities. The precautionary and scientific approach to management, seeking to account for the possible effects of various human activities, supports healthy or increasing population thus reducing ecological scarcity and environmental risks. By providing provisional services (food input), while maintaining cultural (recreational, spiritual, educational and cognitive) and supporting (nutrient cycle, carbon sequestration) services, sustainable and responsible whaling and sealing increase the economic value of the marine environment, thus contributing to Blue Economy.

Blue Economy endorses the principle of resource efficiency, among others endorsing strategies to prevent discard in fisheries. Coastal whaling and sealing for food is indeed traditionally very resource efficient. Taking seals as example, the essential product is meat for human consumption, flippers and some internal organs are also used. Surplus are given to sledge dogs - which also contribute to hunting and fishing, and the skins are used for clothing. Seal products were also used to produce other equally important items such as oil for lamps, tools, kayaks and tents, and they were and are used for decoration, handicrafts and jewellery. The essential value is subsistence, but the skins, although a by-product, generate an added economic value to the seal, and thus the cash necessary to acquire other commodities and food, as well as covering the cost of the hunting. The ban on seal products and fur, are *de facto* also affecting Inuit sealing, with the consequence in Greenland that very few skins are sold and tanned. Great Greenland, a fur company and one of the biggest employers in Greenland had to close its last sewing workshop in January 2016. The livelihoods of the Greenlanders have been decreased due to market failure but the seals are still hunted since their main service is to provide food for humans.

The price of the skins has dramatically decreased, resulting in some hunters not being able to afford hunting anymore. Recently, the Council of Canadian Academies (2013) has shown that hunger in the North results partly from the fact that the cost of hunting is now out of reach for most families[26]. The same is true in Greenland. A columnist for the True North Times recently reflected the frustration in Northern communities as "Seals are cute but starvation is ugly."[27]

In a Blue Economy perspective, the ban on sealskin product does not make sense since, it just reduces resource efficiency. It makes hunters livelihood less sustainable, thus decreasing human well-being and social equity, while not reducing any environmental risks or ecological scarcities but increasing discard. In many cases, seal skin fabrics are more environmentally friendly than any other fabrics.

Coming back to Martin Lindegaard quote "*the seals are hunted in a very sustainable way. The meat is eaten by the Greenlanders and the fur is then sold. That's as sustainable as it gets*". One should now

[24] United Nation Environment Programme
[25] http://www.wwf.se/source.php/1605623/15_1471_blue_economy_6_pages_final.pdf
[26] http://www.scienceadvice.ca/en/assessments/completed/food-security.aspx
[27] http://www.truenorthtimes.ca/2014/03/29/seals-are-cute-but-starvation-is-ugly/

say ***was*** *as sustainable as it could get*. Marine mammals are the predominant component of the Arctic marine ecosystem, and logically any development based on the use of local resources has and will continue to involve the use of marine mammals.

4. MARINE MAMMALS, HEALTHY RESOURCE WITH CHALLENGES

4.1 Nutritive value

The nutritional value of marine mammal meat places them on the top among seafood products and superior to meat from livestock animals (Anon. 2003-2004). The meat is especially rich in protein, essential amino acids and mineral nutrients like iodine, potassium, selenium, magnesium, zinc, phosphorus and calcium. Marine mammals are a good source of vitamins A, B, D and E. The high level of antioxidants found in whale blubber makes it the most important source of vitamin C in the Arctic (Baines et al. 2015). Whale mattak (skin) represent a rich source of vitamin A and C, thiamine, riboflavin and niacin as well as a major source of antioxidants and selenium (Government of Greenland 2012).

Information on nutrients and overall nutritional value of marine mammal products is somewhat limited, with the possible exception of fatty acids. The meat is characterised by being low in saturated fats, rich in healthy long-chain monounsaturated fatty acids, LC-MUFA, and *n-3* long-chain polyunsaturated fatty acids, LC-PUFA (omega-3 fatty acids).

4.2 Health benefits

A substantial number of health benefits are linked to the intake of sea food and marine mammal products. Since the 1970s it has been documented that the traditional Inuit diet, consisting mainly of marine mammals (meat and blubber), relatively little fish, some game meat (reindeer, muskox, birds) and local berries, has prevented the effects of lifestyle diseases raging in the Western world and a major cause of death, such as cardiovascular disease, thrombosis and atherosclerosis (Mulvad et al 1996). It may also be an important protective factor against prostate cancer (Dewailly et al 2003). Regular intake of seal and whale products give a lung functionality compatible with the level achieved when consuming vegetables and fruits on a daily basis (Baines et al. 2015). Also subsistence living requires exercise and hard physical work, which also protect against western societal diseases.

The vitamin A and C, thiamine, riboflavin and niacin, contained in the mattak povide protection against scurvy (Government of Greenland 2012), its antioxidants keep the artery healthy and its selenium contributes to the antioxydation process and may provide some protection against the potential harmful effects of mercury and other heavy metals (e.g. Freeman et all 1998, Mulvad et al 1996).

The beneficial properties of marine mammal products could be connected to their unique fatty acid composition and the high levels of omega-3 fatty acids, but may also be related to antioxidants and other substances found in the oils; oils from marine mammals may have advantages over fish oils (NAMMCO 2007, Anon 2008-2009, Valdersnes et al 2013), with PUFA's from seal blubber oil being more effectively absorbed by the body than those from fish oil (Anon. 2011a). Marine mammal oils have potentially beneficial effects on several diseases and symptoms, such as general and specific pain reducing effects, reducing symptoms in food hypersensitivity, reducing the reactivity of blood cells and the activation of coagulation, beneficial effects on some skin diseases (NAMMCO 2007). There is also a positive effect on the prevention of immune and inflammatory diseases. The intake of food rich in n-3 PUFA during pregnancy may decrease the risk of allergic diseases in the offspring, prolong pregnancy and reduce the risk of pre-term birth (Anon. 2011a).

Balenin (an imidazole dipeptide), found in high quantity in bones and muscle from whales, has beneficial health-related effects as an antioxidant. It may also hasten the recovery process of fatigue induced by physical load and daily activities in humans, as well as having a positive effect on memory loss and learning ability with ageing, indicating a possible preventive effect against dementia (NIFES 2013, Sugino et al 2013).

4.3 Health drawbacks: contaminants

In 2011 and 2012 the Norwegian Scientific Committee for Food Security carried out a risk assessment to identify possible risks associated with human consumption of products from seals (Anon. 2011b) and whales (Anon. 2011b, Valdersnes et al 2013). The panel was unable to document that consumption of seal and whale meat was associated with a risk of exposure to human pathogens. The documentation was limited to draw firm conclusions, but it was underlined that slaughter hygiene was a crucial element, and that a more systematic meat control practice should be established (Anon. 2011b, Valdersnes et al 2013).

Whales and seal are long-living species and as top-predators they are exposed to high levels of environmental persistent organic pollutants, POPs, and heavy metals which accumulate along the food chain. Whales and seals feeding at higher trophic levels are by default expected to contain higher levels of contaminants than species feeding at lower levels, such as krill-eating species. Killer whales, walruses and polar bears are thus expected to have, and have, higher POPs level than fin and blue whales and crabeater seals. The exposure of different organs differs and the geographical area where the stock is feeding also influences the accumulation rate of contaminants due to the large geographical variability in contaminant levels, both natural and anthropogenic (Sanderson and Gabrielsen 1996, Hansen et al 2008, Anon. 2014).

Methyl-mercury is known to adversely affect the development of the nervous and immune systems (e.g. Hansen et al 2008). Adults who are exposed to methyl-mercury are also more prone to developing Parkinson's disease. Although a high content of methyl-mercury can be found in both whale and seal -meat, -blubber and -oil, these are also rich in selenium, which has in marine mammals the effect of counteracting methyl-mercury damage. The toxic effects of diets polluted with methyl-mercury but high in selenium is likely decreased (Anon. 2011a).

In 2011, meat from 84 minke whales taken in the Barents Sea (mostly krill eaters) were analysed for mercury, methylmercury, cadmium, lead and total arsenic and in addition some samples were analysed for polybrominated diphenyl ethers (PBDEs) and perfluorinated compounds (PFCs) (NIFES 2012). None of the samples showed concentrations of mercury above 0.5 mg / kg wet weight (EU and Norway's maximum level for mercury in fish muscle) and the average mercury concentration was 0.15 mg/kg. Likewise, the levels of all the other contaminants were low. Based on these results, the Norwegian Food Safety Authority revoked in 2012 its warning about pregnant and lactating women eating whale meat. Analysis of meat for pollutants in Icelandic fin and minke whales (both baleen whales feeding at low trophic levels) have also shown levels well below residue limits stipulated for food[28].

In contrast, North East Atlantic pilot whales sampled in the Faroe Islands (feeding at a higher trophic level) today contain contaminants (both organochlorines and metals) in concentrations such that neither meat nor blubber would comply with current limits for acceptable concentrations of toxic contaminants. Although Faroe islanders have long relied on pilot whales as a local and important wildlife food resource, the consumption of pilot whale meat represents today a hazard to the health of consumers (e.g., Weihe and Joensen 2012, Grandjean et al 2011). From 2011, the advice from the Faroese Food and Veterinary Authority is as follows: adults should eat at most one meal of pilot whale meat and blubber per month; girls and women should refrain from eating blubber until they have had the number of children they wanted, and particularly if they were planning a pregnancy within the next three months, were pregnant or breastfeeding; kidneys and liver of pilot whales should not be eaten.

The exposure level of organochlorines found in Greenland is a matter of concern due to their potential role in carcinogenesis, their immunotoxic properties and their suggested properties as xenoestrogens (Mulvad et al 1996). In Greenland, the Nutrition Council[29] also recommends that women restrain from

[28] https://eng.atvinnuvegaraduneyti.is/subjects/sustainable-whaling/questions-and-answers/
[29] Grønlands Ernæringsråd 2007, http://old.paarisa.gl/media/9795/contaminant_pjece_dk_pdf.pdf

consuming marine mammals until they have had the number of children they wanted. They also recommended that pregnant and lactating women, small and young children do not eat toothed whales, polar bears, seabirds and old seals (Government of Greenland 2012).

5. MARINE MAMMALS, A RESSOURCE CONTRIBUTING TO FOOD SECURITY

5.1 Food Security – a growing concern

A growing number of fora have raised concerns regarding food security considering the many changes affecting the world ecosystems, brought by climate change but also industrialisation and conflicts. Food security – or rather food insecurity – is recognised as one of the major risks of the 21st century and a major area for international concern and response (WEF[30] 2008, 2012, 2016).

"*Food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life*" (Word Food Summit 1996). Food insecurity is the converse. It is an outcome of inadequate or uncertain access to an acceptable amount and quality of healthy food.

The four main pillars of food security are identified as (1) *availability, (2) access, (3) utilisation and (4) stability* (FAO 2009[31]). Food availability refers to sufficient quantities of food available on a consistent basis, food access refers to the physical, economic and social access to food and food utilisation refers to nutritional diversity and food safety issues. Food stability refers to the maintenance of the three first dimensions over time (seasonally and over the years).

The right to adequate food and thereby food security, generally understood as the right to feed oneself in dignity, is a long standing international human right most countries have committed to. The current definition of food security covers a broad concept, emphasizing the importance of nutrition but also referring directly to food preferences, underlining that this is an important factor - and an acceptable aspect - in striving for food security.

Although food security is often defined in economic (e.g. FAO 1995[32]) and dietary terms, there are clearly other important non-economic considerations that influence food security outcomes. Indeed, the very notion of what constitutes a food resource is itself a cultural construct (Freeman 2001). In the final Declaration and Action Plan, the 1995 Kyoto conference on Fisheries and Food Security "*Call for an increase in the respect and understanding of social, economic and cultural differences among States and regions in the use of living aquatic resources, especially cultural diversity in dietary habits…".*

5.2 The status of Food Security in the Arctic

In the Arctic, food insecurity is particularly exacerbated by the changes brought by climate change and its many impacts have become a central concern (e.g., Goldhar et al 2010, Ford and Goldhar 2012, ICC[33] 2012, Papatsie et al 2013, CCA[34] 2014, MacDonald et al 2015). Food security is linked to a range of driving factors including geography, contamination of country foods, impacts of climate change and economic vulnerability (ICC 2012). Populations in northern Canada and Greenland face similar challenges related to contamination and reduction of country foods and high dependence on imported

[30] World Economic Forum, Geneva. Global Risks Reports, 2008, 2012 and 2016.
[31] FAO [Food and Agriculture Organisation of the United nations] 2009, World Summit on Food security.
[32] FAO 1995. The state of food and agriculture. http://www.fao.org/docrep/017/v6800e/v6800e.pdf
[33] ICC, Inuit Circumpolar Council
[34] CCA, Council of Canadian Academies

products at prohibitive cost. The increased dependence on flown-in food of low nutritional quality contribute to health problems such as obesity, heart disease and diabetes.

UNEP (2007) considers *'health and nutritional concerns (related to the availability of country food) associated with changes in the abundance and migratory patterns of subsistence resources'* among the most significant consequential effect of changes in snow and ice. For communities used to a traditional subsistence way of life, unpredictable weather effects (changing ice freezing patterns, rising temperature, more frequent and intense storms and blizzards) are making it increasingly difficult to adapt. Climate change directly alters both animal migration routes and hunters' access possibilities, making hunting harder. But climate change also causes delayed food shipments and a global rise in food prices (e.g. FAO 2016), which further impact the Inuit access to affordable and nutritious foods (e.g., ICC 2012).

Access to adequate food has been identified as a major challenge in the Canadian Arctic, particularly for Inuit communities, where levels of food insecurity are consistently higher compared to southern Canada (Huet et al 2012, ITK[35] and ICC 2012, CCA 2014). Despite the fact that Canada is a G8 country that often tops rankings in the UN Human Development Index, 800,000 households are food insecure[36]. In Nunavut, household food insecurity rates are six to eight times higher than the national average (Rosol et al 2011, Pardilla et al 2013), with a prevalence of 69% in adults reported by the Inuit Health Survey, in the Inuvialuit and Nunatsiavut they are five times higher. The Nunavut Inuit Child Health Survey found that nearly 70% of Inuit preschoolers resided in food insecure households and 56% were in households with child food insecurity (Egeland et al 2010). In 2012, four million Canadians—including more than a million children—experienced some level of food insecurity. The 2013 report "*Hunger in Nunavut – Local food for healthier communities*"[37] reports that 75 percent of Nunavut household homes without an active hunter in the family were food insecure.

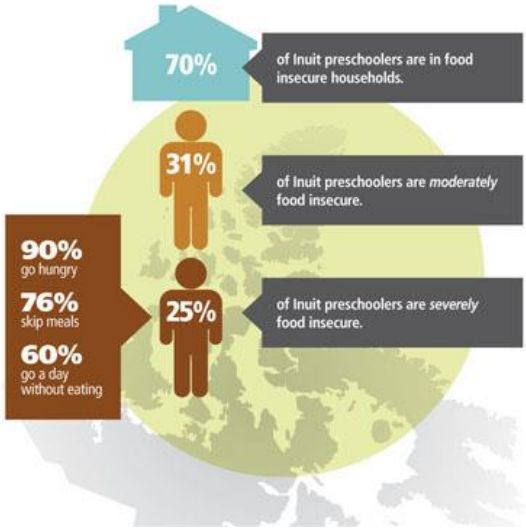


Figure 2. Nunavut Inuit Child Health Survey, 2007–2008 (Egeland *et al.* in CCA 2014)

In Greenland, preliminary studies indicate relatively secure food systems in communities of comparable size to those in Nunavut, albeit with significant differences between different target groups and with emerging stresses in light of climatic and socio-economic change (Goldhar et al 2010, Ford and Goldhar 2012, MacDonald et al 2015). A 2010 survey (Niclassen et al 2013ab) showed that children living in villages and children from homes with a low family affluence were experiencing increased risk of food insecurity, with the associated negative health and cognition effects. In 2006 and 2010 in Greenland, 17 % of 11-17 years old schoolchildren were reported to go to school or to bed hungry "always" or "often" due to lack of food in the home while 19% experienced it "sometimes" (Niclasen et al 2013a, 2015).

[35] ITK, Inuit Tapiriit Kanatami
[36] UN Office of the High Commissioner for Human Rights, 2012
[37] http://www.actioncanada.ca/wp-content/uploads/2014/04/TF-3-Hunger-in-Nunavut-EN.pdf

Noteworthy and worryingly, the youngest children reported more frequently having experienced food insecurity, while previous studies had found that younger children generally were protected at much greater levels of food insecurity than were older teenaged children. New information indicates that small communities and settlements in west northern and east Greenland experienced food insecurity as a growing problem, partly due to restrictions in hunting rights (Jessen pers. com.).

5.3 Marine Mammals as contributors to Food Security?

Focussing on the Atlantic Arctic regions, the following chapters examine whether marine mammals meet the four criteria (*availability*, *access*, *utilisation* and *stability – referring to the three other criteria*) qualifying as valuable contributors to food security.

5.3.1 Stable availability

Food availability addresses the "supply side" of food security and in the case of marine mammals is determined by the stock's abundance. Are marine mammal stocks generally depleted or are there some "healthy" stocks available to Northern coastal residents?

Many of the stocks depleted by overexploitation from commercial whaling and sealing are presently in the process of recovering and some have recovered (e.g., IWC 2016[38], Smith et al *in* UN 2016; Clapham 2016). Indeed, some stocks, such as fin whales in the North Atlantic, are likely over their pre-exploitation level (Víkingsson et al 2015). One reason for this is improved awareness and management. These *healthy* stocks represent renewable, abundant, and locally accessible food resources in different parts of the world, which can contribute to reinforcing food security – if sustainably managed to ensure stable availability.

A compulsory quality for a resource to be a valuable contribution to food security is stable availability, thus requiring a sound and effective management ensuring sustainability, i.e., implying the use of resources at rates that do not exceed the capacity of Earth to replace them. A precautionary, sound scientific-based management inscribed in an ecosystem perspective ensure the sustainability of human activities and therefore the stability of marine mammal resources.

Arctic resources, both animal and plant, are characterised by marked seasonal variations. A flexible, multispecies approach to resource use accommodates this seasonal availability, the diet varies with season, with for example different species of marine mammals exploited at different time of the year. Caulfied (1997) attributes the Inuit survival to this flexible, multispecies approach to resource use; when a valued specific resource is not available due to environmental changes (seasonal or periodical), Inuit shift to other resources. Overall, marine mammals are therefore available all year-round.

5.3.2 Stable access

The second dimension of food security is *Access*, referring to the physical, economic and social access to food. Accessibility and availability of food are the most important aspects of food security. An adequate supply of a resource at the local level does not in itself guarantee food security at household level. There are many factors that influence the accessibility of food choices.

One particular element in some of the Northern communities was the practice of helping each other in acquiring food and sharing food resources, i.e., making accessible to the community resources unavailable to single individuals and also rending resources accessible to persons who would not have had access otherwise. Community-based hunts such as pilot whaling, collective minke whaling, and bowhead hunting are good examples of this collective resource gathering.

[38] Background information on the status of whales, International Whaling Commission. September 2015. https://iwc.int/status

Inuit culture is particularly known for the practice of food sharing, a form of food distribution where one person catches the food and shares with the entire community. Searles (2002) describes the Inuit perspective on food by saying that "*in the Inuit world of goods, foods as well as other objects associated with hunting, fishing, and gathering are more or less communal property, belonging not to individuals but to a larger group, which can include multiple households*." Food in an Inuit household is not meant to be saved for the family who has hunted, fished, gathered, or purchased it, but instead for anyone who is in need of it, with particularly elders and women lone parent with younger kids benefitting from this tradition.

Pilot whaling in the Faroes is also a good example of cultural food-sharing, where whale meat and blubber are, still today, shared as equitably as possible and for free between the participants to the drive. The distribution is based on solidarity and has its roots all the way back to the earliest pilot whale hunts. Depending on the size of the catch, the people who live in the area but have not participated in the hunt typically also receive a share, independently of their age and sex. On two islands, Sandoy and Suðuroy, the catch is automatically distributed equally among the local residents and not between those who participate to the hunt.

Such communal food practices increase the general accessibility to marine mammal resources. Other factors, however, some due to climate change, may limit their accessibility. In Greenland, the high costs of hunting equipment—boats, snowmobiles, rifles, sleds, camping gear— and transportation (oil and fuel) is causing a decline in the number of families who hunt for their meals, as low-income families cannot afford the equipment when they also have to deal with the high cost of essential commodities. This is in a large part due to the ban on sealskins, which has reduced//eliminated the revenues from the sale of by-products that are skins, this affecting particularly families of low affluence and in remote communities where there are also few job opportunities. Young people do not develop the skills to survive off their land and there is a lack of knowledgeable hunters and fisher. Food security may be negatively affected by the loss of traditional hunting practices.

Climate change also affects food access. Changes in sea ice extent and ice freezing patterns leads to changing animal migration patterns, local decreases in marine mammal populations, as well as making hunting less accessible and riskier because of thinner ice, sometimes preventing access to usual hunting grounds, thus reducing accessibility. Also when a valued resource was not available due to environmental changes, Inuit used to shift to another resources. However, restriction in hunting rights and quotas constrains the ability of Arctic people to shift to alternate resources, limiting the overall access to marine mammal and alternative resources.

5.3.3 Stable utilisation

In the definition of food security, utilisation refers to food safety issues. Human consumers are top predators at high risk of bioaccumulation and the contamination of marine mammals is of high relevance to food security. As described earlier (see section 4), there are health benefits related to the consumption of marine mammal products, but there are also risks associated with environmental pollutants. These risks depend on the species, the area, and the organs used.

Contaminant risks in Arctic communities need, however, to be considered in the light of benefits in a risk management approach. Benefits include socio-cultural cohesion, self-sufficiency and self-determination, as well as nutrient benefits. The trade-off balance between benefits and risks depends not only on the nutritional value and health benefits/risks of a specific resource, but also on the nutritional value and health benefits/risks associated with alternative resources. POPs have potential negative effects on children's neuro-physiological, hormonal and immune system development (e.g. Hansen et al 2008). On the other side, food insecurity has adverse health effects on Canadian and Greenlandic school children, particularly younger ones (e.g. Egeland et al 2010, 2011, Niclasen et al 2013a). Among the good reasons for native people to maintain their old way of acquiring food (with the outdoor life and

exercise it requires) and eating, as far as it's possible today, is that it provides a hedge against obesity, type 2 diabetes, and heart disease, that *westernised* flown-in food tend to facilitate. In Greenland, although the Nutrition Council recommends that some sections of the population reduce their intake of marine mammal products, it recommends at the same time to not stop eating traditional food because the effects of stopping are not known, and it is believed that a reduction of the traditional diet would lead to an increase in the consumption of low-quality flown-in food and consequently in the number of western diseases (Government of Greenland 2012).

When exactly do risks outweigh benefits is an area of discourse that has and will continue to be a source of debate and contention (Egeland in Anon 2011a). Continued research is needed, especially on interaction between nutrients and contaminants to better describe the potential risk associated with northern diets. Today the lack of data prevents clear-cut recommendations on risks and benefits of consuming food products from whales and seals (Anon. 2011a). Consumers have to be made aware of risks and benefits of diet choice, so they can make an informed personal decision. Cochran, the Executive Director of the Alaska Native Science Commission says "*We can help communities make informed food choices. A young woman of childbearing age may choose not to eat certain organ meats that concentrate contaminants. As individuals, we do have options. And eating our salmon and our seal is still a heck of a better option than pulling something processed that's full of additives off a store shelf*."[39] For at least some Inuit, the value of eating the foods of their ancestors is worth the cost. "*Contaminants do not affect our soul, avoiding our foods from fear does*." (Egede *in* Cone 2005*).* Clearly the monitoring of the level of contamination of different marine mammal products must be prioritised, so the information and advice provided to the population is *a-jour* and can form the basis of an informed choice.

6. MARINE MAMMALS, A SOURCE TO IDENTITY AND EMPOWERMENT

The traditional ways of acquiring, preparing, and storing food is, in the Arctic as elsewhere, moulded by the surroundings possibilities and realities. In the North, they are such an integral part of cultural identity that they have survived from the days of the first settlers. Northern food is unique, beget by weather and centuries-long struggle for surviving in a harsh environment. The remote and isolated communities of the barren North, with limited communication and transport possibilities, have wrought cultures intimate with their natural surroundings shored on the skill and knowledge required to make the best use of the limited local resources. Northern diets were a way of life, of survival, in places too cold for any substantial agriculture, where food - whether hunted, fished, or gathered - could not be taken for granted.

Marine mammals have been high-prized resources since prehistoric times and subsistence whaling by Native people in the Arctic goes back to millennia. Archaeological excavations in Disko Bay in West Greenland dating back from 4500 years demonstrate Greenlandic ancestors depending on whales and seals for their survival (e.g., Grønnow and Meldgaard 1988), with 60% of bones found in middens belonging to marine mammals. Scandinavian petroglyphs (rock carvings)[40] from about 4,000 years ago depict whales, seals and whaling scenes. Since then, the hunting of marine mammals has been central to the livelihoods of the Northern communities. Marine mammals have represented critical – survival - resources for many coastal communities, as food, fur and leather. Their high cultural and spiritual significance is testified by their appearance in ancient myths, legends, literature and art of different kinds.

[39] http://discovermagazine.com/2004/oct/inuit-paradox
[40] https://en.wikipedia.org/wiki/Rock_carvings_in_Central_Norway

One of the best examples of their vital significance and of the importance of sharing them is likely found in the Faroese "Sheep Letter" from 1298, the oldest surviving Faroese legal document. The Letter already describes the rights to both stranded whales and whales driven ashore and outlines the rules for sharing them. Portraying how valuable the resource was, the catch data were kept partly since 1584 and continuously from 1709, which represents the longest catch statistics series existing for any wild animal harvest in the world. – and the documents were initially kept in the church books.

Nowadays, at the time of social benefits, hunting (incl. whaling and sealing), fishing and gathering do not mean survival as such, but remain enshrined in everyday life of Northern communities– as a cultural tradition, as a complement to household economy, as a contribution to individual economic independency and empowerment. People coming from southern areas are for example surprised by the decreasing number of fish stores that can be found the further north you go although families regularly consume fish. But, why would you have many fish stores when so many families fish for themselves?

6.1 A resource entwined with identity and social purpose: Greenland

Inuit cultures have been through the loss of identity that happens when a culture goes through a rapid and radical societal change, especially when hunting cultures are at the same time demonized. The new generation feel cut off from the older generation, but not really part of the new trends, among other reasons, because of remoteness and limited economical means. Fathers and grandfathers were fierce hunters, skilled at coping with harsh conditions and possessing some unique knowledge, needed and used by the western-admired great polar explorers. Sir John Franklin died in 1847 trying to find the Arctic's fabled North-West Passage partly because he would not accept that an indigenous people held the key to survival in the Arctic (O'Keeffe 2010[41]). But what about the younger generations? Suicide rate has exploded in Inuit communities in the last decades, compared with the rest of the countries, younger men making up the largest proportion of these deaths[42,43]. Greenland has presently by far the highest suicide rate in the world.

Food serves as an important vehicle in the production of meaning and identity, a process that has become increasingly important politically yet increasingly complicated socially and economically as Inuit react to an expanding world of commodities and consumer tastes (Searles 2002). "*How we get our food is intrinsic to our culture. It's how we pass on our values and knowledge to the young*" (Cochran *in* Gadsby and Steele 2004[44]). Subsistence is the intertwining of food gathering and the socio-cultural identification of a traditional and unique lifestyle. This linkage between food and culture is inextricable. Traditional knowledge and traditional food systems support both cultural identity and food security. "*Our foods do more than nourish our bodies, they feed our souls. When I eat Inuit foods, I know who I am. I feel the connection to our ocean and to our land, to our people, to our way of life*" (Egede in Cone 2005).

Whales and seals are also social food, one with multiple cultural meanings, including ideas of care, reciprocity and unity (Sakakibara 2011). Sharing animal food is a basic ethic in Inuit society, and instils a feeling of social solidarity. This ethic remains very strong among the Inuit today (Freeman 2005). Sharing mattak has special significance among all Inuit, because it is so highly valued by everyone. The norm of sharing is one very important way to show respect to animals, for sharing signifies generosity, which is a virtue and an appropriate use for the gift of food the animal provides (Freeman et al 1998). The distribution and sharing of whale meat within a community having taken a whale is based on an assumption of reciprocity. It was and is expected that the successful hunters sharing out the result of their hunt would receive compensation later. This was, in the old time, a kind of "mutual insurance" system (Government of Greenland 2012). It insures that members of the community will always receive food when in need.

[41] O'Keeffe, A. 2010. Food security in the Arctic. Griffith Review 27. https://griffithreview.com/articles/food-security-in-the-arctic/
[42] Nunavut suicide prevention strategy available at http://www.naho.ca/documents/it/2010-10-26-Nunavut-Suicide-Prevention-Strategy-English.pdf
[43] http://www.npr.org/sections/goatsandsoda/2016/04/21/474847921/the-arctic-suicides-its-not-the-dark-that-kills-you
[44] Patricia Gadsby, Leon Steele: The Inuit paradox. http://discovermagazine.com/2004/oct/inuit-paradox

Harvested food is much more than simple calories, it has familial, societal and cultural bonds as well. "*It's part, too, of your development as a person. You share food with your community… So you get all the physical activity of harvesting your own food, all the social activity of sharing and preparing it, and all the spiritual aspects as well. You certainly don't get all that, do you, when you buy pre-packaged food from a store*" (Cochran *in* Gadsby and Steele 2004[45]).

Disko Bay, Greenland, © F. Ugarte

The importance of food security for *indigenous* peoples is recognised not just from a nutritional perspective but also from the broader socio-cultural perspective. "*Indigenous perceptions of livelihood security are inextricably grounded in their socio-cultural traditions and their special relationship to ancestral territories and resources. Food and its procurement and consumption are often an important part of their culture, as well as of their social, economic and political organization"* (UNHCR 2010[46]).

Environmental organisations also have started recognising the meaning of subsistence food. WWF Denmark recently produced a report on the Greenlandic seal hunt and the negative impacts that the European Union import bans on seal products have had on the hunters and the sealskin business in Greenland (WWF 2013). Gitte Seeberg, former CEO of WWF Denmark introduced the report as follows: "*Today, as in the past, the majority of people in Greenland live in close connection to the sea. They engage in hunting and fishing activities on a regular or daily basis that sustain them and contribute to their income. The traditional way of life of hunting and fishing is thus intertwined with a modern society and economics. But there is more to hunting and fishing than earning money. It is a lifestyle, a culture, a tradition, and it provides local food for the inhabitants in Greenland – hence the seals remain to be an important part of everyday life here*." Greenpeace "*today unequivocally support the right of Greenlanders and Indigenous Peoples everywhere to their sustainable seal hunt*"[47], although it remains completely against the commercial hunting of seals for profit. Jon Burgwald, Greenpeace Arctic Director, recognises that[48] "*In fact, Indigenous communities have shown time and again that they understand how to protect the Arctic ecosystem they call home, and their hunting practices have never been a threat to seal or whale populations… The large-scale, commercial hunt is a world away from the traditional practices of Indigenous Peoples in the Arctic. They do not hunt seal pups, and their hunt is conducted with respect for the animal. They hunt because it is a crucial way to sustain themselves and their families in the harsh Arctic environment. We respect their right to continue this tradition. [The hunt] is not just a matter of culture, it is a matter of survival. Many Indigenous communities in the far north rely on seal products for food, warmth and clothing. They sell some of these products so they can sustain their livelihoods and keep their families alive through the harsh Arctic winter*".

As a link to a unique identity, subsistence harvest is, besides its subsistence and economical purposes, a critical activity with a social purpose. By providing self-reliance and self-respect, it serves to alleviate cultural discontinuity, and to create, reinforce and maintain cultural and social identity in communities with limited economic possibilities, but inundated with images of globalisation/consumer values. If not

[45] Patricia Gadsby, Leon Steele: The Inuit paradox. http://discovermagazine.com/2004/oct/inuit-paradox
[46] UNHCHR, 2010: The Right to Adequate Food. Fact Sheet No. 34, http://www.ohchr.org/Documents/Publications/FactSheet34en.pdf
[47] Jon Burgwald blog, February 2014, http://www.greenpeace.org/international/en/news/Blogs/makingwaves/greenland-sustainable-development/blog/48099/
[48] Greenpeace USA website, http://www.greenpeace.org/usa/where-does-greenpeace-stand-on-seal-hunting/

demonised, it would underpin the delicate balancing act of living concurrently in two very different cultures.

6.2 A resource entwined with identity: Faroes

Faroese (still) have a very close relationship with nature and treasure the quality of life and community bonds that this connection maintains. The cultural connection to traditional local food remains strong (Fielding 2011). Most of the ancient hunting traditions are kept alive, Faroese people from all walks of life also keep sheep, hunt birds, fish and participate in whale hunts in their spare time. These modern-day, traditional forms of food production are a welcome contribution to the household economy. In 2002, pilot whaling supplied 30% of the locally produced meat (Anonymous 2002).

Archaeological digs show that pilot whales have been a staple part of the Faroese diet since the Viking age (Sanderson 1992). Pilot whale hunting, Grindadráp, has occurred throughout the Norse history of the Faroes, with written descriptions from as early as 1587 (Sanderson 1994). It was always regulated, the Sheep Letter from 1298 already outlined rules for the use of whales. A dedicated regulation for pilot whaling was enacted in 1832 and was most recently updated in 2013[49]. Today, as in times past, the whale drive is a community activity open to all, organised on a community level and regulated by national laws.

Although of less economic significance today, the free sharing of pilot whale meat and blubber hunt has contributed to good health and to the survival of many elders, low affluence families and families where men and boys were absent fishing for weeks and months or simply disappeared at sea (Joensen 2009). It is therefore enshrined in the Faroese culture and identity, and has long been singled out as a "characteristic feature of Faroese culture" and "an established symbol of Faroese national identity" (Sanderson 1992). It has inspired the production of an extensive culture material including literature, poetry, painting, sculpture, handicraft, music and songs. Whaling equipment is often displayed in houses as décor, taking it beyond its mere utilitarian purpose.

Contrary to the situation in Newfoundland, where the pilot whale stock became severely depleted by the commercial hunt providing whale-based feed to the province's mink and fox fur farms, pilot whaling in the Faroese is forbidden to become commercial by law and the system is designed to provide food to the residents while not depleting the resource through unnecessary extraction (Fielding 2011).

Pilot whale killing, S. J. Mikines 1957

[49] http://www.whaling.fo/media/1041/grindakunnger%C3%B0plus2013plusen-1.pdf

6.3 A resource entwined with conservation *avant l'heure*: Iceland

Utilisation of whale resources is part of Iceland's tradition and history, providing an important dietary component throughout the ages. Written sources of Icelandic whaling reach as far back as the 13th Century (Elis 1991). Whaling in Iceland began with spear-drift whaling which was practiced from as early as the 12th century. Throughout history, whales have been harpooned or speared, driven ashore, or gracefully received when they beached themselves. The importance of whales in earlier Iceland is reflected in the Icelandic language: *hvalreki* is the word for "beached whale", while also meaning something good that is unexpectedly yours or at your disposal, a "godsend".

The Icelandic economy has been and is overwhelmingly dependent on the utilisation of living marine resources and the sustainability of these resources is essential for its long-term prosperity[50]. Iceland was the first countries in the world to take a conservationist approach to whaling, long before any international agreement. Harvesting of fin whale was especially heavy around Iceland, leading to a noticeable decline in catch rates between 1901 and 1915 (NAMMCO 2000). As signs of overexploitation of whales from foreign-owned land stations emerged early, the Icelandic Parliament declared in 1915 a complete ban on whaling for whales larger than common minke whales around Iceland, the first whaling moratorium ever. In 1935, the stock appeared to have recovered west of Iceland, possibly through both natural population growth and immigration from other areas (NAMMCO 2000). A law declared that whales in Icelandic territorial waters could be hunted by Icelanders. Whaling was, however, not resumed until 1948, except for limited catches in 1935-1939. Strict rules and limitations were applied to whaling in Iceland from 1948 to 1985 when commercial whaling was halted again following a decision by the IWC.

Icelanders flensing a whale (16th-century manuscript)

6.4 A resource entwined with small communities' viability: Norway

Rock carving in Central and Northern Norway portrays marine mammals and hunting scenes[51]. Norwegians caught whales off the coast of Tromsø in Northern Norway as early as the 9th or 10th century. Vikings from Norway also introduced whaling methods for driving small cetaceans, like pilot whales, into fjords in Iceland. The Norse sagas, and other ancient documents, provide however few details on Norwegian whaling, mostly recounting disputes between families over the ownership of whale carcasses, but it is hard to imagine that the hardy Norse seafarers ignored this plentiful source of food and oil while they plied the inhospitable seas of the Northern Atlantic (Elis 1991). Norwegian vessels were whaling from Spitsbergen during the 18th century. New techniques and technologies, developed by Norwegian in the mid-19th century, revolutionized the whaling industry and established Norway's prominence as a whaling nation.

[50] https://eng.atvinnuvegaraduneyti.is/subjects/sustainable-whaling/questions-and-answers/
[51] https://en.wikipedia.org/wiki/Rock_carvings_in_Central_Norway

Minke whales have been hunted along the coast of Norway at least since medieval times; the use of harpoon gun mounted on ordinary fishing vessels replacing aboriginal methods from the 1920s[52]. Continuing the Norwegian hunting tradition, small communities mostly from Northern Norway continue hunting minke whales in the idle summer period, as a complement to winter coastal cod fishing. During the winter (January through April) fishermen concentrate on the abundant cod. In the summer, as fish become fewer along the coast, whaling allows to keep boat and crews employed in areas where jobs opportunities are limited. Most of the vessels are family businesses, with the owners working onboard and none of the boat are designed exclusively for whaling. The majority of today's whalers come from the Lofoten Islands where conditions for agriculture are poor. Fishing has always been the most important source of income and a third of the population is engaged in the primary sector (fishing and some sheep raising) (Kalland, in Freeman 2000). As Inuits, people of the Lofoten were/are exploiting generalised niches, switching between several alternative resources, typically being fisher-farmer-whaler. Whaling, unlike fishing, represents a predictable source of income and guarantees the economic viability of many households, when other resources that make up their ecological niche cannot be harvested or are subject to low market prices, and as such secures the viability of small communities (Kalland, in Freeman 2000). Like in other small Northern communities, whaling support individual – and communities - empowerment and self-respect.

Typical Lofotens' scenary, illustrating the limited arable land area

6.5 A resource empowering small coastal communities

Whaling and sealing contribute to supporting a strong, resilient, sustainable circumpolar region by empowering coastal peoples and communities. Fishing and hunting represent small enterprises, which require (relatively) cheap investment and are thus affordable and accessible to many. They support the existence and the development of a micro-economy, thus strengthening coastal settlements. They promote resource sharing and equitability and provide work or part-employment in places where possibilities are highly limited and many survive on social benefits. Food sovereignty—culturally appropriate, locally determined food systems and food distribution—enhance community independence.

Nordic countries have succeeded in maintaining a decentralised pattern of settlements, with small communities scattered along the coast, as the result of deliberate policies. Fishing, sealing and whaling are among the principal means of livelihood of the northernmost coastal populations. If these coastal communities are to have any future, they are dependent on the acceptance of their right to utilise the living, renewable resources of the sea.

[52]http://www.fisheries.no/ecosystems-and-stocks/marine_stocks/mammals/whales/whaling/#.V7_xRvl97cs

The importance of the traditional and local food is acknowledged by many international fora (e.g. FAO 2009), "[we] *Acknowledge the cultural and nutritional importance of traditional and local foods, including from marine living resources in the Arctic"* (Arctic Council 2015[53]). Besides being subsistence, grounded in socio-cultural traditions, whaling and sealing also contribute to communities' empowerment and lessen economic dependency. Even if they only represent a negligible factor in the economies of the nations as a whole, they are of great significance in the local, regional and, not the least, familial economies. Whaling and sealing are part of a larger issue, the right to exploit natural marine resources sustainably and symbolise, besides culture and social integrity, the right to self-determination and self-management.

"*All peoples have the right of self-determination. By virtue of that right they freely determine their political status and freely pursue their economic, social and cultural development. All peoples may, for their own ends, freely dispose of their natural wealth and resources… In no case may a people be deprived of their means of subsistence*"[54].

7. WHALING AND SEALING, PAST AND PRESENT BUT DIFFERENTLY

7.1 Two different scales of hunting pressure

Marine mammals were hunted by coastal people for food and other resources for centuries. Hunting efforts were on a relatively small scale, and the effects were only local and limited. The scale of the impact changed with commercial whaling and sealing. These systematic hunts for profit overexploited many whale and seal stocks. especially with the onset of modern whaling and sealing. Some species or stocks become virtually extinct (Steller's Sea Cow, Caribbean monk seal, Southern fur seal, North East Atlantic Right whale), while many were heavily depleted to 1% of their pristine abundance (e.g., Clapham 2016). Hence whaling and sealing are associated with outrageousness. Moby Dick and the obsessive quest of Ahab, the huge Antarctic factory ships processing in a single day more whales than a New England whaler could capture in its five-year voyage, the virtual extinction of Southern fur seals already by the mid-1800s, the vast waste of resources with oil and fur as single important product and meat a by-product if not discarded. One associates commercial and industrial whaling and sealing to greed, excess and mismanagement – and rightfully so, commercial whaling and sealing were indeed a blueprint for repeated over-exploitation. However, this was the reality of the past, of the last centuries. This was the reality of aggressive competitive whaling and sealing not adhering to any management regime, the reality of an endless demand for profit, moving from one resource to the next one, when the first was depleted. This was, however, only part of the story.

Parallel to these, subsistence/sustenance and coastal whaling and sealing were conducted with limited hunting efforts (scale and target area) and did not have their dramatic unsustainable character. They were a source of food, commodities and cash, and represented the mainstay of many of the coastal communities. Still today, marine mammals represent for many coastal communities of the North an invaluable resource bringing food and/or cash money, as well as job opportunities in places where non marine resources are scarce and/or job opportunities are few, sometimes seasonally supplementing seasonally idle fishing activities.

Small scale whaling and sealing, and the associated ecological risks, are very different from the moving-from-one-resource-to-the next type hunting. They support the well-being of communities, to which the

[53] Iqaluit Declaration 2015 by the Ministers representing the 8 Arctic States and the representatives of the 6 Permanent Participant organisations on the occasion of the 9th Ministerial Meeting of the Arctic Council, Iqaluit, Nunavut, Canada, April 2015. http://www.arctic-council.org/index.php/en/document-archive/category/604-declaration-sao-report

[54] Universal Declaration of Human Rights, International Covenant on Civil and Political Rights & International Covenant on Economic, Social and Cultural Rights, 16 December 1966, Part I, Article 1.1 and 1.2.

activities are necessary. The geographical scope being pre-defined and limited, the perennity of the activity obligatorily rests upon, and is a strong incentive to, keeping the stock at a sustainable level. In the latter case, the activity supports a business, the company has no long-term interest in a particular resource, but illustrate the *tragedy of the commons*: making the highest profit before others, then moving to the next profit-generating activity, a new not yet exploited resource or another activity – there is no incentive to sustainability.

Therefore, the reality of the present harvest of marine mammal is very different from the reality of the last centuries competitive whaling and sealing - at all levels: its scope, the dramatic improvement in monitoring and management skills (among other through the work conducted by the Scientific Committee of the IWC) now permitting the sustainable management of stocks, the efficient utilisation of the resources for human consumption with meat as the most important product, and above all the understanding of nature conservation as the prerequisite for human survival and thus the will to preserve marine resources for future generations. The high level of commitment marine mammal users and managers have today for conservation and sustainable use, combined with the limited scale of current and planned exploitation, their geographically limited scope, the lack of industrial market for whale products and the limited market for whale meat are strong forces contributing to the protection of marine mammal stocks.

7.2 A strong incentive for sustainability

"We do not need to be reminded by others of the preciousness of nature's wealth, because it continues to feed us, clothe us and sustain us every day"[55]. Marine mammals are highly necessary in the Arctic for nutritional, societal, cultural and spiritual reasons. Populations making a direct living/survival off a resource have a very strong interest in managing it in a sustainable way and preserving it for themselves and future generation, and not cut the branch they sit on. It is noteworthy that the depletion of whales and seals stock were due to competitive commercial hunting, and not to subsistence hunting. There are very few example of stock depletion from subsistence or local harvest, likely due to the fact that the interest of the users in protecting the resources at hand is very direct and evident. A strong subsistence-based economy undergirds a strong conservation ethic.

The World Wildlife Fund (WWF) conducted in 1998 two case studies in Western and Eastern Canadian Arctic Inuit communities to test the appropriateness of the guidelines it had proposed for the sustainable consumptive use of arctic wildlife (including marine mammals). It concluded that in the two communities examined there existed a strong conservation-oriented philosophy, sets of principles, and an institutional framework for managing wild species on a sustainable basis and that there was no justification for distinguishing between subsistence use and commercial use (Freeman 2001)

The world has evolved and in particular our perception of nature and wildlife. The notion and importance of ecosystems, inter-reactional multi directional dynamic entities, has emerged. The necessity of preserving and sustainably manage the marine environment(s), which provide goods and services upon which the world depends, has become evident. The over-exploitation and mismanagement of many marine mammal and fish stocks have prompted efforts and progress in wildlife management theories and methodologies. It is now possible too sustainably manage marine mammal hunting activities, especially when their non-industrial small type coastal character in NAMMCO countries makes inspection and enforcement from the catch to the market a feasible reality. The will to, as well as the know-how for, sustainable management are both existing.

[55] Aleqa Hammond, "Greenland's way forward", speech to Arctic Frontiers conference, Tromsø, 21 January 2014.

8. MARINE MAMMALS, A RESOURCE ON THIN ICE

Hunting removals – largely controlled and reported and thus included in management schemes - are only the most apparent anthropogenic pressure that marine mammals face. In this chiefly post-whaling and sealing world, a sizable lists of threats, almost all of them human-caused and with sometimes less tangible impacts, are more significant (e.g. Clapham 2016). Marine mammals face multiple, cumulative and often synergistic anthropogenic threats, although virtually nothing is known about cumulative impacts. Their impacts range from direct mortality, to injury, to fitness impairments, and to disturbance, as well as indirect effects on habitat quality and prey availability. Environmental change is not restricted to global warming alone; the build-up of marine contaminants is one of the many environment changes that shares causal elements with global warming. It is exacerbated by the build-up of microplastics and both could potentially affect Northern – and eventually, worldwide, marine ecosystems, as a whole (including humans) just as severely (Fielding 2010, Jepson et al 2016, Jepson and Law 2016, Law and Thompson 2014). Clearly hunting removals are only the visible part of the iceberg, albeit the most focussed on although the most controlled and the easiest to act upon. For getting long-term population dynamics right and precautionary managed and sustainable marine mammal stocks, it is essential to understand the palette of human impacts and to quantify their effect as much as possible.

8.1 A Changing Arctic as Background

Like the rest of the world, Arctic ecosystems are affected by the many changes associated with climate change, albeit at a faster and greater rate. The Arctic warms at twice the rate of the global average, increasing the likelihood of severe impacts in the region (ACIA[56] 2005, IPCC[57] 2007, 2013, 2014). The consequential effects on snow and ice were already felt in small communities throughout the circumpolar north by mid-2000 (UNEP[58] 2007). The dramatic shrinking of the ice cover and the changing ice freezing patterns both alter animal distribution and migration routes but also the accessibility to resources, making hunting harder (e.g. see [59]). The impacts on wildlife will vary according to the specific ecology of different species, from likely severe negative impacts on ice-dependent species to likely positive impacts on seasonally migrating sub-arctic species. Impacts and consequences are very difficult to predict.

Marine mammals as any other elements of the Arctic ecosystem, will most likely be strongly affected by climate change. The loss of Arctic sea ice is one of the most directly visible aspects of climate change and a key parameter that will affect Arctic marine mammal populations. The impact will be both direct through habitat loss and indirect through changes in prey abundance and distribution (i.e., availability) and food chain dynamics, with changes in top predator communities (particularly marine mammals and birds). Other expected changes are modifications in temperature, ocean circulation, pH balance, sea level and ice cover qualities, as well as unpredictable weather effects and increased human activities (e.g. IPCC 2007), which will also affect food chain dynamics. The serious consequences of climate change for marine mammals can already be seen from the decreasing blubber thickness of harp seals and minke whales in the Barents Sea (Bogstad et al 2015), and the changes in geographical distribution of minke and fin whales around Iceland (Víkingson et al 2015).

8.2 Uncontrolled direct removals

A prerequisite for reliable and responsible resource management is to have reliable estimates of anthropogenic removals, i.e., estimates of the non-natural mortality due to human activities, either direct or indirect, so it can be included in population modelling. The direct non-natural mortality includes direct takes, but also animals which are struck but lost by hunters. It also includes those animals which

[56] ICIA: Arctic Climate Impact Assessment
[57] IPCC: Intergovernmental Panel on Climate Change of the United Nations
[58] United Nation Environment Programme
[59] https://www.newsdeeply.com/arctic/articles/2016/08/31/subsistence-hunting-in-alaska-in-an-age-of-climate-change

are by-caught in fishing gears (dead or alive but injured) and those which died because of ship strikes, and indeed animals taken to captivity. Indeed, from the standpoint of population dynamics and management, there is no intrinsic difference between by-catch, ship strikes and whaling/sealing. All three permanently remove animals from the population. To fully understand the impact of these interactions, it is therefore necessary to have mechanisms not only for monitoring population abundance and trends and harvest reporting (including e.g. reliable struck and lost data), but also to obtain reliable estimates of by-catch and ship strikes for species and areas where these might be an issue. Indeed, all non-natural mortalities - direct catch, bycatch and ship strikes - should ideally be taken into account when estimating allowable catch levels.

8.2.1 Ship strikes

Except in the case of some specific species and areas, ship strikes are at present mostly seen as a welfare problem rather than a population-level issue, and does not appear yet to be a significant problem in NAMMCO countries. Development of shipping activities in pristine areas of the Arctic may, however, change this and ship strike related mortalities in some areas may be equivalent or larger than the harvest of local communities (NAMMCO 2016b, page 48: Comments), which must be included in population modelling. Ship-strike related mortality needs therefore to be monitored and assessed/estimated.

8.2.2 By-catch and entanglement

Mortality due to by-catch and entanglement has long been recognised as having significant demographic effects on many populations of marine mammals and a factor reducing or limiting the recovery of marine mammal population (e.g., Reeves et al 2013). The global annual by-catch of marine mammals was estimated to over half a million, with roughly an equal number of cetaceans than pinnipeds (Read et al 2006). The World Conservation Union (IUCN) recognizes by-catch in fishing gears as one of the greatest threats to the survival of cetacean populations and the single-largest cause of mortality for small cetaceans[60]. ASCOBANS recognises by-catch as the most serious threat to cetacean populations in Europeans waters[61].

In recognition of this, NAMMCO is convening an expert Working Group on By-catch, which should a) *Identify all fisheries with potential by-catch of marine mammals, b) Review and evaluate current by-catch estimates for marine mammals in NAMMCO countries, c) If necessary, provide advice on improved data collection and estimation methods to obtain best estimates of total by-catch over time.* The most problematic species with regard to by-catch in NAMMCO countries are likely harbour porpoises and grey and harbour seals, although an overall assessment of the extent of the risk is needed. Entanglements of large whales seem, for example, to be increasing, the impact of which needs to be assessed.

8.3 Insidious "underwater" anthropogenic stressors

Although many stocks of marine mammals have recovered or are recovering from overexploitation, marine mammal resources face considerable challenges and global pressures (e.g. Clapham 2016). Stressors on the marine environment, such as habitat loss, climate change, ocean acidification and invasive alien species which all impact the health, productivity and resilience of marine ecosystems, represent considerable challenges. We look below with some more details at the potential impacts of some of these insidious stressors, marine pollution and disturbances created by increased human activities in the Arctic.

8.3.1 Pollution by contaminants and microplastics

In addition to their direct toxicity, anthropogenic contaminants may affect resilience of marine mammals and increase their susceptibility to disease, as well as directly affecting their reproductive capabilities. Some small or declining populations of bottlenose dolphins and killer whales in the NE Atlantic are associated with low recruitment, consistent with PCB-induced reproductive toxicity (Jepson et al 2016, Jepson and Law 2016). Despite regulations and mitigation measures to reduce PCB pollution, their

[60] https://portals.iucn.org/library/efiles/edocs/2003-009.pdf
[61] http://www.ascobans.org/fr/species/threats/bycatch. 31/08/2016.

biomagnification and persistence in marine food webs continues to cause severe impacts among cetacean top predators in European seas.

But POPs including PCBs are not static, they do not remain close to their sources. They transfer over long distances from industrialized to non-industrialized regions, mainly through cycles of atmospheric volatilization and condensation, including the Arctic, where they also concentrate as they make their way up the food chain. The general perception of the Arctic region has long been that its distance from industrial centres keeps it pristine and clear from the impact of pollution. But remoteness and the absence of indigenous pollution sources no longer guarantee the well-being of northern communities and the viability of wildlife populations. Through the process known as transboundary pollution, the Arctic is the recipient of contaminants whose sources are thousands of miles away. The problem is compounded by the fact that many such chemicals are fat-soluble and the Arctic has a relatively high-fat food web. In Svalbard in recent years, 1.5% of sampled polar bear females have been observed with partially-developed male sexual organs – pseudohermaphrodites, which is believed to be the result of long-range pollutants (e.g., Wiig et al 1998). Clearly, such effects need to be monitored and taken into account in population modelling. Marine POPs pollution undermines food quality, sometimes with levels above accepted standards for human consumption. As noted, the high level of accumulation of environmental contaminants in the arctic food web has led the Health Authorities in the Faroes[62] and Greenland[63] to recommend a reduced intake of marine mammal meat and a 0-intake for some specific groups. Noteworthy, these contaminants are not manufactured or used in the Arctic, but originate from industrial regions far from the Arctic.

Microplastics, are now turning up in all the world's major oceans including the Arctic and Antarctic and are likely the most numerically abundant items of plastic debris in the ocean today. They include larger plastic items that have been degraded down in size as well as tiny plastic "micro-beads" used to exfoliate skin in soaps, creams and other products. Quantities will inevitably increase at least as long as the release of plastics to the environment is not stopped, in part because large, single plastic items ultimately degrade into millions of microplastic pieces. Microplastics are easily ingested by fish, mussels and other sea animals including marine mammals. In addition to the physical damage done by any plastic itself, microplastic beads accumulate harmful chemical contaminants and transfer them to the animals that ingest the plastic. (e.g. Law and Thompson 2014, GESAMP 2015). "*Major questions remain about the risks from microplastic to marine organisms and ecosystems as well as to food safety and public health*" (Law and Thompson 2014).

8.3.2 Other anthropogenic disturbances

Human activities, such as oil and gas exploration, shipping, fisheries, tourism, generate disturbance to marine mammal population, e.g., through area occupation, noise, competition for resources… (NAMMCO 2016c). Close approach by whale and seal watchers may result in modified behaviour, in particular in breeding and nursery areas, and negatively affect small localised populations (Bejder et al 2006). Direct collisions between whale watching vessel and cetaceans also happen[64], with possibilities for direct serious injuries. Such impacts can be at the individual level (therefore a welfare issue), but may also act at the population level, for example resulting in displacement from habitat (migration, foraging, resting, etc.), habitat disruption/ destruction, and disruption of breeding/moulting /haulout areas (particularly seals and walruses). Also, whereas an individual stressor may not necessarily represent a significant threat, the cumulative impacts of different stressors may represent a significant threat to the species. The impact of such threats need to be addressed (Higham et al 2014).

A consequential effect of Arctic ice reduction coincidental to climate change is the increased human presence and activities in the Arctic, including oil, gas and mineral development, shipping, fishing and

[62] Faroese Food and Veterinary Authority 2011, http://www.whaling.fo/media/1043/hfs-uk_0.pdf
[63] Grønlands Ernæringsråd 2007, http://old.paarisa.gl/media/9795/contaminant_pjece_dk_pdf.pdf
[64] One recent collision example: http://www.cbc.ca/news/canada/montreal/whale-boat-collision-1.3740714

tourism in areas. These activities will have secondary risks such as chemical and noise pollution (Reeves et al 2014). These impacts will occur in areas that were previously (considered) "pristine" and also essential to marine mammals. The cumulative and synergistic effects of these multiple stressors, likely associated to additional competition as temperate species move northward, may become significant challenges for some species, especially those who are ice-dependent. The increased in activities seen in recent years will likely continue to increase with the continued reductions in sea ice extent. The effect of these anthropogenic activities/disturbances clearly need to be assessed and predicted, so their impact can be taken into account in population dynamic models and management. One of the major difficulties and concerns is that impact studies are usually conducted specifically for each project, not taking into account the cumulative effect of different projects on specific areas or marine mammal stocks. There is no umbrella overview of consequences, especially when several countries are involved. Indeed, a typical sentence in impact assessment reports is "No populations of flora or fauna are unique to the Project area". Different projects can for example generate shipping through the same waters important to marine mammals - and until now pristine. Examples of such projects of concerns for marine mammals are the Canadian large scale iron-ore Mary River Project[65] in Baffin Island, Nunavut, and the Greenlandic Citronen Base Metal Project[66] in Peary Land in North Greenland, both generating shipping going through the Northeast and Northwest Water polynyas, important to marine mammals. One problem with such projects is that they may change somewhat in essence (e.g. plans and shipping intensity) after they have obtained a license and have started, like the Mary River Project did changing shipping point and increasing the yearly shipping period.

8.4 Precautionary management needed and an appeal to joining forces

Therefore, aware that direct catches represent only a visible anthropogenic pressure, and that marine mammals also face multiple, cumulative and synergistic threats, NAMMCO countries reiterate their will to progress towards a precautionary and effective ecosystem-based management and the monitoring of all direct or indirect anthropogenic threats and disturbances, such as by-catch and entanglements, noise, pollution, climate change and increased human activities in the Arctic (NAMMCO 2016b).

With certain but complex and somewhat unpredictable environment changes as backdrop, and their unforeseeable consequences for marine mammals and thereby the coastal communities using them as resources, NAMMCO finds it essential to increase the scientific cooperation between organisations dealing with marine mammal conservation (NAMMCO 2016b). NAMMCO therefore aims at strengthening its cooperation with the Arctic Council, the International Council for the Exploration of the Sea (ICES), the International Whaling Commission (IWC), OSPAR, the Agreement on the Conservation of Small Cetaceans in the Baltic, North East Atlantic, Irish and North Seas (ASCOBANS) and any other international instrument, which may require the advice of NAMMCO, for the benefice of marine mammal conservation and future generations. It is essential to underpin the key elements that will strengthen the resilience of Arctic and Northern communities and make them able to survive and thrive in a world of uncertainty. Among them, food security is a prerequisite.

9. MARINE MAMMALS, A FORGOTTEN RESOURCE?

Although

- several marine mammal stocks are abundant and healthy,
- they represent the primary food resource in some ecosystem,
- a secured and precautious management framework has been established,

marine mammals are generally over-looked as potential food resources in the discourse of food security. Not that they are disqualified as potential contributors through a sound argumentation, they are simply ignored (see e.g. Godfray et al 2010, UN 2014, 2015, Potts et al 2016, WEF 2016). Their potential as

[65] http://www.baffinland.com/the-project/location-and-project-history/?lang=en
[66]http://naalakkersuisut.gl/~/media/Nanoq/Files/Hearings/2015/Ironbark_SIA_EIA_NSI/Documents/4%20Citronen%20EIA%20Ikke-teknisk%20resume_ENG.pdf

food resources is overlooked by the highest international institutions when discussing how to feed 9 billion people and at a time when "*Food security and nutrition has become a pressing global challenge underscoring the need for sustainable food sources*" (UN 2014). The 2010 joint FAO/WHO Expert Consultation on the Risks and Benefits of Fish Consumption[67] specifically exclude marine mammal consumption. The sustainable use of marine mammals as food resources and cash-bringer is restricted even for Northern communities for which it represents a significant livelihood and at a time when food insecurity has become a central concern particularly exacerbated by climate change (e.g., ICC 2012).

But why is the consumption of marine mammals perceived as so controversial, so taboo? Is there an overall misunderstanding of the actual environmental situation and the relative impact of pressures and threats on the global environment, based on some incomplete and maybe partially tuned information?

9.1 Is there a general attitude against using marine mammals as food resources?

Is the taken-for-granted attitude against eating marine mammals as generalised as it seems or is this attitude voiced so loudly that it blurs the real situation?

Using marine mammals as food resource has been common in many parts of the world, including across Western Europe and Colonial America, and not necessarily restricted to coastal communities, since flesh and blubber can be salt-cured. After WWII, corned whale meat was available as unrationed alternative to other meats in the UK[68]. The now taken-for-granted anti-whaling and sealing moral discourse has emerged in the middle of the twentieth century from a world were killing – and using and eating - whales and seals was widespread and morally/ethically unquestioned (Epstein 2008). By the late 1970s, Iceland, Brazil, Peru, South Africa and Spain all still counted among the importing countries for Soviet whale meat (Epstein 2008). Regarding the general use of marine mammal products, the U.S. and U.K governments were still maintaining stockpile of sperm oil and, to a lesser extent, whale oil for national emergencies into the early 1990s (Ellis 1991 in Epstein 2008).

Today, marine mammal consumption is far from being restricted to a few states (whaling nations) or isolated coastal communities and may actually be increasing. In their report on "*The global extent and character of marine mammal consumption by humans: 1970–2009*", Robards and Reeves (2011) note that since 1990, people in at least 114 States have consumed one or more of at least 87 marine mammal species, these statistics including animals killed deliberately, or unintentionally as by-catch or strandings. In 87 of these 114, the acquisition was deliberate and targeted, making this the most widespread acquisition category. They note that "*Although changing social, ecological, or political circumstances are leading to reduced killing and consumption of marine mammals in some regions, in other regions the prevailing socio-economic conditions and new technologies are leading to increased killing and consumption, particularly of small cetaceans. Consumption of marine mammals is considered a significant aspect of food security and cultural wellbeing in many regions, and provides some economic (including cash) benefits to people in at least 54 countries*". Their analysis indicates that the number of people taking small cetaceans for food has continued to increase since the 1970s, and that there is a trend towards a greater use of animals killed in fishing gear, regardless of whether they are direct catch or bycatch.

Reviewing the study quoted above, Costello and Baker (2011) concluded to their worries that "*People in many countries have no cultural or ethical prohibitions against eating marine mammals*". Many tourists in Iceland, Norway and Greenland do not hesitate in trying whale meat, even when coming back from a whale watching trip (e.g. The PlanetD[69], The Guardian[70], Bertulli et al 2016). The sale of minke whale meat seems to be increasing in Iceland[71] as well as the tourism from the US[72]. The same is observed in Greenland and Norway.

[67] http://www.fao.org/docrep/014/ba0136e/ba0136e00.pdf
[68] Whacon for U.K. dinners – *The Sunday Times*. Published 8 July 1951. http://trove.nla.gov.au/newspaper/article/59530720
[69] http://theplanetd.com/eating-whale-in-greenland/
[70] https://www.theguardian.com/environment/2012/jun/26/greenland-whale-meat-tourists
[71] http://icelandreview.com/news/2011/08/24/minkes-chase-mackerel-confuse-icelandic-whalers
[72] http://icelandreview.com/news/2016/06/14/iceland-popular-among-likeable-us-tourists

9.2 Are marine mammals an endangered species?

Are marine mammals endangered *per se* and therefore should be protected *a priori* or is this feeling the result of a general disinformation?

Many people believe that whales are endangered, as if there was a unique ubiquitous whale: "Save the whale". They appear surprised to hear that some species are in danger, while others are thriving, and that within a species some stocks might be flourishing while other stocks need protection and some are on the brink of extinction. There are over 86 cetacean species (whales and dolphins) and 36 species of pinnipeds (seals and walruses). Many of these species include several stocks or populations that are reproductively isolated and may have different conservation histories and issues. Perfect examples of this are the gray whale which counts one healthy (non-endangered) population - (eastern North Pacific with about 22,000 individuals), one critically endangered (western North Pacific with about 130 individuals) that requires immediate conservation action, and one extinct (North Atlantic). Closer to us, the fin whale is another good example. The Southern Hemisphere population is still dramatically depleted, while the North Pacific population has likely returned to pre-exploitation level and the North Atlantic fin whale population is actually above pre-exploitation level. Some species and stocks are on the verge of extinction (or extinct), like the vaquita porpoise (less than 100 animals remaining[73]) and Mãui dolphin (55 individuals over one year of age remaining[74]), while other stocks are healthy and actually increasing, like fin and the humpback whales in the North Atlantic. Therefore, it does not make sense to say the fin whale is endangered or the gray whale is abundant. Some populations are, some are not. The same is true for seals, where different sub-species and stocks of a species can have very different conservation status, such is e.g. the case for the ringed seals, with the abundant Arctic ringed seals numbering several millions and the Saimaa ringed seal numbering low hundreds.

THE whale and THE seal do not exist and are therefore not endangered. "Save the whale" is equivalent to say rats are endangered because Kangaroo rats are close to extinction, or cats are endangered because tigers are. Because of the great diversity of habitat, pressures and status, the only sound and biologically sensible way of looking at marine mammal conservation status is at stock/population level (IWC 2016[75], Smith et al *in* UN 2016[76]).

Pooling several stocks together under one single species and attributing to the species a conservation status is not scientifically appropriate and is misleading. It can be very problematic in terms of conservation, especially when the stocks pooled together are of very different size, as the conservation status of the small stocks, good or bad, will be overlooked. The fin whale again is a good example of this. CITES and IUCN assess and list the fin whale as an endangered species[77,78], thus grouping the three recognized populations of the North Atlantic, the Southern Hemisphere and the North Pacific in a mega-population, against their own practice. This classification, however, is only valid for the Southern Hemisphere population which is still dramatically below its pre-exploitation level. Indeed, in its regional European assessment IUCN operates, following normal and best practices, with populations. The North Atlantic fin whale population is not anymore listed as endangered or even vulnerable[79]. The inconsistency in argumentation and definitions is striking when the minke whale, a related species appearing roughly in the same waters, is treated differently and assessed by population and stocks.

[73]http://news.nationalgeographic.com/news/2014/08/140813-vaquita-gulf-california-mexico-totoaba-gillnetting-china-baiji/. 31/08/ 2016.
[74]http://www.doc.govt.nz/nature/native-animals/marine-mammals/dolphins/maui-dolphin/facts/. 31/08/2016.
[75]IWC website, retrieved June 2016: *Status of whales* at https://iwc.int/status
[76]United Nations World Ocean Assessment, 2016; http://www.worldoceanassessment.org/?platform=hootsuite
[77]https://www.cites.org/eng/app/appendices.php
[78]http://www.iucnredlist.org/details/2478/0
[79]http://www.iucnredlist.org/details/2478/1

9.3 Are marine mammal supra-mammals?

Why are whales and dolphins perceived by many as especially charismatic and innocent mammals, as supra-mammals? Are they as cuddly and innocent as taken-for-granted or are they more *natural* than often perceived?

9.3.1 Fascinating animals

They do not fit into our simple categories of fish and mammals. They thrive in a habitat cherished and much coveted but not conquered by humans – the underwater world, where they seem to move about effortlessly and for longer period. They are both conspicuous, sometimes exhibiting precision acrobatics, and mysterious as they completely vanish for longer time periods. They migrate over vast areas and regions, some from the low latitude tropical waters, where they breed and give birth, to cooler, high latitude polar waters where they feed (e.g., humpback whales). The longevity of some species (over 200 years for bowheads) fascinates, although the longevity of some other long-lived species such as ocean quahog (> 400 years), Greenland shark (200 years) or eels and tortoise (150 years) or the immortal jellyfish do not get much attention**.** They are protective of their offspring, some display sophisticated strategy for gathering food, and they communicate and navigate using mysterious sounds, some over large distance. Some sing. They are difficult to study and count. Some are playful, and use boats as toys. Some bond with humans and ally with them to wrangle fish. Some are the largest animals ever to have lived, larger even than the largest dinosaurs. All these traits, especially when lumped together in a single *archetype whale*, contribute to and underpin the idea of whales being friendly supra-mammals, therefore possessing a taken-for-granted supra intelligence. They are majestic ornaments of an imposing environment. They fascinate, they are nature totems. Programmes like "Swimming with dolphins" are presented as the ultimate bounding with nature. This is particularly true for city inhabitants, disconnected from the realities of nature.

Marine mammals and especially whales fascinate, but also how humans connect to these animals. Many myths and legends exist all over the world where marine mammals, usually at the level of the individual, play the lead character. Nautical lore is ripe with tales of dolphins helping humans in the high sea (e.g. the legend of Paikea[80] in New Zealand), and sometimes they'll even go out of their way to help other aquatic species, too. The remarkable destiny of the novel "Moby Dick" by Herman Melville (1851) perhaps best exemplifies this. The novel is ranked by many as equal to novels like "War and Peace", "Don Quixote" and "Wuthering Heights" in world literature. Most people seem to know about it and about Moby Dick, although without actually having read the novel. Through glorifying myths and legends and by attributing human characteristics to them, the idea of marine mammals as special and dignified animals that should not be hunted has emerged and developed and gained foothold in the mind of the general public. *"Our ocean-going mammalian counterparts possess many admirable qualities and characteristics that endear them to us like few other species on Earth"*[81]. The recent super whale, with all its cetaceans and human qualities has proved to have an enormous economic and political potential (Kalland in Freeman and Kreuter 1994).

The protection and hunting of marine mammals seem to illustrate a *clash of cultures* (Norden 2013) between urban and more traditional life style. Ironically native and aboriginal people have long been fascinated by marine mammals, and have certainly spent more time observing and "learning" them, enjoying them than most urbans. They do not know them as iconic animals, but they know them from daily life and encounters, and eternities spent in observing them. At the same time, they consider them beautiful animals but also see them as a food resource, they revere and respect them, hunt and consume them. In Inuit values, the animals are sentient, and like humans and all elements of nature have a soul[82]. They are thus aware of the thoughts, speech and actions of hunters, and from there choose to participate or not in encounters with hunters. To be successful, the hunter must have the right attitude and intent,

[80] http://whales.fieldmuseum.org/behind/people/maori-whale-riders
[81] http://www.treehugger.com/natural-sciences/10-awesome-examples-dolphins-being-awesome.html
[82] https://www.religion.dk/viden/de-ti-vigtigste-ting-vide-om-inuit-religion

a.o., food must be needed, the intention should be of utilising the animals as fully as possible for food, and the food produced should be shared - even after capture, animals belong to all. A reciprocity exists between hunter and animal, between one person and another, and between the human community and the natural environment (e.g., Wenzel 1992).

9.3.2 Fascinating but not "*innocent*"

Noticeably enough, some of marine mammals' other less-human qualities are not highlighted. Their skills as efficient and brutal apex predators, similar to sharks, is not underlined. Although they have a similar diet, sharks are seen as vicious and dolphins are seen as cute. If anything dolphins are clever and more strategic in their killing methods. Killer whales are well-known team killers and use different strategies for different prey such as harassment of mother-calf pairs (whales and dolphins), wave-washing (seals), beach storming (sea lions, elephant seals), karate chop (sharks), pod pin (narwhals), blowhole block (large whales) and carousel (fish)[83]. The killing-not-for food behaviour of some species, both towards their counterparts and other marine mammal, remains largely untold as well as their picky-consumer side (killing a large whale and only eating bites of it). The harsh and aggressive behaviour, both sexual (rape of females and subordinate males) and against pups is not much depicted.

The general public believes, or is made to believe, that marine mammals are cute and cuddly and innocent, but sharks are cruel and evil and bad. Many shark species face serious conservation issues, but only few care. Marine mammals are both nature at its likable side and at its worse, they are *nature* and nature is by definition an a-moral world, where survival and gene-spreading are the key elements. Killer whales and sharks are not a-moral, they are what they should be, what nature made them, efficient and effective top predators.

9.4 An ethical issue?

Ethics can be defined as the moral values and rules which govern our conduct. It tells us what is right and what is wrong and is a choice between alternatives. It varies between cultures, religions and even individuals and often involves very emotional discourses. This is particularly true for animal ethics. As part of the debate on the human duties towards animals and animal rights, the ethical aspect of using wild animals as food resources, and among them marine mammals, has been discussed revealing a clash of cultures between *killing and using* vs *preservation*, between a more traditional utilitarian view and a mostly urban dialogue. Palmer and Sandøe (2011) underline that "*It's important to adopt a reasoned approach to animal ethics, rather than one based on feelings alone. Reliance on feelings makes for difficulty in entering ethical debates, and in explaining to others why particular attitudes or practices are either problematic or beneficial*".

Throughout times, wild animals have been a critical resource for humans and human survival. Wild animals have been fished, trapped and hunted to acquire food, clothing and utensils. Wild animals also have assumed cultural and spiritual significance and been objects of reverence, as witnessed by cave paintings, rock carving, mythology and more modern art pieces. Over the last few centuries different moral visions of the right of humans to utilize wildlife have emerged and three key concepts - wise or sustainable use, preservation (protect nature from use), and animal welfare – are today central to the discussions concerning the use and management of wild animals (Sandøe et al 2008). Both the *wise use of nature* and the *preservation of nature* approach reject, the marginalisation or destruction of wildlife, and underline the responsibilities humans have to wild animals.

The people's right to utilise natural resources lies at the very core of NAMMCO and NAMMCO countries, which consider that the use of marine mammals is ethically defensible if it is sustainable and responsible (minimising suffering and resource waste).

[83] E.g. see http://www.pbs.org/wnet/nature/killer-whales-killer-weapon-brain/11352/

9.5 Another side of ethic and a problematic focus with durable consequences

Human impacts on marine mammals and their environment is both direct and indirect, local and global, impacting the conservation of marine mammal populations at different levels of magnitude. Whaling and sealing in the NAMMCO context are local, controlled and managed stressors, which impact limited to the individual level and not impairing stock survival. The direct and indirect effects of climate change and pollution of the marine environment are in essence global stressors, which will *globally* impact the marine environment with long-term or irreversible consequences. However, it seems that these global threats have more difficulty getting the focus of the wider western urban public and triggering real political consensus – and *effective* actions.

Climate change, which will have in the Arctic serious negative impacts on ice cover dependent wild species, has been described as a "perfect moral storm" (Gardiner 2011). It embraces global, intergenerational and theoretical dimensions, scientific uncertainty and the skewed vulnerability of those least responsible. It confronts serious ethical issues of fairness and responsibility across individuals, nations, generations, and the rest of nature (Gardiner and Hartzell-Nichols 2012). Global warming, affecting the Arctic at a rate of almost twice the global average, will have severe effects on living conditions both for people and wildlife. The natural habitat of ice-dependant species (e.g. polar bears, walrus and ringed seals) will diminish dramatically seriously impacting the species resilience.

Global stressors, like POPs contamination, affect thousands of kilometres away from their origin the overall wealth, resilience and sustainability of Arctic species, thus affecting the food security of Arctic coastal communities who have had little contribution to these stressors. In specific cases, they are likely to affect species survival much more than controlled sustainable removals. Pollution is likely already bringing dysfunction and extinction in uncontrolled ways for some European marine mammal populations, like killer whales, bottlenose dolphins and harbour porpoise, and other wildlife (Murphy et al 2015, Jepson et al 2016, Jepson and Law 2016).

The cessation of controlled and sustainable harvests is asked for in the name of ethics and the preservation of marine mammals. However, the uncontrolled removing of a higher number of marine mammals through by-catch and entanglements in fishing gears, more detrimental in essence to marine mammal conservation, continues with limited monitoring, assessment of effects and mitigation. In parallel, there is a strong stakeholders' pressure for limiting the scope of any by-catch regulations and their implementation - as for example in the European Union with Council Regulation (EC) No 812/2004, as well as for limiting the scope of new monitoring efforts. It appears that incidental catches, or by-catch, seem to be less of an ethical issue than direct catches, as they are incidental and therefore direct human responsibility is not engaged. But is it ethically correct to consider these catches *incidental*, when the risks of by-catch are completely foreseeable and predictable? Certain type of gears, in certain areas, used in a certain way are known, and have long be known, to catch marine mammals. If marine mammals should be protected *in essence*, and not because they are endangered, then all effort should be taken and highly prioritised to stop these catches by any means and at any cost. This is especially so when the animals are simply discarded and wasted, i.e. do not contribute to the well-being or survival of any human communities, and especially have significant animal welfare issues, as by-catch and entanglements in fishing gears have.

In the name of ethic and morality, coastal communities are required by outsiders not affected by consequences to abandon local food resources with societal, cultural and spiritual value, that are abundant, not-threatened and have high nutritional quality, for the benefit of imported foods that are flown in, expensive with intrinsic uncontrollable prices, of lower nutritional quality but higher carbon footprint. Recalling the implications and meaning of food security as defined by the World Summit on Food Security, is it ethically acceptable that a group of persons or a nation pass judgement on other people's food preferences, as long as the harvesting is done in a sustainable and responsible manner, taking into considerations animal welfare issues?

10. CONCLUSION: MARINE MAMMALS – WHY NOT?

The management and use of wild animals generates ethical disagreements and dilemmas in which human needs, preferences, and interests, concern for individual animal welfare, and the value of biodiversity, ecosystems, and wild nature are part of the discussion (Gamborg et al. 2012).

NAMMCO parties strive to conciliate – or/and re-conciliate - cultural diversity and environment/moral principles. NAMMCO strives to ensure the sustainability of any removals, whether the resulting products are consumed locally for free, sold on national and international markets, or dumped back to the sea as by-catch. Provided that they are strictly regulated to ensure that they are sustainable and responsible, whaling and sealing are environmentally-sound ways of obtaining food.

Marine mammals are overlooked as potential food resources because of the resistance of some to see them as such for a variety of reasons, which include wildlife conservation and food safety, but are mainly grounded on moral and ethical arguments of animal rights. Marine mammals, in particular whales and dolphins, are perceived of as an animal category of itself, a charismatic endangered category, which should not be seen as resources. Although recognising the majestic appearance of many marine creatures - not the least whales and other marine mammals, NAMMCO does not distinguish between charismatic or non-charismatic species. Every components of the marine ecosystem have their importance and have synergic roles to play. Marine living creatures, from plankton to marine mammals, are potential resources. Healthy populations may be harvested to contribute to ensuring food security. But harvests should be soundly managed, under five overall principals: *ecosystem-based approach (*integrated management of human activities based on the best available scientific and traditional knowledge about the ecosystem*), sustainability* (sustainable use underpinned by effective science-based conservation measures), *responsibility* (best practices, minimization of animal suffering and food waste), *transparency* (documented and accessible management processes) and *accountability* (to the environment, the users and the wider public).

Environmental NGOs have raised public awareness of the need for wildlife protection, which has been very beneficial to conservation, and in the case of marine mammals has allowed many depleted population and stocks to recover. However, the agenda has been steered away from *wise/sustainable use* towards a *total preservation* and/or a focus on the protection of wild animals from cruelty. This is particularly evident in the debate about the protection/conservation of marine mammals. The IWC was set up after World War II to regulate the hunting of large whales and ensure that whale species would not be depleted – i.e. that they would be restored to and maintained at a level that would allow whaling in the future. However, the majority of IWC members increasingly turned towards the idea of banning all commercial whaling. The "temporary" ban implemented in 1986 has not been lifted – even for populations of whales that are recognised as healthy by the IWC itself and could tolerate controlled harvests.

Many of the marine mammal stocks in the NAMMCO area can unquestionably support controlled removals. The ethical dilemma, the choice between using and not using them as food resource should be viewed in a holistic, ecosystem-based perspective. What is environmentally ethical, i.e., which alternative bears the lowest ecological cost? In the Arctic and Northern perspective, the alternative to the controlled, non-polluting and energy-efficient use of a local, renewable, highly nutritive, societally and culturally meaningful resource is to import flown-in food of lower nutritional quality. Any flown-in meat or vegetable (not taking into account food preferences) will result in an increased carbon footprint (both), increased animal welfare price (livestock incl. poultry), increased GHGs emission (livestock accounts for 51% of annual worldwide human-caused GHGs emissions) and increased deforestations (both).

Who should decide: the coastal communities who will bear the consequences of the choice or the outside world who will not face the consequences? As the harvests in question are sustainable and the cultural and supporting services provided by the resources will therefore be maintained for humanity, NAMMCO believes that the most ethical is to give responsibility to the coastal communities to decide whether they want to use healthy marine mammal stocks as food resources.

NAMMCO supports ecological, social and cultural diversity and sustainability and pledges for a holistic debate, where the real and global threats to marine ecosystems are addressed. Explicit consideration of the values at stake and scientific-based information are the key elements to any nuanced dialogue on the use of any resources, including marine mammals. Information is a prerequisite to balancing the *rights to and interests in* a sustainable living of coastal communities with the local and global cultural value of marine mammals, i.e., balancing their ecosystem value as provisioning (providing food) and cultural services.

It is probably neither ethically sound nor environmentally prudent to base the management of living resources on the commandment in George Orwell's Animal Farm: "All animals are equal, but some animals are more equal than others" (Johansen 2006). The marine mammals exploited by NAMMCO countries, and at the present scale, are clearly not threatened, therefore the efforts and money spent in stopping seal hunting and small coastal whaling would be better spent on animal species that were worse off, and on pressing issues more universal in essence and consequences, e.g. by-catch and marine pollution for example. As Dorsey (2013) underlines, marine mammals should not share the faith of the bison: saved from extinction but with its ecosystem vanished and therefore left as a zoological curiosity.

In the face of climate and other environment changes and their unforeseeable consequences for marine mammals and local communities, NAMMCO likes to repeat and underline that it is essential to join forces. The scientific cooperation between organisations dealing with marine mammal conservation should be strengthened for the benefits of seals and whales (NAMMCO 2016b), and focus and acts should be directed towards conservation issues of importance to the global environment.

APPENDICES

Appendix 1. Description of marine mammal hunting activities in NAMMCO countries, including relevant legislations and associated monitoring schemes.
Appendix 2: The right to marine mammal resources, also a question of indigenous peoples' rights

REFERENCES

AC [Arctic Council]. 2013. Ecosystem-Based Management in the Arctic. Arctic Council. 63pp.

ACIA. 2005. Arctic Climate Impact Assessment. Cambridge University Press. 1042pp.

Alverson, D.L.; Freeberg, M.H.; Pope, J.G.; Murawski, S.A. 1994. A global assessment of fisheries bycatch and discards. FAO Fisheries Technical Paper. No. 339. Rome, FAO. 1994. 233p. http://www.fao.org/docrep/003/T4890E/T4890E00.htm#TOC

Anon. 2002. The Faroe Island – a North Atlantic perspective on sustainable development. Tòrshavn, Prime Minister Office.

Anon. 2003-2004. Norsk sjøpattedyrpolitikk [Norwegian White paper on marine mammals]. Det Kongelige Fiskeridepartment. St.meld. nr.27. 125pp. http://odin.dep.no/

Anon. 2008-2009. Norsk sjøpattedyrpolitikk [Norwegian White paper on marine mammals). Det Kongelige Fiskeridepartment. St.meld. nr.46. 40pp. http://odin.dep.no/

Anon. 2011a. Risks versus Benefits of Whale and Seal Consumption. Workshop Report, January 14, 2011, Copenhagen. Norden. http://setur.fo/fileadmin/user_upload/NVD/Horaldur/Workshop_Report.pdf

Anon. 2011b. Norwegian Scientific Committee for Food Safety: Human pathogens in marine mammal meat, ISBN 978-82-8259-018-1. http://www.vkm.no/dav/2d1eef41a7.pdf

Anon. 2014. Norwegian Environment Agency. Scientific Basis for the updating of the Norwegian Management plan for the Norwegian Sea. 248pp

Baines et al. 2015. Investigating the effects of arctic dietary intake on lung health. Eur J Clin Nutr. 2015 May 27. Doi: 10.1038/ejcn.2015.85.

Bejder, L., Samuels, A., Whitehead, H., Gales, N., Mann, J., Connor, R.C., Heithaus, M.R., Watson-Capps, J., Flaherty, C. and Krutzen, M. 2006. Decline in Relative Abundance of Bottlenose Dolphins Exposed to Long-Term Disturbance. *Conservation Biology*, 20: 1791–1798.

Bertulli, C.G., Leeney, R.H, Barreau, T. and Matassa, D.S. 2016. Can whale-watching and whaling co-exist? Tourist perceptions in Iceland Journal of the Marine Biological Association of the United Kingdom 96(4), 969–977.

Bogstad, B., Gjøsæter, H., Haug, T. and Lindstrøm, U. 2015. A review of the battle for food in the Barents Sea: cod vs. marine mammals. Frontiers in Ecology and Evolution 3:29. 17pp.

Caddell, R. 2013. Marine Mammal Management in the North Atlantic: Challenges and Opportunities for NAMMCO. Presentation to the 21st Council Meeting of NAMMCO, September 2012, Svolvær, Norway. *In* NAMMMCO Annual Report 2012. North Atlantic Marine Mammal Commission. Tromsø, Norway. 642pp.

Caulfield, R.A. 1997. Greenlanders, whales and whaling: Sustainability and self-determination in the Arctic. University Press of New England. 203pp. Clapham, P.J., Young, S. and Brownell, Jr., R. 1999, Baleen Whales: Conservation Issues and The Status Of The Most Endangered Populations. *Publications, Agencies and Staff of the U.S. Department of Commerce.* Paper 104. http://digitalcommons.unl.edu/usdeptcommercepub/104

CCA [Council of Canadian Academies]. 2014. Aboriginal Food Security in Northern Canada: An Assessment of the State of Knowledge, Ottawa, ON. The Expert Panel on the State of Knowledge of Food Security in Northern Canada, Council of Canadian Academies. 256pp.

Clapham, P.J. 2016. Managing leviathan: Conservation challenges for the great whales in a post-whaling world. *Oceanography* 29(3), http://dx.doi.org/10.5670/ oceanog.2016.70.Cone, M. 2005. Silent snow – the slow poisoning of the Arctic. Grove Press.

Costa, D.P., Weise, M.J. and Arnould, J.P.Y. 2006. Potential influences of whaling on the status and trends of pinniped populations. Chap. 17. *In*. J.A. Estes, D. Demaster, D.F. Doak et al, eds, Whales, whaling and ocean ecosystems. University of California Press, Los Angeles. 401ppCostello, M.J. and Baker, C.S. 2011. Who eats sea meat? Expanding human consumption of marine mammals. Biological Conservation 144: 2745–2746. http://www.scienceadvice.ca/uploads/eng/assessments%20and%20publications%20and%20news%20releases/food%20security/foodsecurity_fullreporten.pdf

Dewailly E, Mulvad, G.,Pedersen, H.S, Hansen, J.C., Behrendt, N. and Hart Hansen, J.P.. 2003. Inuits are protected against prostata cancer. Cancer Epidemiol Biomarkers Prev *12;* 926. http://cebp.aacrjournals.org/content/12/9/926.long

Dorsey, K. 2013. Whales and Nations.Environmental Diplomacy on the High Seas. University of Washington Press. 370pp.

Egeland, G. M., Pacey, A., Cao, Z. and Sobol, I. 2010. Food Insecurity among Inuit preschoolers: Nunavut Inuit Child Health Survey, 2007-2008. Canadian Medical Association Journal. 182(3): 243-248.

Egeland, G.M., Williamson-Bathory, L., Johnson-Down, L., Sobol, I. 2011. Traditional food and monetary access to market-food: correlates of food insecurity among Inuit preschoolers. International Journal of Circumpolar Health, 70(4), 373-383.

Ellis, R. 1991. Men and whales. Alfred A. Knopf, New York. 542pp.

Epstein, C. 2008. The power of words in international relations. Birth of an anti-whaling discourse. The MIT Press. (Politics, Science, and the Environment). Cambridge, Massachusetts. 333pp.

FAO 1995. The role of fisheries in food security. Committee on Fisheries, 21st Session, 10-15 March 1995. Paper COFI/95/Info.10. FAO, Rome.

FAO. 2009. FAO and Traditional Knowledge: The Linkages with Sustainability, Food Security and Climate Change Impacts. FAO, Rome. 9pp.
FAO. 2016. Climate change and food security: risks and responses. Available at http://www.fao.org/3/a-i5188e.pdf
Fielding, R. 2011. Environmental change as a threat to the pilot whale hunt in the Faroe Islands. Polar Research 29:430-8.
Freeman, M.M.R. 2000. Endangered peoples of the Arctic. Struggles to survive and thrive. The Greenwood Press, London. 279pp.
Freeman, M.M.R. 2001. Small-scale whaling in North America. In J. R. McGoodwin, ed., Understanding the Cultures of Fishing Communities: A Key to Fisheries Management and Food Security. FAO Fisheries Technical Paper 401. Available at http://www.fao.org/docrep/004/Y1290E/y1290e0f.htm#bm15
Freeman, M.M.R. 2005. "Just one more time before I die": Securing the relationship between Inuit and whales in the Arctic regions. Senri Ethnological Studies 67: 59-76.
Freeman, M.M.R., Bogoslovskaya, L., Caufield, R.A. et al. 1998. Inuit, whaling and sustainability. Walnut Creek, CA: AltaMira Press. 208pp.
Freeman, M.M.R. and Kreuter, U.P. (eds) 1994. Elephants and whales. Resources for whom? Gordon and Breach Science Publishers. 321pp.
Ford, J.D. and Goldhar, C. 2012. Climate change vulnerability and adaptation in resource dependent communities: a case study from West Greenland. Clim. Res. Vol. 54(2): 181–196.
Gambell, R. 1999. The International Whaling Commission and the contemporary whaling debate. Pp. 179 -198, in J.R.Jr. Twiss and R. Reeves, eds, Conservation and Management of marine mammals. Smithsonian Institution Press, 471pp.
Gamborg, C., Palmer, C. & Sandoe, P. 2012. Ethics of Wildlife Management and Conservation: What Should We Try to Protect? *Nature Education Knowledge* 3(10):8.
Gardiner, S.M. 2011. *A Perfect Moral Storm: The Ethical Challenge of Climate Change*. Oxford, UK: Oxford University Press.
Gardiner, S. M. and Hartzell-Nichols, L. (2012) Ethics and Global Climate Change. *Nature Education Knowledge* 3(10):5.
GEAS. 2012. Growing greenhouse gas emissions due to meat production. Global Environment Alert Service - UNEP. 10pp. Available at http://www.unep.org/pdf/unep-geas_oct_2012.pdf.
GESAMP (2015). "Sources, fate and effects of microplastics in the marine environment: a global assessment" (Kershaw, P. J., ed.). (IMO/FAO/UNESCO-IOC/UNIDO/WMO/IAEA/UN/UNEP/UNDP Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection). Rep. Stud. GESAMP No. 90, 96 p.
Godfray, H.C.J., Beddington, J.R., Crute, I.R. et al. 2010. Food security: The challenge of feeding 9 billion people. Science (Review) 327: 812-18.
Goldhar, C., Ford, J.D., Berrang-Ford, L. 2010. Prevalence of food insecurity in a Greenlandic community and the importance of social, economic and environmental stressors. Int J Circumpolar Health 69(3):285-303.
Goodland, R. and Anhang, J. 2009. Livestock and Climate Change. What if the key actors in climate change were pigs, chickens and cows? Worldwatch November/December 2009, Worldwatch Institute, Washington, DC, USA, pp. 10–19.
Government of Greenland. 2012. White paper on management and utilisation of large whales in Greenland. In International Whaling Commission IWC/64/ASW7 2014. 95pp.
Grandjean, P., Henriksen, J.E., Choi, A.L., Petersen, M.S., Dalgård, C., Nielsen, F. and Weihe, P. 2011. Marine food pollutants as a risk factor for hypoinsulinemia and type 2 diabetes. *Epidemiology* 22:410–417.
Grønnow, B. and Meldgaard, M. 1988. Boplads i dybfrost: fra Christianshåb Museums udgravninger på vestgrønlands ældste boplads. *Naturens Verden*: 409–440.
Hansen, J.C., Deutch, B. and Odland, J.Ø. 2008. Dietary transition and contaminants in the Arctic: emphasis on Greenland. Oulu: International Association of Circumpolar Health. p. 1-96.
Hardy, B. 2006. A regional approach to whaling: how the North Atlantic Marine Mammal Commission is shifting the tides for whale management. Duke Journal of Comparative & International Law 17:169-198.
Heide-Jørgensen, M.P., Laidre, K., Borchers, D., Samarra, F. and Stern, H. 2007. Increasing abundance of bowhead whales in West Greenland. Biol. Lett. (2007) 3, 577–580. http://rsbl.royalsocietypublishing.org/content/roybiolett/3/5/577.full.pdf
Higham, J., Bejder, L. and Williams, R. (eds.). 2014. *Whale-watching: Sustainable Tourism and Ecological Management*. Cambridge University Press, Cambridge, UK, 387 pages.
Huet, C., Rosol, R., Egeland, G.M. 2012. The Prevalence of Food Insecurity is High and the Diet Quality Poor in Inuit Communities. The Journal of Nutrition 142(3): 541-7.
ICC [Inuit Circumpolar Council]. 2012. Food security across the Arctic. Background paper of the Steering Committee of the Circumpolar Inuit Health Strategy. 12pp. available at http://www.inuitcircumpolar.com/uploads/3/0/5/4/30542564/icc_food_security_across_the_arctic_may_2012.pdf
IPCC [Intergovernmental Panel on Climate Change]. 2007. *Climate Change 2007: The Physical Science Basis. Contribution of Working Group 1 to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* (eds. S. Solomon, D. Qin, M. Manning, Z).
IPCC [Intergovernmental Panel on Climate Change]. 2013. *Climate change 2013: the physical science basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press, Cambridge, United Kingdom.
IPCC [Intergovernmental Panel on Climate Change]. 2014. Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland, 151 pp.
ITK [Inuit Tapiriit Kanatami] and ICC. 2012. Inuit and the Right to Food. Submission to the United Nations Special Rapporteur on the Right to Food for the Official Country Mission to Canada. 14pp. http://www.inuitcircumpolar.com/uploads/3/0/5/4/30542564/icc.itk.inuit_and_the_right_to_food-for_un_rapporteur_on_the_right_to_food.pdf
Jepson, P.D., Deaville, R., Barber, J.L. et al. 2016. PCB pollution continues to impact populations of orcas and other dolphins in European waters. Scintific Reports 6: 18573. 15pp.
Jepson, P.D. and Law. 2016. Persistent pollutants, persistent threats. *Science* 17 (352): 1388-1389.

Joensen, J. P. 2009. Pilot Whaling in the Faroe Islands. History. Ethnography. Symbols. Tórshavn, 295 pages. Faroe University Press. ISBN: 978-99918-65-25-6

Johansen, H.P. 2006. Opposition to whaling – arguments and ethics. *In* J.E. Ringstad, ed, *Whaling and History II – New perspective*, Whaling Museum of Sandefjord.192pp.

Laidre, K., Stern, H., Kovacs, K.M., et al. 2015. Arctic marine mammal population status, sea ice habitat loss, and conservation recommendations for the 21st century. Conservation Biology, Volume 29(3): 724–737.

Lal, R., Miller, F.P. & Logan, T.J. 1988. Are intensive agricultural practices environmentally and ethically sound? Journal of Agricultural Ethics 1(3): 193-210.

Law, K.L. and Thompson, R.C. 2014. Microplastics in the Sea. Science 345(6193):144-5.

MacDonald, J. P., Huet, C. and Ford, J. 2015. The commercialization of country food and food security: The case of Greenland and what Nunavut can learn. Abstract. 16th International Congress on Circumpolar Health, June 8-12, Oulu, Finland. http://icch16.oulu.fi/site/files/Abstracts/Poster-abstracts/C9.pdf

Mulvad, G.,Pedersen, H.S, Hansen, J.C., et al. 1996: The Inuit diet. Arctic Med Res. 55 Suppl. 1:20-4. Murphy, S., Barber, J.L., Leamonth, J.A. *et al. 2015.* Reproductive failure in UK harbour porpoises *Phocoena phocoena*: legacy of pollutant exposure? *PLOS ONE* **10(7),** e0131085. doi: 10.1371/journal.pone.0131085 NAMMCO. 2000. Report of the Scientific Committee. In: NAMMCO Annual Report 1999. NAMMCO, Tromsø, Norway, pp. 125-211. [Fin whale from page 143]

NAMMCO 2005. Report of the NAMMCO Workshop on Hunting Methods for Seals and Walruses. Pp 63-126. *In* NAMMMCO Annual Report 2004. North Atlantic Marine Mammal Commission. Tromsø, Norway. 353pp.

NAMMCO. 2007. Expert meeting on potential positive health effects of consuming whale and seal oil. 3 October 2007. Copenhagen, Denmark. North Atlantic Marine Mammal Commission. Tromsø, Norway. 16pp.

NAMMCO. 2000. Report of the NAMMCO Scientific Committee Working Group on North Atlantic Fin whales. Pp 189-214. In NAMMMCO Annual Report 1999. North Atlantic Marine Mammal Commission. Tromsø, Norway. 265pp.

NAMMCO. 2001. NAMMMCO Annual Report 2000. North Atlantic Marine Mammal Commission. Tromsø, Norway. 359pp.

NAMMCO. 2016a. Report of the Meeting of the Working Group on Coastal Seals, March 2016, Reykjavík, Iceland. *In* Report of the 2016 Meeting of the NAMMCO Scientific Committee.

NAMMCO. 2016b. Annual report 2015. North Atlantic Marine Mammal Commission. Tromsø, Norway. 374pp.

NAMMCO. 2016c. Report on the Symposium on "Impacts of Human Activities on Arctic Marine Mammals". October 2015, Copenhagen, Denmark. North Atlantic Marine Mammal Commission. Tromsø, Norway.

Niclasen, B., Davison, C., King, N., Pickett, W.L. 2015. Self-assessed food poverty among school children - a comparison between Greenland and Northern Canada. Abstract. 16th International Congress on Circumpolar Health, June 8-12, Oulu, Finland. http://icch16.oulu.fi/site/files/Abstracts/S19P04.pdf

Niclasen, B., Molcho, M., Arnfjord, S.and Schnohr, C. 2013b. Conceptualizing and contextualizing food insecurity among Greenlandic children. International Journal of Circumpolar Health, [S.l.], v. 72. ISSN 1797-237X. Available at: <http://www.circumpolarhealthjournal.net/index.php/ijch/article/view/19928>. Date accessed: 21 Mar. 2016. doi:http://dx.doi.org/10.3402/ijch.v72i0.19928.

Niclasen, B., Petzold, M. and Schnohr, C.W. 2013a. Adverse health effects of experiencing food insecurity among Greenlandic school children. Int J Circumpolar Health. 2013; 72: 10.3402/ijch.v72i0.20849.

NIFES [Norwegian Food Safety Authority]. 2012. Årsrapport 2011, Mattilsynet. Fremmedstoffer I villfisk med vekt på kystnære farvann: Delrapport II- undesøkelser av hval. NIFES August 20 http://nifes.no/wp-content/uploads/arsrapport-fremmedstoffer-i-villfisk-2011-hval-9-okt-.pdf

Norden. 2013. Hunting and Protecting of Marine Mammals – A Clash of Cultures? Nordic Committee on Bioethics. Retrieved from http://ncbio.org/nordisk/arkiv/mammals-report-final.pdf

Norden. 2015. Synthesis Report. Blue Growth in the North East Atlantic and Arctic. Working paper. Nordic Marine Think Tank. 35 pp. Retrieved from http://cdn.norden2015.fo/media/1077/synteserapport-sidste-version-tema-nord-format-fin.pdf

Øigård, T.A., Haug, T. & Nilssen, K.T. 2014. Current status of hooded seals in the Greenland Sea. Victims of climate change and predation? Biol. Conserv. 172: 29-36. doi.org/10.1016/j.biocon.2014.02.007)

Palmer, C. and Sandøe, P. 2011. Animal ethics. In M. C. Appleby, J. A. Mench, I. A. S. Olsson, & B. O. Hughes (Eds.), Animal welfare. (2. ed., pp. 1-12). Chapter 1. CABI Publishing.

Papatsie, L. Ellsworth, L., Meakin, S. and Kurvits, T. 2013. "The right to food security in a changing Arctic: The Nunavut Food Security Coalition and the Feeding My Family campaign", Hunger, Nutrition, Climate Justice 2013, A new Dialogue: Putting People at the Heart of Global Development, 15-16 April 2013. https://issuu.com/departmentofforeignaffairs/docs/hncj_conference_papers

Pardilla, M., Prasad, D., Suratkar, S., and Gittelsohn, J. 2013. High levels of household food insecurity on the Navajo Nation. Public Health Nutrition. doi:10.1017/S1368980012005630. otts, J., Wilkings, A., Lynch, M. and McFatridge, S. 2016. State of Sustainability Initiatives Review: Standards and the Blue Economy. 207pp. International Institute for Sustainable Development (IISD). ISBN: 978-1-894784-74-0. Retrieved from https://www.iisd.org/sites/default/files/publications/ssi-blue-economy-2016.pdf.

Potts, J., Wilkings, A., Lynch, M. and McFatridge, S. 2016. State of Sustainability Initiatives Review: Standards and the Blue Economy. International Institute for Sustainable Development. 208pp. Available at http://www.iisd.org/ssi/standards-and-the-blue-economy/

Read. A.J. 2008. The looming crisis: interactions between marine mammals and fisheries. Journal of Mammal 89: 541−548.

Read, A.J., Drinker, P., and Northridge, S. 2006. *Bycatch of marine mammals in the U.S. and Global Fisheries.* Conservation Biology 20(1): 163-169.

Reeves, R.R., Ewins, P. J., Agbayani, S. et al. 2014. Distribution of endemic cetaceans in relation to hydrocarbon development and commercial shipping in a warming Arctic. Marine Policy 44: 375-389.

Reeves, R.R., McClellan, K. and Werner, T.B. 2013. Marine mammal bycatch in gillnet and other entangling net fisheries, 1990 to 2011. E*ndangered Species Research* 20:71–97, http://dx.doi.org/ 10.3354/esr00481.

Robards, M.D. and Reeves, R.R. 2011. The global extent and character of marine mammal consumption by humans: 1970–2009. Biological Conservation 144: 2770–2786.

Rosol, R., Huet, C., Wood, M., Lennie, C., Osborne, G., and Egeland, G.M. 2011. Prevalence of affirmative responses to questions of food insecurity: International Polar Year Inuit Health Survey, 2007-2008. International Journal on Circumpolar Health. 70(5): 488-497.
Sakakibara, C. 2011. Climate Change and Cultural Survival in the Arctic: People of the Whales and Muktuk Politics. American Meteorological Society - Ways of Knowing special collection. Journals online 3: 76-89.
Sanderson K. 1992. Grindadráp: a textual history of whaling traditions in the Faroes to 1900. MPh thesis, University of Sydney.
Sanderson K. 1994. "Grind"—ambiguity and pressure to conform: Faroese whaling and the anti-whaling protest. In M. Freeman & U.P. Kreuter (eds.): Elephants and whales: resources for whom? Pp. 187–201. Basel: Gordon and Breach.
Sanderson, K. and Gabrielsen, G. W., eds. 1996. Marine mammals and the marine environment. A collection of papers presented at the International Conference on Marine Mammals and the Marine Environment, Lerwick, Shetland, 20-21 April 1995. Special Issue. The Science of the Total Environment 186(1,2).
Sandøe, P., Christiansen, S. B. and Holst, B. 2008. Management and use of wild animals. In Ethics of animal use. (pp. 153-164). Chapter 10. Chichester: Blackwell Publishing Ltd.
Searles. E. 2002. Food and the Making of Modern Inuit Identities." Food & Foodways: History & Culture of Human Nourishment 10: 55–78.
Shoemaker, N. 2005. Whale meat in American history. Environmental History, 10 (2). pp. 269-294.
Sims, M., Cox, T. and Lewison, R. 2008. Modeling spatial patterns in fisheries bycatch: improving bycatch maps to aid fisheries management. Ecol Appl. 18(3):649-61.
Steinfeld, H., Gerber, P., Wassenaar, T., Castel, V., Rosales, M. and de Haan, C. 2006. Livestock's long shadow: Environmental issues and options. Food and Agriculture Organization of the United Nations (FAO), Rome, Italy. 391pp. Available at http://www.fao.org/docrep/010/a0701e/a0701e00.HTM
Sugino, T., Yasunaga, G. and Fukuda, M. 2013. Effect of whale meat extract on fatigue induced by physical load and by daily activities in humans. *Jpn. Pharmacol. Ther* 41 (9): 879-893 (in Japanese).
Thomas, P.O., Reeves, R.R. and Brownell, R.L. Jr. 2015. Status of the world's baleen whales. *Marine Mammal Science*, http://dx.doi.org/10.1111/mms.12281.Tilman, D., Cassman, K.G., Matson, P.A., Naylor, R. and Polasky, S. 2002. Agricultural sustainability and intensive production practices. *Nature* 418, 671-677. http://www.nature.com/nature/journal/v418/n6898/full/nature01014.html
UN [United Nations]. 2014. General Assembly. Document A/69/71 to the fifteenth meeting of the United Nations Open-ended Informal Consultative Process on Oceans and the Law of the Sea, entitled: "The role of seafood in global food security". 36pp.
UN [United Nations]. 2015. General Assembly. Document A/70/74 to the sixteenth meeting of the United Nations Open-ended Informal Consultative Process on Oceans and the Law of the Sea, entitled: ""Oceans and sustainable development: integration of the three dimensions of sustainable development, namely, environmental, social and economic"". 40pp. file:///C:/Users/gde/Documents/NAMMCO/Documents%20en%20preparation/Food%20security/UN-2015.pdf
UN [United Nations]. 2016. The First Global Integrated Marine Assessment. World Ocean Assessment I – Chapter 37. Marine mammals. ttp://www.un.org/Depts/los/global_reporting/WOA_RPROC/Title_Page.pdf
UNEP [United Nations Environment Programme]. 2007. Global Outlook for Ice and Snow. UNEP/GRID-Arendal, Norway. Available at http://www.unep.org/geo/geo_ice/PDF/full_report_LowRes.pdf
UNEP [United Nations Environment Programme]. 2013. Blue economy concept paper. Retrieved from https:// sustainabledevelopment.un.org/content/ documents/2978BEconcept.pdf
UNESCO. 2010. Energy Flow, Environment and Ethical Implications for Meat Production. ECCAP WG13 Report. 66pp. available at http://www.eubios.info/yahoo_site_admin/assets/docs/ECCAPWG13.83161418.pdf
Valdersnes, S., Måge, A., Waagbø, R., Lunestad, B.T. and Frøyland, F. 2014. Kjemisk testing av valolje og sammenligning med tidligere produkt av spekk. NIFES. Norway. 27pp.
Víkingsson, G.A. 2015. Decadal changes in distribution, abundance and feeding ecology of baleen whales in Icelandic and adjacent waters – A consequence of climate change? Dissertation for the degree of Doctor Philosophiae. Faculty of Biosciences, Fisheries and economics, Department of Arctic and Marine Biology. University of Tromsø, Norway. 54pp + associated publications.
Víkingsson, G.A., Pike, D.G., Valdimarsson, H. et al. 2015. Distribution, abundance, and feeding ecology of baleen whales in Icelandic waters: have recent environmental changes had an effect? Frontiers in Ecology and Evolution 3:6. 18pp.
WEF [Word Economic Forum]. 2008. The Global Risks Report 2008. 54pp. available at www.stat.berkeley.edu/~aldous/157/Papers/WEF_GlobalRisks_Report_2008.pdf
WEF [Word Economic Forum]. 2012. The Global Risks Report 2012. 7th Edition. 62pp. available at http://www3.weforum.org/docs/WEF_GlobalRisks_Report_2012.pdf
WEF [Word Economic Forum]. 2016. The Global Risks Report 2016. 11th Edition. 98pp. available at http://wef.ch/risks2016.
Weihe, P. and Joensen, H. D. F.2012. Dietary recommendations regarding pilot whale meat and blubber in the Faroe Islands. Int J Circumpolar Health 71:18594
Wenzel, G. 1992. Animal rights, human rights. Ecology, economy and ideology in the Canadian Arctic. University of Toronto Press. 206pp.
Wiig, O., Derocher, A.E., Cronin, M.M. and Skaare, J.U. 1998. Female pseudohermaphrodite polar bears at Svalbard. J Wildl Dis. 34(4):792-6.
WWF. 2013. Seals in Greenland - An important component of culture and economy. The Last Ice Area Project. WWF Denmark. 44pp. Available at: http://awsassets.wwfdk.panda.org/downloads/seals_in_greenland__wwf_report__dec_2013.pdf
WWF. 2015. All hands on deck: Setting course towards a sustainable blue economy. Retrieved from http://www.wwf.se/source.php/1605622/15-6802%20All%20Hands%20on%20Deck_LR_151008.pdf