IWC/M10/2

Report of the small working group on conversion factors (from whales to edible products) for the Greenlandic large whale hunt

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1 Introduction

1.1 Recent IWC discussions related to conversion factors and the Greenlandic request for humpback whales

The discussion of Greenlandic need for whale products and its multispecies component dates back to discussions within the IWC from the late 1970s and considerable documentation has been presented over the years and discussed at the IWC Annual Meetings, initially in the discussions of the Commission's Aboriginal Subsistence Whaling sub-committee.

The Greenlandic hunt is a multispecies hunt and for this reason, the 'need' statement (documentation of the cultural and nutritional requirements of the population) has traditionally been expressed in terms of tonnes of edible products of large whales, rather than in individual animals by species. It should be noted that the Scientific Committee's advice on catch limits is based first on whether hunting levels meet the Commission's conservation objectives and secondly whether they meet need. In an ideal world both objectives are met but where this is not possible, priority is given to long-term sustainability. To determine how need can be met in terms of long-term sustainable catches, then a conversion factor is required by species that turns 'strikes' (which may or may not result in a landed animal but which the Scientific Committee assumes always results in death) into tonnes of edible products. Based on information provided by Greenland, the conversion factors that have been considered by the Commission for many years are: common minke whales – 2 and fin whales – 10 (IWC/61/12).

The recent discussions arose out of the request from the Danish Commissioner in 2006, agreed by the Commission (IWC, 2007), for the Scientific Committee to consider whether sustainable catches could be taken from species other than the common minke whale (*Balaenoptera acutorostrata)* and the fin whale (*B. physalus*) that have been the focus of catching for many years[1]. In particular, the Committee was asked to examine the possibility of catches of bowhead whales (*Balaena mysticetus)* and humpback whales (*Megaptera novaeangliae)*. This request had been made in the light of Denmark's view that: (a) the estimated amount of edible products from the existing catch limits based on previously agreed conversion factors was well below the previously agreed estimated need for such products in West Greenland (670 tonnes)[2].

Subsequently, the Scientific Committee has examined the available data on abundance for bowhead and humpback whales. Using a newly developed approach to provide safe interim advice on catch limits for a period of up to 10 years, the Scientific Committee agreed that annual strike limits of two bowhead whales and ten humpback whales off West Greenland (numbers first requested by Denmark at the 2007 Annual Meeting - (IWC, 2008)) would not harm the stocks (IWC, 2009b).

[1] Humpback whales had also been caught by Greenland for many years but at the 1985 annual meeting this exemption was removed by the Commission (IWC, 1986) and an increase in the number of fin whales was agreed.

[2] IWC/41/13 submitted to the 1989 meeting of the Commission presented the Greenlandic information on conversion factors and need, subsequently expanded in TC/43/AS3 ADD.

At the 2007 Annual Meeting, there had been considerable discussion of Denmark's proposed Schedule amendment (IWC, 2008) which had included a proposal for up to ten humpback whales and a voluntary reduction in the quota of fin whales from 19 to 11 (IWC, 2009a). After a lengthy and difficult discussion, consensus could not be reached. For those countries who opposed the Danish proposal, in particular the EU countries and the 'Buenos Aires Group' of countries, the concerns expressed had primarily centred around the question of need. Prior to the vote, Argentina requested the Scientific Committee to provide advice on the yield of edible products and thus appropriate conversion factors for whales taken off Greenland and the Chair of the Commission had agreed. The catch limit proposal was defeated by 29 votes to 36 with 2 abstentions.

At the 2009 Annual Meeting, the Scientific Committee had considered the question of yield (the basis of the conversion factors which are the number of tonnes of edible products). Two analyses had been discussed (see Item 4.2 below) but the Committee had agreed that both had limitations. It agreed that:

"for it to be able to adequately address the question and to determine a conversion rate per strike, it would require reliable, representative data from the Greenlandic hunt. This would involve data on the measured weight of obtained edible products (meat, ventral grooves, skin/mattak) from an adequate sample of animals of each species and associated information on the individuals (sex, length, date of capture, position of capture). The Committee requests that Greenland collect such information and provide it, along with sampling and validation protocols and information on factors that may affect yield, to the Committee for its consideration."

At the 2009 Commission meeting, Denmark introduced a review document (IWC/61/12) that provided background to the Greenlandic request including information on exchange and distribution, the hunting methods and conversion factors, as well as an Annex listing all documents it had submitted to the Commission since 1979.

The Commission agreed to a proposal from the Chair that a small scientific group, convened by Greg Donovan, Head of Science at the Secretariat, be asked to look at the question of conversion factors and that the matter of the catch limits for the Greenlandic hunts be addressed at an intersessional meeting prior to the 2010 Annual Meeting.

1.2 Objective and *modus operandi*

The objective for the small working group (Table 1) as set by the Chair of the Commission was to examine the conversion factors used in determining need for the Greenlandic hunts and not to evaluate the need statement itself. In practice this was to be achieved by:

(1) obtaining an understanding of, and documenting, those elements of the Greenlandic hunts of relevance to the determination of appropriate conversion factors (tonnes of edible products per strike by species);

(2) collating and evaluating the existing information of relevance to determining conversion factors (including consultation with other potential data holders, analysts as well as published and 'grey' literature);

(3) if possible, using this to develop/update conversion factors - the group may recommend that these be considered interim;

(4) developing, as and if required, a detailed workplan (including sampling protocols) to collect new data to allow the estimation of final conversion factors;

(5) circulate a full report to Commissioners and Contracting Governments as soon as possible and certainly at least 3 weeks before any intersessional meeting.

A key component of (1) was to arrange a visit to Greenland to obtain a better understanding of the situation in Greenland itself and the factors that may affect yield. Not all members of the small working group were able to participate in the field trip for logistical reasons; the field trip was undertaken by Donovan, Palka, George and Levermann.

Table 1

The members of the small working group.

Greg Donovan	Head of Science IWC, Chair of SWG on AWMP and field experience in Greenland
Debi Palka	Chair of the Scientific Committee
Craig George	Member of Scientific Committee with experience in fieldwork on BCB bowhead whales
Philip Hammond	Ex-chair Scientific Committee, University of St Andrews, fieldwork in Greenland
Lars Witting	Scientist from Greenland Institute of Natural Resources and member of the Scientific Committee
Nette Levermann	Representative of the Government of Greenland

1.2.1 Short summary of the field trip

The primary aim of the field trip was to obtain a better understanding of the field conditions in Greenland that may affect yield. An important component of this was to observe the nature of the flensing sites and to interview the hunters about methods and techniques used. Ideally, the team would have been present to observe a flensing operation but the widespread geographical and temporal nature of the hunt meant that this would have to have been a fortuitous circumstance; in the event, no whales were caught whilst the team was present.

The objective was to try to visit a full range of flensing site types and to interview local hunters. The relative size of the catches of whales in the communities, the logistics of access and the time available to the team played an important part in determining the places visited. Three settlements (out of some 15) were chosen: Sisimiut; Ilulissat and Nuuk (see Fig. 1). These represent the three largest settlements in Greenland. All three have both harpoon and rifle hunts and a variety of flensing site types. Their percentage of the total catch by species for the period 2002-2008 is shown in Table 2. In addition, two of the three bowhead whales caught in 2009 were taken from Ilulissat.

Table 2

Summary of percentage of total Greenlandic catches of common minke and fin whales taken from the three settlements visited by the team, for the period 2002-2008

	Common minke whale			Fin whale
Place and population	Harpoon	Rifle	Total	Total (harpoon only)
Sisimiut (around 6,000)	15.58	6.21	12.80	6.02
Ilulissat (around 5,000)	4.71	6.90	5.03	26.51
Nuuk (around 15,500)	14.73	7.24	12.20	2.41
Total	35.02	20.35	30.03	34.94

The pattern for each visit was similar:

(1) arrive at the town and have a meeting with the local hunters and wildlife officers in the evening to (a) introduce ourselves and explain the purpose of the visit (b); ask questions relevant to the project (e.g. on the differences and similarities between harpoon and rifle hunts; methods of flensing; what products were considered edible; likely yields; distribution system of products; information collected and provided on the animals and products);

(2) go out on vessels (this varied from settlement to settlement and could be a hunting vessel or a government inspection vessel) the next day to visit flensing sites used by hunters from those places, accompanied by hunter representatives and wildlife officers;

(3) have a final meeting with local hunters and wildlife officers the following morning to check details and ask further questions if necessary;

(4) travel by small plane to the next settlement.

During the visit, the small working group was given access to the Greenlandic product records from 1987. In addition, information was obtained from other operations that may provide insight. The nature of these data is discussed under Item 3.2.

The small working group would like to record its great appreciation for the time, patience and openness with which the hunters and the wildlife officers showed the team while we were in Greenland; a list of people interviewed and places visited is summarised in Annex B.

Pinngortitaq naalagaavaq: 'Nature controls'

Fig. 1. Greenland, showing the three places visited in yellow and other hunting settlements in red (see Table 3). Note that the NW region is north of 67.5°N, the CW region is between 63.0°-67.5°N and the SW region is south of 63.0°N.

2 General information on Greenlandic whaling

2.1 Categories

There are two types of hunting of large whales off Greenland: the harpoon hunt (all species) and the rifle hunt (common minke whales only). These are discussed further under Items 2.1.1 and 2.1.2. Table 3 summarises the catches of common minke whales and fin whales for the period 2002-2008. About three-quarters of the common minke whales are taken by harpoon and one-quarter by rifle.

Table 3

Catches by municipality and by hunting type (H=harpoon; R=rifle and To=total). Note that the total is sometimes greater than H+R as in a few cases the report did not specify to hunting type. The final three columns show the percentage of catches of the total 2002-2008 period by each municipality. *visited by team

Year	2002			2003			2004			2005			2006			2007			2008			%2002-2008		
Type	H	R	To	H	R	To	H	R	To	H	R	To	H	R	To	H	R	To	H	R	To	H	R	To
Minke																								
*Ilulissat**	*0*	*4*	*4*	*2*	*3*	*5*	*2*	*3*	*5*	*4*	*3*	*7*	*6*	*2*	*8*	*16*	*1*	*17*	*9*	*4*	*13*	*4.7*	*6.9*	*5.0*
Kangaatsiaq	2	3	7	1	3	4	1	4	5	2	4	6	5	2	8	1	2	3	4	5	9	1.9	7.9	3.6
Maniitsoq	16	6	22	9	10	19	18	2	28	23	3	26	65	2	68	50	4	54	36	5	41	26.2	7.6	22.0
Nanortalik	2	5	7	6	7	13	3	4	7	7	5	12	1	2	3	0	0	0	0	1	1	2.3	8.3	3.7
Narsaq	13	3	16	22	4	27	8	1	10	6	2	8	4	2	6	4	1	5	2	2	4	7.1	5.2	6.5
*Nuuk**	*18*	*4*	*22*	*20*	*2*	*22*	*30*	*4*	*34*	*18*	*3*	*21*	*13*	*3*	*16*	*15*	*2*	*17*	*8*	*3*	*11*	*14.7*	*7.2*	*12.2*
Paamiut	2	3	6	8	3	11	8	2	10	9	2	11	7	3	10	11	1	12	8	2	10	6.4	5.5	6.0
Qaanaaq	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0.0	0.3	0.0
Qaqortoq	18	1	20	28	3	31	28	4	33	20	3	23	8	3	11	9	2	12	9	2	11	14.5	6.2	12.0
Qasigiannguit	2	2	4	1	1	3	0	0	0	2	2	4	0	1	1	1	1	2	0	3	3	0.7	3.4	1.5
Qeqertarsuaq	4	4	8	6	4	10	1	5	6	2	3	5	2	3	5	7	2	9	4	5	9	3.1	9.0	4.4
*Sisimiut**	*6*	*3*	*9*	*20*	*5*	*25*	*18*	*3*	*21*	*29*	*2*	*31*	*28*	*1*	*32*	*17*	*0*	*17*	*11*	*4*	*15*	*15.6*	*6.2*	*12.8*
Upernavik	0	0	0	0	2	0	0	2	7	0	5	5	0	5	5	0	5	5	0	7	7	0.0	9.0	2.6
Uummannaq	1	4	5	1	4	5	0	4	5	0	5	5	0	3	3	0	5	5	0	6	6	0.2	10.7	2.9
Aasiaat	4	2	7	4	1	5	3	2	5	5	3	8	0	3	3	0	2	3	4	6	10	2.4	6.6	3.5
No location			2			3			3			4			0			3			0			
Grand Total			139			185			179			176			179			164			151			

Fin (all H)	2002	2003	2004	2005	2006	2007	2008	%2002-2008
*Ilulissat**	*5*	*1*	*2*	*1*	*4*	*3*	*6*	*26.5*
Kangaatsiaq	1		1					2.4
Maniitsoq	1		2	1			4	9.6
Narsaq			1			1		2.4
*Nuuk**				*1*		*1*		*2.4*
Paamiut				1		1	1	3.6
Qaqortoq						1	1	2.4
Qasigiannguit	1		2	2	3	1		10.8
Qeqertarsuaq			1					1.2
*Sisimiut**			*2*	*2*		*1*		*6.0*
Aasiaat	4	3	1	4	3	3	2	24.1
No location	0	5	2	0	0	0	0	8.4
Grand Total	12	9	14	12	10	12	14	

2.1.1 Harpoon hunt

Vessels with a harpoon cannon (e.g. Plates I and II) take common minke, fin and also bowhead whales. Not all local communities have a vessel with harpoon cannon (since 2004, 3 out of 16 communities in West Greenland do not: Qaanaaq, Upernavik and Uummannaq). In recent years, of the approximately 60 fishing vessels equipped with a harpoon canon, some 35-45 are approved[3] for hunting and active in whaling during the season. Gunners must be trained and formal approval of the harpoon cannon is mandatory and required every second year. Courses are provided in the use of the harpoon and grenades and are compulsory to obtain a licence for the hunting of large whales.

The size of the vessels varies (9-20 m) with 75 % < 15m. A 30 foot (9m) vessel is required for minke whale hunting and 36 foot (11m) vessel for fin whale and bowhead whale hunting[4] Crew size also varies from around 4 to up to 7. The vessels operate opportunistically and seasonally i.e. they are not full-time whaling vessels but are also fishing vessels and crew members may also have other seasonal employment (Fig. 2 shows the monthly distribution of catches of common minke whales and fin whales by the harpoon hunt – the peak for the former is from June-October while for the latter it is August to September). For example, the timing of our visit coincided with the start of the caribou hunting season and was thus a lower intensity whaling period as the primary demand was for caribou meat. Hunting generally occurs in good sea conditions only (<Beaufort 3) as the main method of hunting is stealth. Trips generally last less than 24 hours and once a vessel has caught a whale it tows it to the nearest suitable flensing site (see below). Hunting usually occurs within 60n.miles of the home port of the vessel and depending on conditions up to 10n.miles offshore.

Maintaining and running a vessel used in whaling has inherent expenses over and above those of running an ordinary vessel. This is primarily due to the regulations that require the use of explosive grenade harpoons in order to maximise the humaneness of the hunt. A harpoon gun itself (essentially a one-off purchase) costs around US$60,000 while an individual grenade costs as much as US$1,000. In addition, a suitable high-powered rifle may be required to apply a coup de grace (30.06[5], 0.338, 0.375 or greater). Other expenses of course, include fuel, maintenance and crew remuneration if outside the family. The mixed distribution system summarised under Item 2.3.2 enables the hunters to meet these costs.

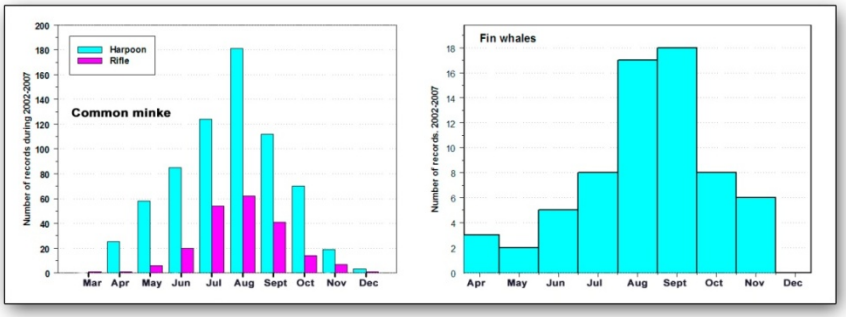

Fig.2 Recent monthly distribution of catches (for the years 2002-2007)

[3] executive order number 26 of 24 October 1997 on Extraordinary Check and Approval of Harpoon Cannons

[4] executive order number 9 of 17 April 2009 on Protection and Hunting of Large Whales

[5] executive order number 9 of 17 April 2009 on Protection and Hunting of Large Whales

Plate I. Examples of harpoon vessels; the team travelled on the Eli Fontaine (top) while visiting flensing sites in Sisimiut

Plate II. Harpoon gun and grenades

2.1.2 Rifle hunt

By contrast, the rifle hunt (that only takes common minke whales) is a co-operative hunt, using up to 8-10[6] small (usually around 6m and never more than 9m) vessels equipped with outboard motors (Plate III). Each boat generally contains around 2-4 people. The whale is killed using high powered rifles of acceptable

[6] A minimum of 5 is required in accordance to the executive order number 9 of 17 April 2009 on Protection and Hunting of Large Whales

calibre (30.06[7], 0.338, 0.375 and larger) and secured with hand harpoons and floats. One hunter is designated the leader and it is his task to secure the animal with the hand harpoon. As for the harpoon hunt, the animal is towed to the nearest suitable flensing site and whaling can only occur in good weather conditions (<Beaufort 3). The economic costs of such hunting are less than those of a harpoon vessel (although the number of participants requiring a share is greater and the amount available for sale is less). Again, this is a seasonal activity for the hunters. The peak season is from July-September (Fig. 2).

Plate III. The rifle hunt: a common minke whale caught and brought to a flensing site in 2008.

2.2 Edible products

The parts of the whale that are considered edible varies between regions and villages (Table 4). Particularly with respect to the internal organs (e.g. liver, heart and kidneys) and tongue which can vary from being considered a delicacy to being considered inedible. However, in all cases the following three major products constitute almost all of the edible production: meat (muscle or *negi*), blubber (*mattak*) and the throat pleats (ventral grooves or *qiporak*). In the case of the bowhead whale, the true blubber or dermis is trimmed into *mattak* which includes the epidermis with about 5cm of blubber (see Plate IV). In several cases, the captain retains the heart and kidney for use by his family. The intestines are generally not eaten. The pectoral fin (*naparutaq*), peduncle area (*singerneq*) and flukes (*sarpik*) are a delicacy and often retained by the captain and crew as well. These products, when reported, are included in the total weight on the harvest form, often under the heading "meat". In some places (e.g. Sisimiut) the tongue and intestines may be used to feed dog teams.

The size of animals targeted seemed to vary somewhat between villages. In Sisimiut, hunters reported that food products from large animals tended to be lower quality. Sisimiut hunters said they take larger (> 7.5 m) whales early in the season, as villagers are eager for fresh whale meat. Later they will take smaller whales when food quality (not quantity) is more of a consideration. Sisimiut hunters also commented that smaller animals (*ca* 6 m) were the best tasting, however they avoided whales in the 4-5 m range.

[7] in accordance to the executive order number 9 of 17 April 2009 on Protection and Hunting of Large Whales

Table 4

Summary of information on flensing, edible products and other information from hunter interviews (and see text). Other parts used refers to parts eaten in addition to blubber, muscle, throat, peduncle and flukes

Species	Flensing	Est. edible product	Parts used	Comments
Sisimiut				
Minke	1-4hr (some start on boat)	6m- 500kg 7m – 1500kg 7+m – 2000kg; in autumn the largest may be up to 3000 kg	heart (tongue and intestines not used) 6-7m best 9m animals 'tough	Heaviest animals taken in autumn; up to 500 kg more product; taken in both rifle and harpoon hunt
Fin	12-24hr (winches)	15m and up 10-13,000kg	Heart (grooves prized)	Harvest in summer sometimes up to 16 km offshore; 12 km offshore in autumn
Ilulissat				
Minke	0.5-4hr	5 m = 500 kg 7 m = 1500-2000 kg includes 300 kg blubber	heart, kidney, tongue	Few large (> 7 m) animals seen in area; may travel occasionally as far 600 km to hunt; whales are quite close to shore in autumn.
Fin	24-48 hr	10,000kg	heart, kidney, tongue	Flukes are delicacy;
Bowhead	48 hr	10,000 kg meat and mattak	Muscle, blubber, heart (tongue, intestines and heart not used)	Taken in spring; only large whales available; sub-optimal harvest site was used, some spoilage of organs
Nuuk				
Minke	1-4 hr	6m – 500-800kg 8m – 1200- 1600kg	heart, kidney, tongue, liver, intestines.	More large animals in the area; most organ meats used.
Fin	48hr	20m - up to 17,000 kg	heart	Mainly offshore

Plate IV. Edible products. This shows the multispecies nature of a hunters' lifestyle. This whaler is also drying fish, seal meat and caribou meat as well as whale products. In the bottom left hand side you can see his fish smoker, fuelled by local vegetation. *Mattak* can be seen bottom left.

2.3 Flensing and distribution of products

2.3.1 Flensing

There are a wide variety of flensing sites and a number of ingenious techniques used to manoeuvre the whale into a position on land to allow flensing to occur. Of the sites we visited, and in Greenland in general, winches were rare[8]. Towing animals is not easy and may increase the risk of losing the animal, thus hunters do not wish to tow animals great distances and so they usually have a number of sites that are suitable within a region – which is chosen will vary according to a number of features including size of the animal and the prevailing wind and weather conditions. Many of these are away from settlements. A number of different sites are illustrated in Plate V. A detailed (80pp.) description of the flensing sites visited by the team is obtainable from the authors.

The simplest technique to describe is that involving a winch, whereby the animal is attached by a cable around the flukes and then pulled ashore to be flensed. In such cases the whale is usually able to be dragged above the high tide mark. In other cases, the whale is towed at high tide and manoeuvred over the flensing site such that as the tide goes out, the animal is beached and flensing can begin. A similar approach can be used where the animal is towed near to a small island and then the vessel pulls the whale ashore from the far side of the island. The nature of the shore can also vary but the aim is to have a (slightly sloping) area that causes as little damage as possible to the animal when (if) it is dragged ashore. One site we visited had a heavy covering of kelp and seaweed that assisted the manoeuvring process.

The number of people flensing also varied from site to site and depending on the nature of the hunt (rifle or harpoon). Generally, all participants in the rifle hunt would participate in the flensing process. In the case of harpoon vessel hunting, additional flensers to the crew may be used for fin or bowhead whale flensing.

The time it takes to flense an animal will depend on a number of factors including size of the flensing team, weather conditions, nature of the site (e.g. if an animal could not be completely flensed in one tide cycle) and, of course, the size of the animal. Of the hunters (both rifle and harpoon) we interviewed flensing times were variable but ranged from:

- about 1-4 hours for common minke whales;
- 12-48 hours for fin whales;
- and about 48 hours for bowhead whales (although the experience with bowhead whales was limited as the hunt has only recently been reinstated and as ice conditions precluded use of the preferred flensing site that had been fitted with an extra winch – see Plate V).

Products from the whales are generally placed in suitable standard-sized plastic transportation boxes (280 litres) and taken to the homeport or nearest settlement. The use of these boxes can assist the hunters in the estimation of the products obtained.

[8] One flensing site in Ilulissat and one in Qeqertarsuaq has got winches. In general, natural sites that are suitable for the use of winches are rare. Winches themselves are also an added expense and only of major benefit for larger animals such as fin and bowhead whales.

Plate V (a). Examples of types of flensing sites: top: 'island' - Saqqap Avannaatunga nr Sisimiut; middle: slope with winches in sheltered inlet – Oqaatsut nr Ilulissat; bottom: slope in sheltered inlet – Assaqutak nr Sisimiut

Plate V(b). Top: rocky with kelp covered slope – Appannguit Iluat nr Nuuk; middle: rocky gentle slope, sheltered – Kuannerit Nuaa nr Ilulissat; bottom: flat area below water at high tide – Ittileq nr Sisimiut.

2.3.2 Distribution

Greenland has about 18 towns/villages and 60 settlements spread along some 44,000km of coastline, many of which are accessible only by sea or air, in some cases only for part of the year. As noted earlier, in two of the more isolated communities, only rifle hunting occurs and thus only common minke whales can be taken; in such cases all products are consumed within the village. In the other communities where multiple species can be taken, products are distributed via direct sharing, bartering or sales at local markets (Plate VI) and in some cases, transportation and sales to other towns and settlements that do not have direct access to whale products or for which there is a shortage. This may be via a co-operative supermarket chain or two distribution companies that are partially owned by the Greenlandic Government; Greenland is a very large island – for example the distance between Qaanaaq in the north and Nanortalik in the south along the coast is over 2,300km (see Fig. 1).

Plate VI. Market at Nuuk with whale, seal, fish and caribou products.

2.3.3 Efficiency

In our interviews with the hunters it was clear that there was no incentive for them *not* to obtain as much edible products from each whale as possible given the conditions. Although we were unable to watch the flensing of a whale, we did see the remains of one flensing operation of a common minke whale that had taken place a week earlier that suggested an efficient process (Plate VII), even allowing for birds attacking the carcase. This view is confirmed by the fact that the yield for common minke whales obtained from the Greenlandic data are similar to those obtained under 'ideal' conditions presented for North Pacific common minke whales by Japan (see Item 5.1.1). That being said, the conditions for flensing are not at all equivalent to those on a commercial whaling station (Plate VIII), in terms of ease of access, conditions and equipment. The opportunistic and geographically widespread nature of the hunt makes the building of equivalent land stations impractical in Greenland. Where appropriate and possible, hunters have made local improvements to increase efficiency e.g. an additional winch at the site where bowhead whales were expected to be flensed and at which fin whales are flensed – Plate IX. It appears generally true that larger whales (incl. large minke whales – see Fig. 4, p.26) are more difficult to fully flense (as well as capture) than smaller

whales given *inter alia* the time required (more than one tidal cycle) and difficulties in manoeuvring the animal during flensing, as discussed under Item 5.1.2.

Plate VII Remains of a common minke whale – one week after flensing occurred (Qasigiattaat near Ilulissat)

Plate VIII Icelandic land station operations at Hvalfjorður, early 1980s: catcher boat with two fin whales, flensing a fin

whale, land station (note the slipway on the left)

Plate IX. Flensing site Oqaatsut near Ilulissat, improved for landing bowhead whales – the new winch and base is at the rear

2.4 Regulations

The management of Greenland's living resources is divided between the Ministry of Fisheries, Hunting and Agriculture (responsible for the management of living resources, including commercially exploited fish species, terrestrial mammals and marine mammals and for trophy hunting/sport fishing) and the Ministry of Domestic Affairs, Nature e and Environment (responsible for international agreements and conventions regarding biodiversity and nature conservation).

In Greenland, there is no private ownership of land, sea or living resources. Hunting grounds and game animals are open to harvest and use by Greenlandic citizens, subject to hunting licenses[9]. However, only persons with a full-time occupational hunting license are allowed to hunt large whales, and there are a number of important conditions and limitations, including those related to catch limits, methods of hunting, training and reporting. In addition to Greenland Government rules there may also be additional rules set by the municipality[10].

[9] Home Rule Act no. 12 of 29 October 1999 on hunting with later amendments, as well as other regulations such as Home Rule Act no. 25 of 18 December 2003 on Animal welfare and Act no. 25 of 18 December 2003 on Nature Protection. Furthermore, a series of executive orders regulate the hunt for most species and the issuing of hunters' permits.

[10] Since 2009 the 18 municipalities have been merged into 4 regions

Permits for occupational hunters are based on a number of criteria. The applicant must be a permanent resident of Greenland, having lived here for a minimum of two years over the last decade, and must establish that hunting is a primary source of income (at least half of the applicant's income must be based on hunting and small-scale fishing). The licences are issued by the Ministry of Fisheries, Hunting and Agriculture, but the hunters' organization, the KNAPK, is involved before permits are issued.

There is a well-developed process for stakeholder participation in harvest management that includes KNAPK, the municipalities, the Greenland Institute of Natural Resources and the Environmental and Nature Protection Agency.

Hunting is regulated and administered by the Ministry of Fisheries, Hunting and Agriculture, and supervised by the Fisheries Licence Control Authority. Locally, a team of wildlife officers/wardens control hunting and fishing activities, making sure that conservation measures of protected areas and species are observed, and passing on information to the local community. The wildlife officers work in close cooperation with the municipalities, the police, Island Command Greenland, and the Government of Greenland. In 2009, 9 wildlife officers and up to 12 assisting wildlife officers were employed nationally. Wildlife officers are operating on the west coast as well as on the east coast.

Quotas set by the IWC apply to all three large whale species taken in Greenland. The quota year goes from January to December with different hunting periods: common minke whale 1 April to 31 December, fin whale 1 January to 31 December and bowhead whale 1 April to 31 December.

When a hunter catches an animal, he must inform the authorities and obtain a stamp on his licence. Hunters with a harpoon canon license need to show the bill for the purchase of the harpoon grenade together with the used grenade. Any sale of edible products is forbidden until the licence is stamped. If the catch happens at the weekend, it must be reported on Monday. When the municipality sees that the local quota is almost reached, it informs the Ministry of Fisheries, Hunting and Agriculture, and the time to stop the overall hunt is announced through a media release.

For large whales, a special report must be completed by the hunter shortly after the hunt (see Annex D). The Ministry of Fisheries, Hunting and Agriculture present annual hunting statistics, based on the statutory reports of catches by all hunters, in the information folder *Piniarneq*. The *Piniarneq* is sent to all licence holders and also made available online by the Government of Greenland.

3 Conversion factors

3.1 Review of publications on weight/length relationship

3.1.1 Lockyer (1976)

Lockyer (1976) reviews and brings together information on length-weight relationships and weights of edible products for baleen whale species and the sperm whale up to that time. The data used for species relevant to the Greenland hunt are almost all from the North Pacific or Antarctic: 39 fin whales (plus 2 from around Iceland), 20 minke whales (*Balaenoptera bonaerensis*) from the Southern Hemisphere (plus 3 of unknown origin), 24 humpback whales (but see below) and 19 North Pacific right whales, *Eubalaena japonica* (no bowhead data are presented). The raw data are given in an Appendix to the paper. The data were obtained by direct measurement of total length and weight of body parts but it should be noted that

these come from a variety of different studies by authors from a number of nationalities (and thus operations, conditions for collecting the data, etc.). In all cases for baleen whales, the weights were obtained in co-operation with a whaling operations and the result of a weighing of the various parts of the animals. It is not possible to determine the degree of similarity between studies, although all appear to have been carried out with scientists present. The author states that inaccuracies in weights of a single animal resulting from double weighing, loss of parts and inaccurate balance settings are within 5% according to two studies (Bjarnason and Lingas, 1954; Nishiwaki, 1950). Estimated weights are thought to be within 1-5% of true weight according to two small scale studies (Ash, 1953; Nishiwaki and Hayashi, 1950).

The equations used to predict weight (W) from length (L) were of the form $W = aL^b$ and weights were corrected for blood loss, estimated from other data as 6% of total weight. The estimates of a and b for each species are given in Lockyer (1976) table 1. No estimates of uncertainty are presented although the relationship could be refitted and precision estimated from the raw data presented.

The weights of muscle, blubber, bone and viscera are presented as percentages of total body weight in Lockyer (1976), table 3. There is no information on whether or not skin is included with blubber. At least for the baleen whales, these figures appear corrected in some way for blood loss as they do not sum to 100%, although the 'missing percentage' ranges from 1%- 5% so it is not quite clear how this was done. No estimates of precision are given in the table. Although the sample sizes are small, the results for the *average* percentage of muscle plus blubber (relative to total body weight) in the paper vary little among balaenopterid species, ranging from 66%-77% (67% for minke whales and 69% for fin whales but no estimate of intra or interspecific variation is given – table 3). However, it is interesting to note the wide variation in the average percentages of each (fin: 24% blubber and 45% meat; Antarctic minke: 15% blubber and 62% meat). There are no data presented on these percentages for humpback whales in the paper (although there are data for three animals in the Appendix) and the North Pacific right whale is the only balaenid represented (i.e. is the closest to the bowhead whale, although a different genus). Health and reproductive status can have a significant effect on body mass.

As the author recognises, there are a number of difficulties with the data used; the extent to which these are important depends on the use to which they are to be put. It should be noted that the data in Lockyer (1976) are not ideal for consideration of the Greenland hunt because not only are none of the data from whales taken off Greenland, virtually no data (apart from two fin whales) are from the North Atlantic; there are no data for bowhead whales or common minke whales (only North Pacific right whales and Antarctic minke whales – different species). The issue of humpback whales is considered below. In addition, as noted above, no full estimates of uncertainty are presented. Lockyer's table 3 shows that average percentage of muscle + blubber varies relatively little among the balaenopterid species and this might appear to give some confidence that the lack of data outside the North Atlantic may not be as important as one might at first believe. However, our analysis of the raw data included in the appendix of Lockyer's paper shows that there is quite a large range (both inter and intraspecific) in the individual and combined percentages (see Table 5). Where possible, we conclude, estimates for the North Atlantic are preferable for our study (see below).

In fact, the estimated relationship provided for humpback whales in the Lockyer paper (table 2) is somewhat different in nature from the other estimates. It appears to be taken directly from Ash (1953) who estimated the relationship not from direct weighing but by examining the number of 'apparatus

fillings' (processing equipment) for period in 1949/50 and 1952/53[11] in which humpback, blue, sei and fin whales were processed and then subtracting from this the estimated weights for blue, sei and fin whales from the weight/length relationships for those species developed by Japanese scientists. After subtraction for the other species, the resultant 'weights' left were attributed to humpback whales. Seventeen data points (one per day)[12] were generated using the average length of humpback catches on that day and the total estimated weight in tons (as described above) divided by the sample size. The range in *average* lengths covered was narrow (39.0 feet to 42.3 feet or about 11.9m to 12.9m) but it is not possible to deduce the range in lengths that made up the averages. Daily sample sizes of humpback whale catches ranged from 8-86 (total catch for the 17 days was 781). Catches of the other species per day were much smaller (total for the 17 days, 71). Lockyer then used these 17 data points (converted to metric units) to estimate the length-weight relationship. It has to be said that while the Ash (1953) method is ingenious, it must contain considerable uncertainty that it is difficult to quantify. However, this remains the only available data set for humpback whales.

Table 5

Summary of the information on % blubber, % meat and % blubber plus meat (as a percentage of total body weight) calculated from the appendices of Lockyer (1976) apart from North Atlantic fin whales which also includes data from Table 1 of Lockyer and Waters (1986) . Note: (1) the 11.1m Antarctic minke whale appears large; and (2) for two fin whales, the sum of the percentages of body weights (incl. bone etc) given added up to a little over 100% but have been retained.

	Length (m)	% blubber	% meat	%b+m
Antarctic and North Atlantic fin n=51				
Average	20.0	20.8	44.5	65.2
SD	2.0	5.0	4.1	7.9
Min	15.9	8.3	33.2	41.5
Max	23.2	31.3	53.6	81.2
Antarctic minke n=8				
Average	8.5	17.6	58.3	75.9
SD	1.3	7.9	7.3	10.7
Min	7.1	8.0	45.8	56.0
Max	11.1	34.5	65.7	93.8

3.1.2 Víkingsson *et al.* (1988) and Víkingsson (1995)

Víkingsson *et al.* (1988) and Víkingsson (1995) report on the length-weight relationship for fin and sei whales taken by Icelandic whaling operations (see Plate VIII), focussing on the period 1986-1989. For the purposes of the present study, the discussion focuses on fin whales. Weighing was undertaken by scientists, in parts not the whole animal, using metal containers and a weighbridge; the error in the weighbridge itself was estimated to be within 5%. The primary difficulty noted by the authors was in obtaining the weight of the tongue; in most cases parts of it had been torn away, the weights of the remains ranging from 0-1,655kg – an intact tongue was stated to represent 'around 3%' of the total body weight. Between 1986- 89 a total of 72 fin whales were weighed. The authors showed that a simple length-weight relationship was greatly enhanced in terms of precision by the inclusion of girth measurements, although of course such measurements are not available for Greenland.

[11] He states that 100 tons of raw material = 6.87 fillings

[12] Not 17 animals as stated in Lockyer (1976)

3.1.3 Bando and Fujise (2009)

Bando and Fujise (2009[13]) estimated the yield of edible products for common minke whales in the North Pacific using 126 common minke whales (86 males and 40 females) taken in the North Pacific between 2000 and 2009 between May and October during the JARPNII scientific permit programme. After investigating a number of factors including sex and location of whaling grounds they developed weight-length relationships for meat products and blubber (including ventral grooves). These formulae, for both sexes combined as no significant differences were found, are provided under Item 3.2.5.2. The mean length of the animals was 6.2m (range from 4.0m to 8.2m). The authors' commented that the data were collected on land stations or a research base ship using effective equipment for ensuring full collection of data.

3.2 Review of strengths and weaknesses of available data

3.2.1 Greenland (common minke, fin, humpback, bowhead)

3.2.1.1 Reporting system for Greenland

The hunter (captain of the harpoon vessel or chosen leader in case of the collective hunt) is required to fill out a special report for every large whale taken[14]. The report is submitted to the Ministry of Fisheries, Hunting and Agriculture shortly after the hunt. A digital database is kept at the Ministry with data on hunted minke whale and fin whale in West Greenland since 1987 until present. Some changes have taken place in the required reported data in the last 20 years but essential data as specified by the IWC have been constant (see Annex D for an unofficial translation of the information required on the special reporting form).

The parameters provided for each record included: a unique identifier for each record, the catch area, municipality, date harvested, body length, sex, harvesting method, and yield of meat, *mattak*, ventral grooves, and the total weight.

A major focus of attention was on the reliability of the results provided on weight of edible products by the hunters. It is well known from fisheries and other literature that a degree of caution must be exercised when considering the use of such data for scientific studies. Considerable time during the interviews with hunters and wildlife officers was spent discussing the reliability of these data. In those discussions it was clear that:

(1) the attention to detail in terms of filling in the data would vary by individual and circumstances e.g. in some cases hunters would estimate the products at flensing (based on the number of cases as discussed above) but then update the forms after some of the products had been distributed at the local market where more accurate weighing may occur – in other cases the estimates would remain;
(2) the reporting of certain edible products (e.g. organs) might vary (e.g. the Captain's share might not always be reported) – usually organs were included under 'meat';
(3) there were differences between individuals/settlements as to what comprised edible products (e.g. see Item 2.2);

[13] Bando, T. And Fujise, Y. 2009. *Per capita* yield of meat and blubber of common minke whales sampled by JARPN II. Unpublished manuscript.

[14] executive order number 10 of 17 April 2009 on Reporting of Hunting and Struck and Lost of Whales

(4) obtaining products from large animals (such as some fin and bowhead whales) that require longer flensing times would sometimes be more difficult than for smaller animals as weather conditions may change during the flensing period and more than one tide cycle may be involved (the influence of the latter will depend on the type of flensing site as discussed earlier).

The results of our investigations of the suitability of these data for the purpose of examining conversion factors are given under various Items below under Items 3 and 4.

The Greenlandic catch data are reported to the IWC Secretariat and held in the official IWC database. These data include date of capture, position of capture, sex and length (see 3.2.1.2 for clarification of an issue related to the length data). Data from the period 1904-2008 were available for the analyses. Unfortunately there is very little length data (and no weight data) for the earlier period of Greenland whaling for humpbacks (see Item 3.2.4).

3.2.1.2 Problem with length data

During the interviews with the hunters an extremely important discovery was made that is critical to understanding and interpreting the Greenlandic data i.e. the length measurements are taken over the body[15] rather than parallel to the body – this will result in an overestimate of length data compared to the 'standard' measurements used in the length-weight relationship studies reported (see Fig. 3). The extent to which this is an overestimate is unknown and a formal study to examine this is presented in the recommendations section (see Item 5.2.5).

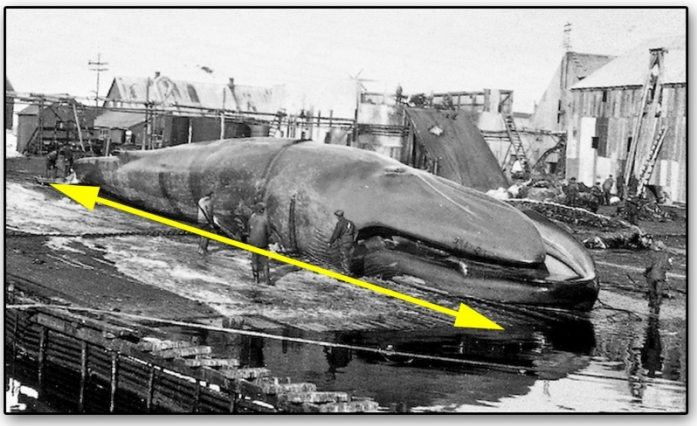

Fig. 3. Blue whale at the South Georgia whaling station in the 1930s. The standard measurement (yellow line) is taken along the deck parallel to the notch of the tail flukes and the tip of the jaw. Clearly measuring along the back of the animals will give a greater length (see text).

An *ad hoc* 'experiment' carried out using chairs suggested that this may be of the order of up to 10% - this is clearly not satisfactory for developing a formal correction factor but it was possible to obtain some limited data from the bowhead hunt. In a simple test, three bowhead whales harvested in Alaska were measured using both straight line and curved methods. Length measurements increased by about 4-11% based on how the tape was held. Measurement increases were greatest if the tape was held on the ground at the fluke notch and on the ground underneath the tip of the rostrum. Given the importance of the length data to the process, especially when comparing results to those obtained elsewhere, the small working group agreed to investigate underestimates of 5, 7.5 and 10% to examine sensitivity to assumptions made (see Item 5).

[15] The hunter uses a 'measuring rope' from the tip of the snout to the tail flukes across the body. The length of this is then measured against a tape measure.

3.2.1.3 Examination of data incl. any internal inconsistencies, errors and how dealt with including removal of data from dataset, conversion to 'true' length, summary of final dataset

An electronic version of the hunter provided harvest records from 1987 to 2007 of the common minke and fin whales (see 3.2.1.1 above) was made available to the small working group under the IWC's data availability agreement. These data were examined to determine their value for investigating their use for estimating the conversion factor and examining the factors that may affect yield per animal (see Item 4). The examination of the data under Item 4 was also used to confirm that the patterns emerging from the data for the various factors were consistent with expectation, thus providing an additional check on their suitability for use.

As in any user-reporting system, there are a handful of records that appear to be internally inconsistent (e.g. sum of yield of meat (including organs), *mattak* and ventral grooves does not equal the total weight of yield, or clearly unreasonable relationship between body length and weight of edible parts) and records with values that were typos, unrealistic or missing. The harvest records were checked for these issues and as a result a few records were removed and modified. Specifically, of the 2,787 common minke whale harvest records, there were 2,439 records with length measurements, 1,876 with meat yields, 1,877 with *mattak* yields, and 1,863 with groove yields. Of these records, 3 records were removed because the body lengths were greater than 17m (inspection of the IWC database shows that North Atlantic common minke whales rarely exceed about 10m) and 5 records were removed because the body lengths were less than 3m (4cm, 6cm, 1.5m, 2.5m, and 2.8m) where the smallest recorded North Atlantic minke whale in the IWC database was 3m, again a rare occurrence). After comparing the sum of the individual weights to the recorded total weight, 10 minke whale records were modified to correct obvious typographical errors (that is, changing one digit in the weight of a single part resulting in the sum of individual parts equalling the recorded total weight); 5 records were removed because all the weights were missing; and 8 records were removed because the sum of the parts was very far from the total weight and there was no obvious typo that could have corrected this (Table 6).

Of the 271 fin whale harvest records, 210 records had length measurements, 134 *mattak* measurements and 135 groove measurements. Of these records, one record was modified because there was an obvious typographical error when comparing the sum of the parts to the recorded total weight. No other fin whale record was modified or deleted because the records appear to be internally consistent and all of recorded body lengths (8-27m) were within the range of body lengths of North Atlantic fin whales within the IWC database (Table 6).

Over and above the removal of clear errors, it is important to undertake some feasibility checks of the hunter data by comparing these with estimates from other sources, particularly with respect to the relationship between body length (L) and weight of edible products (W). To explore this relationship, Greenlandic minke whales were compared to North Pacific common minke whales (Bando and Fujise, 2009) and to Antarctic minke whales (Lockyer, 1976), while Greenlandic fin whales were compared to Icelandic North Atlantic fin whales (Víkingsson *et al.*, 1988) and to Antarctic fin whales (Lockyer, 1976).

In comparing the data, the following issues need to be accounted for to ensure that the comparisons are to the extent possible of like with like: fluid loss; body tissue proportions; efficiency of flensing/scientific study or not; length measurements (see item 3.2.1.2) and overall uncertainty.

Table 6

Summary of the effects of data removal/truncation on total sample size for the Greenlandic data.

Species	Total no. of records	No. after removal of errors	No. after truncation (see text)
Common minke	2,787	2,766*	1207 blubber, 1203 meat
Fin	271	271**	68 blubber , 30 meat
Bowhead	3	3	3

*Twenty-one records were removed: 8 due to unrealistic lengths, 5 due to all weight values missing, and 8 due to the fact that the sum of the parts was very far from the total recorded weight. Ten records were modified to correct obvious typos and were retained in the dataset.
** No records were removed. One record was modified to correct an obvious typo and was retained in the dataset.

Lockyer (1976) reported that due to fluid loss, there was an approximately 5% loss of the total weight between the weight before and after the flensing of an Antarctic minke whale, and on average a 6% loss for baleen whales in general, although the data are sparse. Víkingsson *et al.* (1988), referred to Scholander's (1940) estimate of blood volume of 10% for fin whales. The proportions of body tissues of various species were reported in table 3 in Lockyer (1976) and the uncertainty around these is discussed under Item 3.1.1. Bando and Fujise (2009) estimated yield directly from the weight of individual tissues so fluid has already been lost as in the Greenlandic harvest data. Corrections for curved body length measurements for the Greenlandic data are discussed under Item 3.2.1.2 (the other studies used standard measurements). Finally, all but the Greenlandic estimates were made from scientific studies in co-operation with whaling operations at land stations or aboard factory ships (i.e. under optimal conditions), apart from the Ash (1953) study for humpback whales discussed under Item 3.1.1. Although difficult to quantify, it is clear that (a) the scientific results would have been recorded more assiduously; and (b) the operational conditions are such that one would expect the hunter collected data to be generally lower (in reliability, quality and success in completely removing all tissue) than in a scientifically controlled study under optimal conditions.

It was clear from an examination of the data that there was a very wide range in the weights at lengths of the various edible products (Fig. 4) – while varying reliability is not unexpected for hunter-derived estimates, it was clear that a degree of truncation (aside from removing the obvious errors discussed above) was necessary, noting (a) that the data were not collected in a fully scientific manner; (b) some hunters do not fill in forms completely and may not include products taken directly by captain and/or crew; and (c) there are differences in yield related to local circumstances (see Item 4) including what is considered edible, flensing site conditions, reporting rigour and what is considered necessary to report. As the objective of this study is to obtain an 'average' yield of products to arrive at a fair 'average' conversion rate by species, it was also agreed that any attempt at a complex analysis that takes account individually of the many factors that may affect yield (see Item 4) is both unwarranted and not justified by the quality of the available data.

For common minke whales to obtain the representative average yield records, the truncation approach adopted was thus to use the most reliable available independent, scientifically derived weight-length relationship for harvested tissues (i.e. that of Bando and Fujise (2009) given under Item 3.2.5.2) and then subset the harvest records to those between 50% and 150% of the Bando and Fujise (2009) predicted values for the Greenland-corrected lengths. This resulted in 1,207 values of blubber yield and 1,203 values of meat yield (Table 6).

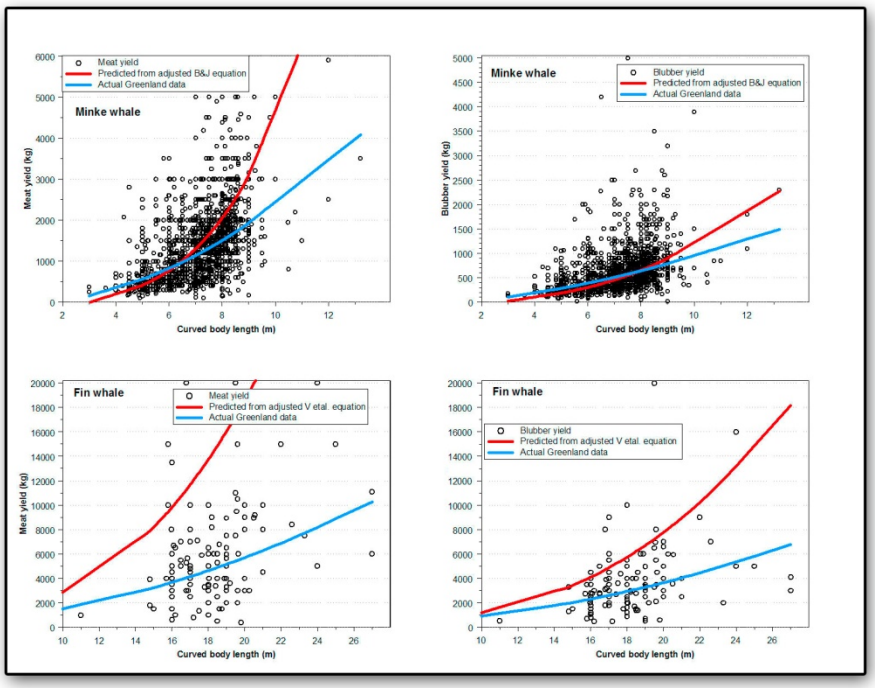

Fig. 4. Plots of length-weight (meat or blubber incl. grooves) data for common minke and fin whales from the Greenlandic harvest from the non-truncated (but error removed) data. In larger minke whales (>8m) and fin whales, the difficulties in flensing larger whales are shown, especially for meat (see text).

For fin whales, the most appropriate relationship to use is that of Víkingsson *et al.* (1988; 1995) – see Item 3.2.2. To obtain a representative average yield of fin whales, the same general procedure used for common minke whales was used. The meat (or blubber) yields that were used were between 50% and 150% of the most reliable available independent, scientifically derived weight-length relationship for total body weights, i.e. Víkingsson *et al.* (1988) predicted values that were adjusted for Greenland-corrected lengths and for average percent tissue type. This resulted in 68 values of blubber yield and 30 values of meat yield (Table 6).

The limited data for bowhead whales and humpback whales are discussed under Items 3.2.5.1 and 3.2.5.3 respectively.

3.2.2 Iceland – direct

The Icelandic data relevant to length-weight relationships are only relevant to the fin whale and are discussed above (Item 3.1.2). In addition, standard catch data for both common minke whales and fin whales are available in the official IWC catch database. The following length-weight relationship for fin whales, reported in Víkingsson *et al.* (1988), was used as the most reliable available independent, scientifically derived weight-length relationship for fin whale total body weights:

$$W=0.0095L^{2.865},$$

where W = total body weight (t) and L = body length (m).

The percentages of tissue types for fin whales relative to the total body weight that were considered were the minima, maxima and averages, which are based on the values reported in Lockyer (1976) and Lockyer and Waters (1986), see Item 3.1.1 and Table 5.

3.2.3 Norway (common minke) - direct

Standard catch information is available in the IWC catch database but there are no data relevant to estimating a length-weight relationship. It was agreed to use only the Greenlandic length data (corrected for curvature – see Item 3.2.1.2) for the final analyses.

3.2.4 North Atlantic data (all species)

In addition to the information referred to above, the small working group had access to all of the standard catch information for whales caught in the North Atlantic. It was agreed that for common minke whales and fin whales it was appropriate to use the data for Greenland for the period 1987 onwards (i.e. for which hunter reports of the weight of edible products were available – see Item 3.2). However, for humpback whales there are unfortunately, very few (n=8) length measurements for whales caught off West Greenland; it was therefore agreed to use all 1,439 records with length measurements (the whales were taken between 1886 and the present).

3.2.5 Non-North Atlantic

3.2.5.1 Bering-Chukchi-Beaufort Seas bowhead whales

Total body mass data are available for five BCB bowhead whales harvested at Barrow (George *et al.*, 1991; George *et al.*, 1988; George *et al.*, 1992). Models using length and axillary girth data and total mass appear to have reasonable predictive capability (r^2 = 0.98) within the size range of the whales weighed. Estimates of the proportions of muscle and blubber were also determined for these selected whales (Table 7).

Table 7

Relative proportional mass of edible tissues as a function of total body mass for BCB bowhead whales *Note that *mattak* is trimmed blubber which includes the skin with about 1/5 of the blubber column.

Statistic	% Blubber	% Bone	% Muscle
Mean	44.1	12.0	18.6
SD	4.1	3.6	4.6
N	5	5	5
min	39.1	8.0	13.0
max	50.5	16.6	24.2

The weight-length relationship for BCB bowhead whales is the best available for that species:

$$W = aLG^2$$

Where, W = Weight (or body mass, kg); L= Length (m), G= axillary girth (m); a= fitted parameter (a = 38.53, 95% CI = 35.85 – 41.21).

3.2.5.2 North Pacific common minke whales

The available data for North Pacific common minke whales relevant to length-weight relationships are discussed under Item 3.1.3. It was agreed that these represent the best dataset for comparison with the Greenlandic situation as they are of large sample size and for the same species (unlike the Lockyer, 1976 data), albeit from a different ocean basin.

The weight-length relationships given are:

meat: $y=2.164L^{3.414}$

blubber (including ventral grooves): $y=3.057L^{2.671}$

where y is the tissue yield in kg and L is the body length in m. As discussed under Item 5.1.1, these data are used in the truncation process for the Greenlandic data.

3.2.5.3 Southern Hemisphere Antarctic minke, fin and humpback whales

In light of the review of earlier information under Item 3.1, it was agreed that given the lack of data from elsewhere, the length-weight relationship for humpback whales given in Lockyer (1976) from Ash's (1953) study would have to be used in the primary analyses. For the other species, the data from the North Atlantic (fin - Víkingsson and colleagues), North Pacific (common minke - Bando and Fujise) and Arctic (bowhead - George and colleagues) are preferred. The length (m)-weight (tonnes) relationship for humpback whales provided in Lockyer (1976) is:

$W=0.016473L^{2.95}$.

where W is the total body weight (tonnes) and L is the body length in m. To estimate the predicted yield of humpback tissue using this equation, the percentage of tissue type (the average, minimum and maximum values for total blubber and meat for fin whales was used as there were no reliable humpback whale data; Table 5) and correction for fluid loss (0.94 or 0.90) were applied to the humpback whale weight-length equation.

3.2.6 Conclusion on appropriate data (incl. whether need to collect new data)

In summary, after reviewing the available data (especially the comparisons and checks with both internal (see Item 4 below) and external data (see Items 3.2.1.3 and 5)) and reviewing the strengths and weaknesses of these, we agree that for common minke and fin whales, the most appropriate data to use for the purpose of the present study (i.e. obtaining realistic conversion factors for the circumstances of the Greenlandic hunts) are the Greenlandic data themselves. There are no data for humpback whales from Greenland (apart from eight length measurements from many years ago – see Item 3.2.4) and only length-weight data for three bowhead whales from Greenland (see Item 5.1.1.3). For these, the weight length relationships for humpback whales from Lockyer (1976) using Ash's (1953) data (see Item 3.2.5.3) and for bowhead whales from the BCB stock (see Item 3.2.5.1) are used.

The primary use of the Lockyer (1976), Bando and Fujise (2009) and Víkingsson *et al.* (1988; 1995) analyses/data for fin whales and/or common minke whales is to (1) provide information for truncation –see above) and (2) provide comparative values to ensure that the Greenlandic data are not providing results that would give cause for concern after uncertainty is taken into account.

The most obvious weaknesses in the datasets available are the lack of:

(1) a robust estimate of the effect of measuring lengths along the back;
(2) a better estimate for the amount of edible products available from bowhead and humpback whales;
(3) a greater sample size for information on the amount of edible products from fin whales.
(4) a better estimate of the proportions of edible products to total body mass from fin whales.

Item 5.2 discusses further how these weaknesses may be addressed.

4 Review of factors that may affect yield per animal

The data from the Greenlandic harvest records (the truncated dataset) were used both to explore factors that may affect yield per animal and to obtain an insight into their reliability (see Item 3.2.1). The available factors were: sex (male, female or unknown), location (by settlement as listed in Table 3 and regions NW, CW, SW as shown in Fig. 1, and unknown) and timing of the harvest as expressed by the year (1987-2007), month (Mar-Dec), and day of the year (1-365).

It is important to note that the category' meat' is used as a shorthand for all products but skin+blubber (which is termed 'blubber') throughout the rest of the report.

A covariate analysis was conducted where a null model ($\log(W) \sim \log(L)$) was compared to a covariate model $\log(W) \sim \log(L)$ + factor). In addition, the weight-length relationship ($W = aL^b$ or $\log(W) = \log(a) + b\log(L)$) for different levels of a factor were individually regressed, plotted and compared. The plots were visually inspected and z-tests were used to compare the values of the regression parameters (and their standard deviations) from the weight-length relationship for the levels within a factor. The simultaneous confidence intervals for all pairwise comparisons were used to determine which levels within a factor were the most different from the other levels.

4.1.1 Biological factors

4.1.1.1 Sex and reproductive status

Mature baleen whale females are generally larger than males but for length-weight relationships, no significant differences by sex were reported for North Atlantic fin whales by Víkingsson *et al.* (1988;1995) or for North Pacific common minke whales (Bando and Fujise, 2009). There is some evidence that seasonal fattening is greatest in pregnant females and that recently lactating females are thinner (Lockyer, 1981a;1981b;1986; Víkingsson, 1995).

For the Greenlandic harvested common minke whales, the average meat yield in the truncated dataset was 1,387 kg (SD = 712 kg) for females and 1,296 kg (SD = 645 kg) for males, while the average blubber yield in the truncated dataset was 512 kg (SD = 225 kg) for females and 494 kg (SD = 242 kg) for males.

For Greenlandic harvested fin whales, the average meat yield was 9,574 kg (SD = 3,419 kg) for females and 9,587 kg (SD = 4,637 kg) for males, while the average blubber yield in the truncated dataset was 4,829 kg (SD = 2,360 kg) for females and 3,8216 kg (SD = 1,190 kg) for males.

In accord with the studies of Víkingsson *et al.* (1988) and Bando and Fujise (2009), for neither species do the covariate analysis or pairwise comparisons suggest significant differences by sex.

4.1.1.2 Length

All studies show an overall increase in weight with length as discussed elsewhere in this report. This is also true, as one would expect, for the Greenlandic data (see Fig. 4) for relationships between body length as related to meat and blubber yields, and Fig. 5 for the relationship between body length and total yield).

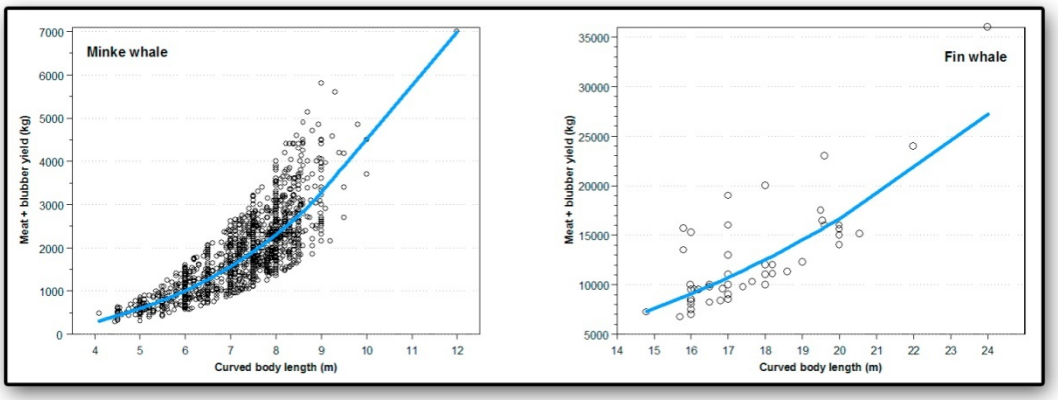

Fig. 5 Length and weight data – Greenlandic dataset truncated. Note that in a number of cases there are multiple records for the same point.

4.1.1.3 Year and month

West Greenland represents a feeding ground for baleen whales. As such one might expect animals caught later in the season to be fatter and this was commented upon by some of the hunters. The general patterns seen in the harvest records support the hunter's observation.

For the Greenlandic harvested common minke whales, the average meat yield in the truncated dataset was 1,335 kg (SD = 427 kg) for spring (Mar-May), 1,367 kg (SD = 719 kg) for summer (Jun-Sep) and 1,358 kg (SD = 715 kg) for winter (Oct-Dec), while the average blubber yield in the truncated dataset was 488 kg (SD = 213 kg) for spring, 506 kg (SD = 232 kg) for summer and 523 kg (SD = 227 kg) for winter.

For Greenlandic harvested fin whales, the average meat yield in the truncated dataset was 9,258 kg (SD = 3,330 kg) for summer (Jun-Sep) and 10,635 kg (SD = 5,494 kg) for winter (Oct-Dec), while the average blubber yield in the truncated dataset was 4,453 kg (SD = 1,721 kg) for summer and 5,412 kg (SD = 2,989 kg) for winter.

For both species the covariate analysis and pairwise comparisons do not suggest significant differences by month.

For common minke whales, the covariate analysis and pairwise comparisons of yield by year suggest a difference between the average meat and blubber yields before and after the year 2000. The covariates 'year' and 'groups of years' (1987-1999 versus 2000-2007) significantly improved the null weight-length relationship and the simultaneously estimated pairwise comparisons indicated that both the meat and blubber yields from the earlier years were slightly larger than that from more recent years. For the Greenlandic harvested common minke whales, the average meat yield in the truncated data was 1,465 kg (SD = 703 kg) during 1987-1999 and 1,242 kg (SD = 671 kg) during 2000-2007, while the average blubber yield in the truncated data was 545 kg (SD = 227 kg) during 1987-1999 and 470 kg (SD = 226 kg) during 2000-2007. These differences are significant (meat: t=5.68 p=0; blubber: t=5.74 p=0). There has been a suggestion that the distribution and abundance of common minke whale prey species has changed since 2000, perhaps as a result of temperature changes; this might be reflected in yield of edible products e.g. see Laidre *et al.* (2009) .

For fin whales, the covariate analysis and pairwise comparisons of yield by year do not suggest differences by year. For the Greenlandic harvested fin whales, the average meat yield in the truncated data was 9,812 kg (SD = 4,167 kg) during 1987-1999 and 8,938 kg (SD = 3,076 kg) during 2000-2007, while the average blubber yield in the truncated data was 6,978 kg (SD = 3,781 kg) during 1987-1999 and 6,157 kg (SD = 3,902 kg) during 2000-2007.

4.1.2 Operational factors

4.1.2.1 Type of hunt

For Greenlandic harvested common minke whales, the average meat yield in the truncated dataset was 1,278 kg (SD = 579 kg) for hunts using a harpoon and 1,549 kg (SD = 873 kg) for hunts using a rifle, while the average blubber yield in the truncated dataset was 500 kg (SD = 222 kg) for hunts using a harpoon and 521 kg (SD = 252 kg) for hunts using a rifle. There is an indication that there is a difference in the common minke whale yields by type of hunt according to the covariate analysis and the pairwise comparisons. The covariate 'type of hunt' improved the null weight-length relationship and the simultaneously estimated pairwise comparisons indicated that the both the meat and blubber yields from rifle hunts were slightly larger than that from harpoon hunts. However, only the difference in the meat yields appear to be significantly different (meat: t=5.18, p=0; blubber: t=1.23 p=0.22). This does not appear to be related to the body length which was similar in the harpoon (7.16m, SD = 1.08 m) and rifle (7.07m, SD = 1.26 kg) hunts but may possibly reflect either slightly more efficient flensing by the rifle hunters, perhaps due to a larger number of participants in the process and/or differences in the internal organs considered as edible in the two fishery types reflecting the balance of fishery type by settlement. The average lengths of common minke whales were similar for the harpoon hunt and the rifle hunt.

Greenlandic fin whales are only harvested using harpoons.

4.1.2.2 Location of hunters/hunt

For common minke whales the covariate analysis and pairwise comparisons of yield by municipality and region suggest a difference between the average meat and blubber yields in some areas. The covariates 'municipality' and 'region' significantly improved the null weight-length relationship and the simultaneously estimated pairwise comparisons indicated a gradient where both the meat and blubber yields were larger in the south than in the north. For the Greenlandic harvested common minke whales, the average meat yield in the truncated data was 1,589 kg (SD = 625 kg) for the SW region, 1,254 kg (SD = 662 kg) for the CW region and 1,083 kg (SD = 750 kg) for the NW region, while the average blubber yield in the truncated data was 582 kg (SD = 214 kg) for the SW region, 474 kg (SD = 203 kg) for the CW region and 420 kg (SD = 257 kg) for the NW region. In particular the municipality of Ilulissat (in the NW region) has the lowest yields, while Nanortalik (in the SW region) had the highest yields per animal. This yield gradient can be explained by the fact that there is also a gradient in length of harvested common minke whales, where the longest whales are found in the SW where the yield is the largest. The average body length in the truncated data was 7.59 m (SD = 0.87 m) for the SW region, 7.21 m (SD = 0.96 m) for the CW region and 6.76 m (SD = 1.30 m) for the NW region.

For fin whales the covariate analysis and pairwise comparisons of yield by municipality and region do not suggest significant differences between these areas, though the same spatial pattern as seen in common minke whales occurs: larger yields in the south and smallest yields in the north. For the Greenlandic harvested fin whales, the average meat yield in the truncated data was 14,400 kg (SD = 5,923 kg) for the SW region, 8,870 kg (SD = 2,791 kg) for the CW region and 6,250 kg (SD = 3,964 kg) for the NW region, while

the average blubber yield in the truncated data was 7,270 kg (SD = 3,670 kg) for the SW region, 7,272 kg (SD = 3,622 kg) for the CW region and 9,145 kg (SD = 3,683 kg) for the NW region.

4.1.2.3 Flensing site

From the selection of flensing sites visited, some appeared to be better than others in terms of ease of access, whether or not tidally affected, presence of winches etc. In principle, this might affect the ability to fully flense animals – this is likely to be particularly relevant for larger animals such as fin and bowhead whales. The reported data are provided by broad area (municipality/region see above), not individual flensing site and thus do not allow an analysis by flensing site type.

4.1.2.4 Other

Discussions with the hunters and the wildlife officers revealed no reason why hunters would *not* try to maximise yield from the animals caught. Considerable effort and cost is involved in catching a whale and there is every incentive to maximise yield to the extent allowed by the conditions.

4.1.2.5 Struck-and-lost

In the most recent five year strike limit period (2003-2007), the average proportion of landed animals relative to all struck animals (landed plus lost animals) is 98% for Greenlandic minke whales and 66% for Greenlandic fin whales (Witting, 2009 – SC/61/AWMP8). This is also in accord with hunter comments that fin whales are more difficult to capture. There were no struck-and-lost bowhead whales in the 2009 hunt (although the sample size is only three). These values are used in the analyses presented under Item 5. There are no available data on struck-and-lost rates for humpback whales. One of the reasons that hunters stated they preferred humpback whales was that they were easier to approach and catch than fin whales; their distribution is also more clumped and easier to predict (some are also available almost year-round with some overwintering in ice-free fjords in the Sisimiut-Nuuk region). The analysis presented under Item 5 has arbitrarily chosen the average value of 82% for humpback whales based on that for fin whales (66%) and common minke whales (98%) to take into account the hunters' view that they are easier to capture and handle than fin whales.

4.2 Review of analytical techniques

4.2.1 Clapham and Kennedy

Clapham and Kennedy (SC/61/AWMP6) used length data from a number of sources to estimate average total weight and then the weight of edible (muscle/blubber) and inedible (bone/viscera) products for minke and fin whales. The length data were from three subsets of the IWC catch database: the entire North Atlantic; the Davis Strait/Baffin Basin; West Greenland, and from the Greenlandic hunt. The analyses used the weight-length relationships and the average proportions of products given by Lockyer (1976). The estimates of mean total weight and mean weights of muscle and blubber are given for males and females and both combined, together with standard deviations for each dataset. For minke whales there was a very high consistency among the datasets in mean body length (6.9-7.2 m). This, not surprisingly since the same weight-length relationships were being used, led to consistent estimated mean total body weight (4.4-5.0 t) and, therefore, estimated mean weight of muscle (2.7-3.1 t) and blubber (0.7 t). There was also a high consistency among datasets for fin whales in mean body length (17.8-18.6 m), again therefore leading to consistent estimated mean total weight (34.2-39.1 t) and, therefore, estimated mean weight of muscle (15.4-17.6 t) and blubber (8.2-9.4 t). These estimates of muscle plus blubber weight are higher for minke

whales (3.4-3.8 t) and much higher for fin whales (23.6-27.0 t) than the current conversion factors for West Greenland of 2 tonnes and 10 tonnes, respectively.

The primary concern with this essentially sound analysis is that it relies uncritically on the information in Lockyer (1976) for the conversion of overall body length to weight of edible products. As discussed above (Item 3.1), there are a number of problems with the results presented by Lockyer (1976) in the present context, *inter alia* in terms of species/ocean basin, sample size for Antarctic minke whales and treatment of uncertainty. In addition, as Clapham and Kennedy recognise, logistical factors may affect the yield of edible products, especially for fin whales. The authors were, of course, unaware of the problems with the length measurements of the Greenlandic data (see Item 3.2.1.2).

4.2.2 Witting

Witting (SC/61/AMMP8) reported on the yield of meat, blubber and skin/*mattak* of minke and fin whales reported from the Greenland hunt and used these to calculate mean values per whale. The mean weight of meat was used to estimate the total amount of meat that would be obtained for a range of strike limits, assuming the percentage landed was that for the period 2003-2007: 98% for minke and 66% for fin whales. 5%-iles and 10%-iles of the distributions about the estimates were obtained by bootstrap resampling of the whales caught. For the current strike limit of 200 minke whales, 269 tonnes of product was estimated to be obtained and for the current strike limit of 19 fin whales, 76 tonnes of product was estimated to be obtained. These estimates were then used to calculate mean conversion factors of product per strike: 1.34 tonnes for minke whales and 4.02 tonnes for fin whales. Conversion factors calculated from the 10%-ile and 5%-ile were also presented; these can be used to calculate the total amount of product that would be obtained with 90% or 95% probability (the probability of fulfilling a given need), respectively, from any given strike limit.

The analysis performed used data from a 20-year period to estimate the mean reported yield of edible products but data only from 2003-2007 to estimate mean percentage of the strike limit landed. The paper does provide a way to calculate a conversion factor to satisfy a given need at a given probability level for a given strike limit using data reported from the Greenland hunt. However, *inter alia* the paper did not address the difficulties with the reliability of the Greenlandic data, including the inclusion of unrealistically low and high values discussed under 4.1.

4.2.3 Conclusion and recommended approach

The two methods for calculating the amount of meat and other edible products from minke and fin whales described in 4.2.1 (SC/61/AWMP6) and 4.2.2 (SC/61/AWMP6) differ in that the first considers the total amount of such products that could theoretically be obtained under an uncritical acceptance of the assumptions of Lockyer (1976) and the second considers the amount of these products that were reported from the Greenland hunt without a full appreciation of the strengths and weaknesses of the dataset. The conversion factors obtained from the two approaches are thus very different.

The small working group concurs with the view of the Scientific Committee that neither approach was wholly acceptable.

Under Item 5 below, therefore, the small working group adopts the following approach to arrive at recommended conversion factors (sexes are combined as no significant differences in the length-weight relationship were found by sex).

4.2.3.1 Common minke whales

(1) Estimate the conversion factor directly from the truncated Greenlandic dataset (note that this will be the sum of the 'meat', the 'blubber' and the 'ventral grooves') in tonnes adjusted by 0.98 to account for struck-and-lost animals.

(2) Compare this with the values obtained from the Bando and Fujise (2009) equations for 'meat' and 'blubber' (noting that their category 'blubber' includes 'ventral grooves') using the corrected average Greenlandic length (testing the sensitivity of the correction factor by using 5%, 7.5% and 10%) and then adjusting the total edible products in tonnes by 0.98 to account for struck-and-lost animals.

4.2.3.2 Fin whales

(1) Estimate the conversion factor directly from the truncated Greenlandic dataset (note that this will be the sum of the 'meat', the 'blubber' and the 'ventral grooves' in tonnes) adjusted by 0.66 to account for struck-and-lost animals.

(2) Compare this with the values predicted using the analysis of Víkingsson and colleagues, by:

(a) estimating total body mass from their weight-length relationship using the corrected Greenlandic average length (testing the sensitivity of the correction factor by using 5%, 7.5% and 10);

(b) using this to determine the predicted quantities of the total yield ('meat' plus 'blubber') in tonnes using the proportions provided in Table 5 (testing the sensitivity of the correction factor by using the minimum, average, and maximum percent total yield from all of the fin whales in the Antarctic and North Atlantic), and;

(c) adjusting the total edible products in tonnes by 0.66 to account for struck-and-lost animals.

4.2.3.3 Humpback whales

(1) Estimate total body mass from the Lockyer weight-length relationship for southern humpback whales and the average length for North Atlantic humpback whale catches taking into account body fluid loss using values of 6% and 10%;

(b) Use this to determine the predicted quantities of 'total edible products', 'meat' and 'blubber' in tonnes using the proportions provided in Table 5 for the fin whale dataset[16] (average value for 'b+m' along with sensitivities using minimum and maximum, i.e. 0.652, 0.415 and 0.812);

(c) adjusting the total edible products in tonnes by 0.82 to account for struck-and-lost animals;

(d) use the Greenlandic fin whale data to adjust for difficulties in flensing large animals.

4.2.3.4 Bowhead whales

For bowhead whales, the length-weight relationship from BCB bowhead whales is used as the basis for predicting edible product yield (see Item 5.1.1.3).

[16] The fin whale dataset is used as there are insufficient humpback whale data available.

5 Proposal for conversion factors for yield per strike

The objective of the study was to estimate appropriate conversion factors for the hunt in terms of the ability to meet need – the Scientific Committee report itself talks of the need to evaluate a conversion factor per strike as quoted under Item 1.1. The values per strike are based on the calculations per animal corrected by the struck-and-lost rates.

5.1 Analysis

5.1.1 Common minke whales

Table 8 and Fig 7 show the results of the analysis described above for common minke whales.

Table 8

Actual (Greenlandic data) and predicted (Bando and Fujise length-weight relationships with length corrections of 5%,7.5% and 10%) edible product yields per strike for common minke whales

	Yields					
	Meat (t)		Blubber incl. grooves (t)		Total edible (t)	
	mean	SD	mean	SD	mean	SD
Greenland	1.34	0.68	0.50	0.23	1.84	0.72
Bando and Fujise - 5% adjust	1.64	0.76	0.55	0.22	2.19	0.79
Bando and Fujise - 7.5% adjust	1.51	0.71	0.52	0.20	2.03	0.73
Bando and Fujise - 10% adjust	1.40	0.66	0.49	0.19	1.89	0.68

The results show that the Greenlandic harvest data are in accord with the data obtained from the Bando and Fujise relationship (it should be noted that the heart and kidneys are not included in the Japanese study, which would make their predicted yield perhaps 1-2% greater). The results suggest that the flensing efficiency for common minke whales in Greenland is very good. It is also interesting to note that the effect of curved versus 'standard' length measurements provided as a sensitivity analysis shows that improved information on the actual differences obtained by a scientific study, while welcome, would not alter the conclusion that the Greenlandic dataset appears robust.

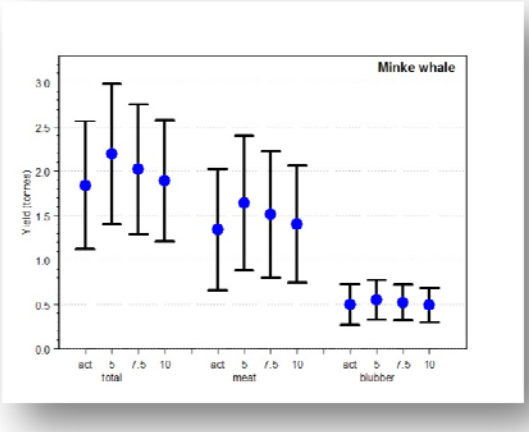

Fig. 7. Plot of the actual and predicted edible product yields per strike for common minke whales – the bars show the SD – as given in Table 8 (see text).

5.1.2 Fin whales

Table 9 and Fig 8 show the results of the analysis described above for fin whales. It is clear from Table 9 that the actual yield from fin whales is somewhat below that expected from the Víkingsson *et al.* relationship, especially with respect to meat. As discussed above, that it is lower is not surprising given the additional difficulty in handling and flensing large animals and remembering that the Víkingsson *et al*. data were collected using professional equipment (see Plate VII and item 3.2.1.3). In fact, for blubber and ventral grooves (Fig. 8), the value is not dissimilar, which can be explained by the fact that the blubber is removed first (i.e. before a tide cycle may have an effect). A further factor is that the predicted results are strongly influenced by the proportions of meat and blubber that are used to convert total body mass to edible products. The predicted quantities shown in Table 9 are based on the average values from Table 5 (i.e. not taking the uncertainty into account) but if the upper and lower SDs are used then the 'lower' predicted values are closer to the reported Greenlandic data (i.e. about 9.7 tonnes). Taking the difficulty in handling large animals, the SDs and the variance in the proportions of blubber to meat into consideration, the data from the Greenlandic records are not inconsistent with the predicted values.

Table 9

For fin whales, the total yield (t) of meat and blubber per strike obtained from the Greenlandic truncated fin whale harvest records (Greenland actual in the central section of the table), and yield per strike predicted by the Víkingsson *et al.* (1988) weight-length relationship, adjusted for Greenlandic lengths (5%, 7.5% and 10%) and proportion of tissue type (minimum, average, and maximum values from Table 5 for fin whales in the Antarctic and North Atlantic). The mean, standard deviation (SD), lower 1 SD limit (Lower) and, upper 1 SD limit (Upper) are reported.

	Total yield (t)			
	mean	SD	Lower (1SD)	Upper (1SD)
Minimum %				
Víkingsson - 5% adjust	9.88	3.27	6.61	13.15
Víkingsson - 7.5% adjust	9.23	3.05	6.18	12.28
Víkingsson - 10% adjust	8.64	2.86	5.78	11.50
Average %				
Greenland (actual)	*7.15*	*2.63*	*4.52*	*9.78*
Víkingsson - 5% adjust	14.08	3.36	10.72	17.44
Víkingsson - 7.5% adjust	13.16	3.14	10.02	16.30
Víkingsson - 10% adjust	12.32	2.94	9.38	15.26
Maximum %				
Víkingsson - 5% adjust	18.72	4.96	13.76	23.68
Víkingsson - 7.5% adjust	17.50	4.64	12.86	22.14
Víkingsson - 10% adjust	16.38	4.34	12.04	20.72

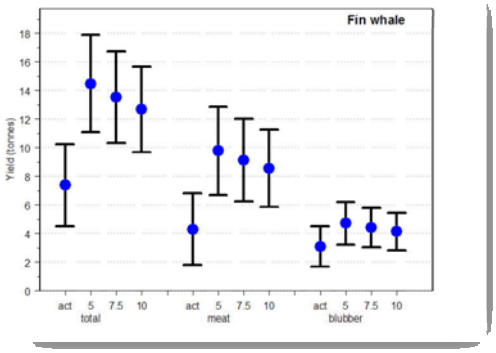

Fig. 8. Plot of the actual and predicted edible product yields per strike for fin whales – the bars show the SD – as given in Table 9 (see text).

5.1.3 Bowhead whales

Greenlandic hunters harvest bowheads in the region near Disko Island in spring. Whales in that area in spring tend to be large adults; for operational reasons the hunters prefer to take smaller animals where possible. The lengths/weights of the three landed whales in 2009 were: 14.1m/8.2 tonnes; 14.8m/9.0 tonnes; 16m/10 tonnes. Applying the weight-length relationship derived from BCB bowheads to the whales harvested by Greenland in 2009 suggests total body mass of 36-65 tonnes. Using BCB bowhead whale data, total body mass estimates lead to the food production estimates given in Table 10. In Greenland, the tongue is not eaten and is probably about 7% of the body mass. During processing, the blubber is trimmed into *mattak*, where about 20% of the blubber mass is consumed; blubber is pure fat and the quantity of blubber on a bowhead whale is considerably larger than for rorquals. The remaining blubber is used for heating and for dog food.

Table 10.

Estimated food production from Greenland bowhead whales per strike based on data for BCB bowheads (note that the largest bowhead whale measured directly was 12.87m (standard length) and some extrapolation using the derived length-weight relationship was needed. Edible weight = muscle+*mattak*. The *mattak* is estimated as the blubber mass * 0.20 to account for trimming. Note that animals over 45 tonnes are more difficult to handle and flense and thus the amount of edible products obtained is likely to be below the values indicated in the table.

Body mass (t)	Muscle	*Mattak*	Total edible
40	7.4	3.5	11.0
45	8.4	4.0	12.3
50	9.3	4.4	13.7
55	10.2	4.9	15.1
60	11.1	5.3	16.4

The bowhead whale hunt has only just been resumed in Greenland. To assist in the flensing of these large animals, the flensing site at Oqaatsoq was upgraded to include two winches (Plate XI). Unfortunately, changed ice conditions blocked access to that flensing site. The actual conditions for butchering the bowheads in 2009 were in fact very problematic and not all the portions could be recovered. A secondary site had to be used which was smaller and subject to flooding during high tide. Nearly two days were required to flense each of the animals. Given the circumstances of the 2009 hunt, the food production estimates based on BCB bowheads are lower but not inconsistent with the reported Greenland bowhead edible product estimates.

5.1.4 Humpback whales

Table 11 and Fig. 9 present the results of the analysis for humpback whales.

There have been no catches of humpback whales off Greenland in recent years and thus no 'actual' data to compare with the predictions. As is the case for fin whales, the following factors need to be taken into account: (1) the total average products obtained from the Greenlandic data is lower for large animals (in the case of fin whales, the mean value of reported products is around about 50-60% of the predicted value depending on the correction factor for length used); and (2) the predictions are subject to considerable uncertainty as is shown in the range of values given in Table 11 i.e. from a minimum of 10.94 (SD 4.09) to a maximum of 23.38 (SD 7.74).

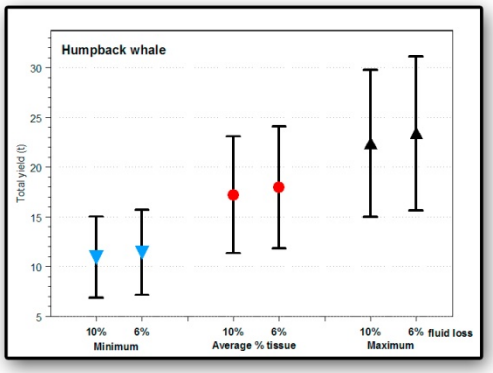

Fig. 9. Results of the analysis for humpback whales, showing predicted values of total yield per strike under the assumption of the minimum, average and maximum proportions of blubber and meat to total body mass (see Table 5).

Table 11

For humpback whales, the total yield (t) of meat and blubber per strike as predicted from the Lockyer (1976) weight-length relationship, adjusted for fluid loss (6% and 10%) and proportion of tissue type (minimum, average, and maximum values from Table 5 for fin whales in the Antarctic and North Atlantic). The mean, standard deviation (SD), lower 1 SD limit (Lower) and, upper 1 SD limit (Upper) are reported.

	Total yield (meat + blubber)			
Minimum %	Mean	SD	Lower	Upper
6% fluid loss	11.43	4.27	7.16	15.70
10% fluid loss	10.94	4.09	6.85	15.03
Average %				
6% fluid loss	17.98	6.13	11.85	24.11
10% fluid loss	17.22	5.87	11.35	23.09
Maximum %				
6% fluid loss	23.38	7.74	15.64	31.12
10% fluid loss	22.38	7.41	14.97	29.79

5.2 Conclusion and recommendations

This section presents the recommendations of the small working group with respect to conversion factors for the Greenlandic hunts, taking into account local conditions and struck-and-lost rates, as well as recommendations for additional work (summarised in Table 12 under Item 6). Where possible, the conversion factors are based on the existing data for the Greenland hunts. Where data permit, the recommendations are provided to more accurate values rather than an integer since the ultimate use for these conversion factors is to provide information on whether and how the Greenlandic multispecies hunt can obtain an agreed level of need expressed in terms of edible products. This is particularly important for common minke whales where the annual strike limit recommended by the Scientific Committee is 178 animals and thus rounding to an integer can have a major effect on estimated products obtained. Table 13 under Item 6 provides information on estimated edible products using these conversion factors for (A) the present strike limits and (B) for those limits that were in accord with Scientific Committee advice in its report based upon the request by Denmark. Note that this table only includes catches for West Greenland

(Denmark requested its 670 tonnes of products for West Greenland – its need statement for East Greenland is expressed in terms of numbers of animals - 12).

The conversion factors proposed are average values based wherever possible on the available Greenlandic data, truncated to remove implausibly low or high values for products based on the best scientific evidence. By doing this, we reduce the likelihood of either over- or underestimating the product yield when assessing whether particular combinations of catch limits do or do not meet yield. The use of average values is important in that it takes into account the variation in yield that is to be expected in a hunt in which animals of varying lengths are taken throughout a season in which animals are feeding. While in theory, a weighted conversion factor could be obtained that tried to take into account the many factors discussed under Item 4, we do not believe that the data that exist now, or that might be expected to be obtained in the future would justify this level of analysis. The implications determining *Strike Limit Algorithms* and for setting catch limits under such a regime would also be extremely complex.

The recommended conversion factors per strike along with the equivalent conversion factors per animal, as well as the original conversion factors (per animal and calculated per strike on the basis of the struck-and-lost rates given in this report) are summarised in Table 12 under Item 6. The conversion factors all refer to tonnes of edible products.

5.2.1 Common minke whales

Given the results of the analyses given under Item 5.1.1, the small working group suggests that, for the time being, an appropriate conversion factor per strike is **1.84** (see Table 8); this suggested factor compares with the existing conversion factor of 2 per animal which would be 1.96 per strike (or in other words, the conversion factor per strike of 1.84 is the equivalent of a conversion factor per caught whale of 1.88 i.e. slightly below the existing factor of 2). Or in other words, the level of accuracy seems warranted by the large sample size (around 1,200) and the consistency with the Bando and Fujise scientific study. While data on the yield of edible products should and will continue to be collected under the existing Greenland regulations, we agree that the focussed effort should concentrate on the other species (see below) where the sample sizes are small. As for the other species, emphasis should be made on informing the hunters of the importance of reliable reporting given the numbers of unrealistically large and small values found in the original records.

5.2.2 Fin whales

Given the results of the analyses given under Item 5.1.2, the small working group suggests that an appropriate interim conversion factor per strike is **7.2** (see Table 9); this suggested factor compares with the existing conversion factor of 10 t per animal which would be 6.6 t per strike (or in other words, the conversion factor per strike of 7.2 is the equivalent of a conversion factor per caught whale of 10.91 i.e. above the existing factor of 10 if struck-but-lost animals are not taken into account). However, it notes that this is based on a much lower sample size than for common minke whales (68 blubber and 30 meat) and that the values, although not inconsistent with the Víkingsson scientific study for the reasons discussed under Item 5.1.2, are, especially for meat, well below the predicted maximum levels. We also **recommend**, therefore, that a focussed attempt to collect new data on edible products taken from fin whales be undertaken, at least until the end of the next block quota when the interim conversion factor should be reviewed. These data should be collected as a collaborative effort between scientists, wildlife officers and hunters.

5.2.3 Bowhead whales

The available data for bowhead whales are considerable more limited than for common minke or fin whales (see Item 5.1.3). This makes developing an appropriate conversion factor more difficult. The low catch limit and the sparse data warrant choice of an integer value for the conversion factor until more data become available.

Noting the desire for the hunters to take smaller animals where possible, the potential difficulties with flensing conditions in 2009 and the lack of recent experience in catching and flensing bowhead whales, an appropriate conversion factor for the Greenland take of bowhead whales would be between 10 (the amount of tonnes of reported edible products obtained from the largest animal caught in 2009) and 12.3 (the expected number of tonnes of edible products from a 45-tonne animal using the BCB data).

The small working group suggests that an appropriate interim conversion factor per strike is **11**, but this should be reviewed at the end of the next 5-year quota block in the light of new data on the actual yield of edible products collected from the hunt during that period. This should be a focussed effort and the small working group **recommends** that these data are collected as a collaborative effort between scientists, wildlife officers and hunters.

5.2.4 Humpback whales

As for bowhead whales, the data for humpback whales (not caught off West Greenland since 1985) are sparse and the information on the length-weight relationship comes from data collected in the Antarctic in the early 1950s using an imaginative method but one which encompasses considerable uncertainty. The lack of Greenlandic data and the range of plausible predicted values shown in Table 11 make it difficult to choose an appropriate precise accurate conversion factor.

Taking into account the fact that it is not possible for the hunters to obtain the maximum predicted edible yield for large animals (see the discussion on fin whales above), the small working group suggests that an appropriate interim conversion factor per strike could be based on the average predicted value (17.6), reduced to 54% (the value for fin whales assuming a 7.5% correction factor for length) to allow for the difficulties in obtaining the maximum predicted values from large animals i.e. **9.5** or the equivalent of a conversion factor per whale of 11.6 tonnes if struck-but-lost animals are not taken into account. However, given the uncertainty, it is important that this conversion factor be kept under review, recognising that the actual yield may turn out to be somewhat lower or somewhat higher than this, with consequential implications for the ability to meet need.

Therefore, if the Commission agrees to a catch limit for humpback whales, this conversion factor should be reviewed at the end of the next 5-year quota block in the light of new data on the actual yield of edible products collected from any hunt during that period. The small working group **recommends** that these data are collected as a collaborative effort between scientists, wildlife officers and hunters.

5.2.5 Other recommendations

5.2.5.1 Improved length data collection

The small working group **recommends** that data on *both* 'curved' and 'standard' measurements are obtained during the coming season for common minke whales, fin whales and bowhead whales. From the analyses under item 5.1, it is clear that this is of more importance for fin whales. However, the ability to be able to convert from 'curved' and 'standard' length measurements has a number of practical and scientific

benefits. These data should be collected as a collaborative effort between scientists, wildlife officers and hunters.

6 Executive summary and conclusions

Please note that this does not preclude the need to read the whole report.

At the request of Commission, a small scientific group (Table 1) was established to examine the issue of the quantities of edible products that might be expected from catches of common minke, fin, bowhead and humpback whales in the Greenlandic fisheries. It is important to note that we were not asked to examine the 'need statement' itself.

An extremely important component of our work was a field visit to Greenland, to obtain as much information possible on those factors that might affect yield. The group visited the three largest settlements in Greenland (Sisimiut, Ilulissat and Nuuk), interviewed hunters and wildlife officers, and visited a variety of flensing site types. In addition we were granted access to the raw data on edible products provided by hunters.

During the field trip, we collected considerable general information on the nature of the hunt. There are two types of hunting of large whales off Greenland: the harpoon hunt (all species) and the rifle hunt (common minke whales only); about three-quarters of the common minke whales are taken by harpoon and one-quarter by rifle. Information on these two hunting types is summarised under Item 2.1 of the report. In both types of hunting, whaling is only a seasonal part of the activities of the hunters, along with, for example, fishing and the hunting of land animals. While the expenses of the harpoon hunt are greater than those of the rifle hunt (for example, a single explosive grenade can cost US$1,000), the number of hunters requiring a share is considerably less - up to 7 versus up to 40). Only persons with a full-time occupational hunting license are allowed to hunt large whales. There are a number of important conditions and limitations, including those related to catch limits, methods of hunting, training and reporting.

In terms of edible products, as is the case elsewhere in the world, we found differences in what products are considered edible by region. In all places, blubber, muscle, throat, peduncle and flukes are consumed but the importance attached to internal organs and intestines varied (see Item 2.2).

Cutting up the animals to obtain the edible products is known as 'flensing'. There are a wide variety of flensing sites and a number of techniques used to manoeuvre the whale into a position on land to allow flensing to occur. The time it takes to flense an animal depends on a number of factors including size of the flensing team, weather conditions, nature of the site (e.g. if an animal could not be completely flensed in one tide cycle) and, of course, the size of the animal. Flensing times vary with conditions but range from about 1-4 hours for common minke whales to 12-48 hours for fin and bowhead whales. There were no financial or other incentives for hunters *not* to obtain as much edible products from each whale as possible given the conditions. Our visit to the remains of one flensing operation of a common minke whale suggested an efficient process for this species. This is confirmed by the fact that the yield for common minke whales obtained from the Greenlandic data are similar to those obtained under 'ideal' conditions elsewhere in the world. Larger whales (incl. large minke whales) are more difficult to fully flense (as well as capture) than smaller whales given *inter alia* the time required (more than one tidal cycle) and difficulties in manoeuvring the animal during flensing, as discussed in the report and revealed by other analyses.

In order to examine the most appropriate dataset to develop conversion factors, we undertook a thorough review of all relevant published and unpublished data. The details and conclusions of that review can be found under Item 3 of the report. Particular focus was placed on strengths and weaknesses of the hunter-provided data on lengths and amounts of edible products for Greenland that has been submitted to the Ministry of Fisheries, Hunting and Agriculture since 1987. During the interviews with the hunters an important discovery was made that is critical to understanding and interpreting the Greenlandic data i.e. the length measurements are taken over the body rather than parallel to the body – this will result in an overestimate of length data compared to the 'standard' measurements used in traditional length-weight relationship studies reported. The extent to which this is an overestimate is unknown and a formal study to examine this is presented in the recommendations section (see Item 5.2.5).

After extensively reviewing the available data from Greenland and elsewhere (see Items 3 and 4 of this report), we agreed that for common minke and fin whales, the most appropriate data to use for the the present study (i.e. obtaining realistic conversion factors for the circumstances of the Greenlandic hunts) are the Greenlandic data themselves, truncated using the scientific data available from other studies to allow for known and suspected issues with hunter-derived data. These issues include (a) that the data were not collected in a fully scientific manner; (b) some hunters do not fill in forms completely and may not include products taken directly by captain and/or crew; and (c) there are differences in yield related to local circumstances (see Item 4) including what is considered edible, flensing site conditions, reporting rigour and what is considered necessary to report.

There are little or no useful local data for humpback whales and for bowhead whales and so external data were used for these.

After reviewing possible approaches for estimating the average yield of products per whale and correcting this for struck-and-lost animals to obtain the average yield per strike (i.e. the amount that one could expect to contribute to meeting need), we adopted the methods described under Item 4.2.3 by species. The results of this, including a consideration of uncertainty are given in detail under Item 5 and summarised in Table 12.

Table 12

The recommended conversion factors per strike (RCFPS). In addition we provide the equivalent conversion factors per animal (RCFPA), as well as the original conversion factors (per animal and calculated per strike on the basis of the struck-and-lost rates given in this report – OCFPA and OCFPS). NG = not previously given.

	OCFPA	RCFPA	OCFPS	**RCFPS**
Common minke whale	2	1.88	1.96	**1.84**
Fin whale	10	10.91	6.6	**7.2**
Bowhead whale	NG	11.00	NG	**11**
Humpback whale	NG	11.59	NG	**9.5**

We stress that the conversion factors we **recommend** are average values based wherever possible on the available Greenlandic data, truncated to remove implausibly low or high values for products based on the best scientific evidence. This reduces the likelihood of either over- or underestimating the product yield when assessing whether particular combinations of catch limits do or do not meet need. The use of average values is important in that it takes into account the variation in yield that is to be expected in a hunt in

which animals of varying lengths are taken throughout a season in which animals are feeding, not to mention natural variation among individuals. While in theory, a weighted conversion factor (or factors) could be obtained that tried to take into account the many factors discussed under Item 4, we do not believe that the data that exist now, or that might be expected to be obtained in the future would justify this level of analysis. The implications for determining *Strike Limit Algorithms* and for setting catch limits under such a regime would also be extremely complex.

Where data permit, the recommendations are provided to more accurate values rather than an integer since the ultimate use for these conversion factors is to provide information on whether and how the Greenlandic multispecies hunt can obtain an agreed level of need expressed in terms of edible products. This is particularly important for common minke whales where the annual strike limit recommended by the Scientific Committee is 178 animals and thus rounding to an integer can have a major effect on estimated products obtained.

Table 13 provides information on estimated edible products using these conversion factors for (A) the present strike limits and (B) for those limits that were in accord with Scientific Committee advice in its report based upon the request by Denmark. It only includes catches for West Greenland (Denmark requested its 670 tonnes of products for West Greenland – its need statement for East Greenland is expressed in terms of numbers of animals - 12).

Table 13

Information on tonnes of products to be expected on average for certain catch limits (see text) using the conversion factors per strike (RCFPS) recommended in this report and for (A) the present strike limits and (B) for those limits that were in accord with Scientific Committee advice in its report based upon the request by Denmark.

	RCFPS	(A) present limits	(B) Limits within SC advice on sustainability	Products for (A)	Products for (B)
Common minke whale	1.84	200	178	368	327.52
Fin whale	7.2	19	19	136.8	136.8
Bowhead whale	11	2	2	22	22
Humpback whale	9.5	0	10	0	95
Total				526.8	581.32

Given the uncertainties expressed in its report and the different levels of available information by species, we also make a number of recommendations for further work. These are summarised below but the reader is referred to the full text under Item 5 for details.

Given the large sample size and consistency with scientific studies for common minke whales, we agree that while data on the yield of edible products should and will continue to be collected under the existing Greenland regulations, focussed effort should concentrate on the other species, where the sample sizes are small.

We **recommend**, therefore, that a focussed attempt to collect new data on edible products taken from species other than common minke whales be undertaken, at least until the end of the next block quota when the interim conversion factors should be reviewed. These data should be collected as a collaborative effort between scientists, wildlife officers and hunters.

In addition, we **recommend** that data on *both* 'curved' and 'standard' measurements are obtained during the coming season for all species taken. These data should be collected as a collaborative effort between scientists, wildlife officers and hunters.

7 Acknowledgements

The authors would like to thank all of the people who assisted in the development of this report. Initially, the idea for such a report came from the Chair of the IWC, Bill Hogarth, as part of his tireless efforts to improve the work of the IWC in conservation and management. Much of the fieldwork was funded by a voluntary contribution from the USA to the IWC; Ryan Wulff assisted greatly in this process. The Greenlandic authorities helped with the logistical aspects of the fieldwork and kindly made the raw data available to the team for analysis. The kindness, responsiveness and patience shown to us by the hunters and wildlife officers made the fieldwork an extremely valuable and enjoyable experience; their names are all listed in Annex B. We are particularly grateful to Takeharu Bando and Yoshihiro Fujise of the Institute of Cetacean Research, Tokyo, who allowed us access to their unpublished manuscript on western North Pacific common minke whales that proved so invaluable to our work. Panayiota Apostolaki of the UK's Centre for Environment, Fisheries & Aquaculture Science provided us with valuable comments on the first draft of the manuscript, although, of course, the final report is our own responsibility.

Annexes

A. Terms of reference and membership of group

B. Summary of field trip: base, people met and affiliations, sites visited

C. Data availability agreement

D. Translation of the hunter reporting form

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Annex A

Workplan for the small group to examine conversion factors for Greenlandic hunts

Membership

The group must be small to be effective. It should comprise no more than 6-7 people. It must include scientists and others with experience of aboriginal subsistence whaling, especially the Greenland hunt, as well as analysts. The group will comprise:

Greg Donovan	Head of Science IWC, Chair of SWG on AWMP and field experience in Greenland
Debi Palka	Chair of the Scientific Committee
Craig George	members of Scientific Committee with long experience in fieldwork on BCB bowhead whales
Philip Hammond	Ex-chair Scientific Committee, University of St Andrews
Lars Witting	scientist from Greenland Institute of Natural Resources, experience with fieldwork in Greenland
Nette Leverman	Representative of the Greenland Home Rule Government

Workplan

The group will:

(1) Obtain an understanding of, and document, those elements of the Greenlandic hunts of relevance to the determination of appropriate conversion factors (tonnes of edible products per strike by species)
(2) Collate and evaluate the existing information of relevance to determining conversion factors (this will include consultation with other potential data holders, analysts as well as published and 'grey' literature);
(3) If possible, the scientists will use this to develop/update conversion factors - the group may recommend that these be considered interim;
(4) Develop, as required, a detailed workplan (including sampling protocols) to collect new data to allow the estimation of final conversion factors
(5) Circulate a full report to Commissioners and Contracting Governments as soon as possible and certainly at least 3 weeks before any intersessional meeting.

Addressing Item (1) will involve a field trip by the non-Greenland based members of the group to Greenland.

Annex B

Summary of field trip

The schedule for the field trip was following the same procedure in all three cities. On the afternoon of arrival, there was an interview with local hunters (from the harpoon and rifle hunts) and wildlife officers. The following day was spent sailing to flensing places representing different conditions of the areas typically used flensing places. On the morning of the final day there was an opportunity to meet again with hunters and wildlife officers for any additional questions/clarifications.

24. – 26 August Sisimiut. We visited Itillip eqqaani / Uiffaq, South of Sisimiut, Itilleq / Itillimi, South of Sisimiut, Saqqap avannaatungaa, South of Sisimiut, Assaqutaq, South of Sisimiut, Qeqertarmiut / Paarngat / Paongat / Paanngat / Panngaap eqeras / Pangaat, West of Sisimiut. We interviewed Noah Enoksen, Gustav Berthelsen and the crew of Eli Fontaine, all full time hunters from the local hunter's organisation KNAPP. The local wildlife officer Hans Mølgaard and his assistant Aqqalu Lyberh were also participating in the visiting to the sites and at the interviews.

26. -28 August Ilulissat. We visited Pangalittut, North of Ilulissat, Oqaatsut / Rode Bay, North of Ilulissat, Taseraasap nuua, North of Ilulissat, Kuannerit nuua, North of Ilulissat, Ilimanaq / Ilimanap eqqaani, South of Ilulissat, Qeqertassuk, South of Ilulissat and Qasigiattaat / Qasigiatsiaat, North of Ilulissat. We interviewed Jess Johansen, Otto Mathiesen, John Ole Jensen, Ove Rosbach and Peter Olsen, all full time hunters from the local hunter's organisation KNAPP. The local wildlife officer assistant Ejvind Søby Jensen was also participating in the visiting to the sites and at the interviews.

28. – 31 August Nuuk. We visited Appannguit iluat, South of Nuuk and Ikaarissat, West of Nuuk. We interviewed Johannes Heilmann, Anthon Egede, Carl Nielsen, Lars Mathæusen and Johannes Egede, all full time hunters from the local hunter's organisation KNAPP. Two wild life officers Ole Jerimiassen and Jakob Heilmann with assistant Morten Lyberth were also participating in the visiting to the sites and at the interviews.

Annex C

Data availability agreement

Introduction

Although a Commission matter, this request has been developed in the context of Procedure B of the IWC Scientific Committee's rules for data availability adopted at the 55th Annual Meeting (*Journal of Cetacean Research and Management* 6 (suppl.). Conditions for data recipients (repeated below) as specified in the rules for data availability are applicable. The nature of the work is specified in the Workplan of the small group established to examine conversion factors for Greenlandic hunts.

Application

(a) *Title* :

Examination of conversion factors for Greenlandic hunts

(b) *Investigators:*

Greg Donovan (IWC), Debra Palka (NOAA, USA), Craig George (North Slope Borough, Alaska, USA), Phil Hammond (University of St Andrews, UK), Lars Witting (GNRI)

(c) *Objectives and rationale of the study*

The study is being undertaken at the request of the IWC at its 2009 Annual Meeting. Its objectives are:

(6) Obtain an understanding of, and document, those elements of the Greenlandic hunts of relevance to the determination of appropriate conversion factors (tonnes of edible products per strike by species)
(7) Collate and evaluate the existing information of relevance to determining conversion factors (this will include consultation with other potential data holders, analysts as well as published and 'grey' literature);
(8) Develop/update conversion factors - the group may recommend that these be considered interim;
(9) Develop, as required, a detailed workplan (including sampling protocols) to collect new data to allow the estimation of final conversion factors

(d) *Data held by Greenland to be used:*

Hunter's records of products obtained from large whales, 1987 to present. Any items that can identify specific individuals or boats will only be presented such that those individuals/boats cannot be identified (e.g. by using codes)

(e) *Description of the analytical methods*

Methods have yet to be finalised depending on examination of the available data from Greenland and elsewhere but will be agreed by all of the investigators noted above

(f) *Schedule of the work:*

The final report must be available at least three weeks before the Commission's intersessional meeting in December 2009. It is hoped to complete the report by mid-October

(g) *Output of the research:*

The report will be submitted to the IWC for use only within that context unless it is later agreed by all data holders to be published.

Conditions for data recipients

(1) Data shall not be transmitted to third parties.
(2) Papers may only be submitted to a Committee meeting in accordance with the time restrictions given below. Such papers must not include the raw data or the data in a form in more detail than is necessary to understand the analysis.
(3) Papers must carry a restriction on citation except in the context of IWC meetings.
(4) Data owners are offered co-authorship.
(5) Publication rights remain strictly with the data owner.
(6) Data shall be returned, to the Secretariat or the data owner as appropriate, immediately after the meeting at which the paper is submitted and any copies destroyed, unless an extension is granted.
(7) Data requesters sign a form agreeing to the above conditions. Such forms will be held by the data owner and the Secretariat.

Annex D

Translation of the hunter reporting form

REPORT ON HUNTING OF WHALE: (make x) ❑ (app. I, page 1)

REPORT ON STRUCK AND LOSS OF WHALE: (*) ❑

A	**Date Name** Cpr. nr. License nr. GR-nr. Number of skiffs**
B	**Whale species: Minke** ❑ **Fin whale** ❑ **Bowhead whale** ❑ **Other** ❑
C	**Length: _____** meter (from point in tale fin to over jaw)
D	**Sex:**(cross off) **Female** ❑ **Male** ❑ If female: With milk in mammary glands: Yes ❑ No ❑ With foetus: Yes ❑ No ❑ foetus sex: Female ❑ Male ❑ foetus length: _____meter
E	**Stomach content:**_____
F	**Place name of hunting place:**_____ or **Position:**_____ degrees_____ min. Northern latitude _____ degrees_____ min. Western longitude
G	**Flensing place:**
H	**Catch in approximate kg: Kg meat:** **Kg mattak:** **Kg qiporaq:** **Kg Total:** ❑ Samples taken out and send to Greenland Institute of natural Resources, Box 570, 3900 Nuuk.
I	**Used weapon:** ❑ Harpoon canon with warm grenade Serial nr._____ ❑ Riffle Calibre:_____ ❑ Other Define:_____
J	**Killing time:_____** minutes (If longer than 30 minutes, write explanation on the next page)
K	**Reason for struck and lost***: write explanation on the next page.
L	**Filled out by (**):** _____ **Date Name Signature**

* In case of a struck and lost, only fill out column A, B, F, I, K & L. In case of a struck and lost an explanation of the reason for the strike has to follow in the report.

** For the riffle hunt put down other participating hunters name in appendix I, page 2.

RIFLE HUNT: (Appendix I, page 2)

NAME & CPR. NR. OF HUNTERS:	NAME & CPR. NR. OF HUNTERS:

Reporting procedure for hunt or struck and lost of whales:

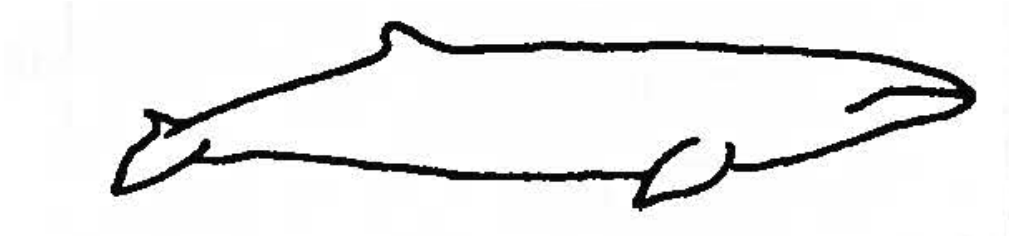
In case of hunt or struck and lost of all large whales the hunter has to fill out, in case of riffle hunt the chosen captain, a reporting scheme and send it to the office of the municipality/settlement.

In case of hunt column A-J & L has to filled out, while column A, B, F, I, K & L has to be filled out in case of a **struck and lost**.

Immediately after each hunt one reporting scheme per whale has to be handed in to the the office of the municipality/settlement. The municipality will forward a copy off all received reporting schemes following the rules written in the executive order to the Agency of Fisheries, Hunting and Agriculture.

In case of an illegal struck whale the municipality is obligated to report the catch to the Agency of Fisheries, Hunting and Agriculture immediately after finding out.

IN CASE OF A STRUCK AND LOST: (Appendix I, page 3)

In case of a struck and lost, or a time to death longer than 30 minutes, the explanation are the following:
Cross off, where the whale is struck:
Fin whale or minke whale: 
Bowhead whale: