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Estimating Struck and Loss Rates for Harp Seals in the Northwest Atlantic

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Abstract

One of the major sources of unreported mortality during the commercial harp seal hunt in the Northwest Atlantic is the number of animals killed or fatally wounded and not recovered by hunters (i.e. seals that are struck and lost). With the significant expansion of the hunt both in Canada and in Greenland during the mid 1990s, there is a concern that unreported mortalities of harp seals struck and lost may have reached a level that is not sustainable from a long-term management perspective. To address this problem a study on the number of seals struck and lost in Newfoundland waters was initiated. The results summarized in this research document are based on observations collected by the Marine Mammal Section, DFO and the Fisheries Observer Program in 1998 and 1999. In general, overall loss rates for beaters taken on the ice varied from 0-2.0% and from 0–10.0% when taken in the water. Older seals aged 1+ had overall loss rates of 0–21.6% when taken on ice and rates of 5.0–50.0% when taken in the water. Although sample sizes were limited (especially for seals taken in the water) and there was only limited coverage of the hunt, these data provide current estimates of struck and loss rates and have been incorporated into recent harp seal population modeling initiatives.

Résumé

Les phoques du Groenland tués ou mortellement blessés qui ne sont pas récupérés par les chasseurs (les phoques qui ont été abattus et perdus) constituent un des plus importants types de mortalité non déclarée de la chasse commerciale de cette espèce dans l'Atlantique nord-ouest. L'expansion considérable de cette chasse au Canada et au Groenland dans le milieu des années 1990 fait craindre que la mortalité non déclarée de phoques du Groenland qui ont été abattus et perdus pourrait avoir atteint un niveau incompatible avec une exploitation durable dans le contexte d'une gestion à long terme. Pour résoudre ce problème, une étude portant sur le nombre de phoques abattus et perdus dans les eaux de Terre-Neuve a été lancée. Les résultats résumés dans le présent document sont fondés sur des observations recueillies en 1998 et en 1999 par la section des mammifères marins du MPO et par le Programme des observateurs des pêches. En général, le taux de perte total de jeunes phoques variait de 0 à 2,0 % lorsqu'ils étaient abattus sur la glace et de 0 à 10,0 % lorsqu'ils étaient abattus dans l'eau. Le taux de perte des phoques âgés de 1 an et plus variait de 0 à 21,6 % sur la glace et de 5,0 à 50 % dans l'eau. Bien que l'effectif des échantillons ait été limité (surtout pour les phoques abattus dans l'eau) et que la représentativité n'ait été que partielle, ces données constituent des estimations actuelles du taux d'animaux abattus et perdus qui ont été utilisées pour l'initiative de la modélisation de la population de phoques du Groenland.

Introduction

Estimating the magnitude of unreported harp seal mortality in the Northwest Atlantic during the commercial hunt is a difficult task because there are several potential sources contributing to the problem. Including seals that are killed or fatally wounded but are not recovered by hunters, commonly referred to the as the number of seals struck and lost (Malouf 1986; Lien et al. 1988). Historically the seal hunt off Canada's East Coast focused on the harvest of harp seal pups (whitecoats) while they were still on the ice in whelping concentrations. The number of animals struck and lost during this hunt was reported to be negligible (Malouf 1986). When the whitecoat hunt ended in 1983, commercial harp seal catch levels remained relatively low until 1995. During this time the hunt focused on young harp seals about 1 month old (beaters), and on seals 1 year of age and older (bedlamers) and adult seals aged 1+). Unreported mortalities were not considered to be serious conservation issues because of the low catch levels. However, with the significant expansion of the hunt in both Canada and Greenland during the mid 1990s there is growing concern that unreported mortalities of harp seals may have reached a level that is not sustainable from a long-term management perspective Stenson et al. 1999). Until recently, there was little, or no, quantitative information available on any sources of unreported mortality.

A recent study by Lavigne (1999) reviewed the literature on harp seal stuck loss rates and presented estimates of the total number of harp seals lost during the commercial hunt in the northwest Atlantic. Many of the estimates available from the literature are limited in geographic scope, outdated, and highly variable. Good quality data are difficult to collect because loss rates are influenced by several factors: the skill of the hunter; whether the seal is taken on ice or in the water; sea and weather conditions at the time; the age and body condition of the seal; and, the time of year (Sergeant 1991; Lavigne 1999). This complex suite of interacting factors is responsible for the highly variable nature of struck and lost data. Lavigne (1999) cites loss rates for 1+ age harp seals that varied from 0–85% depending upon some, or all, of the above mentioned factors. For younger seals there are virtually no data available; Rowsell's (1977) report of a 1.3% struck and loss rate for beaters taken on ice is the only study. In addition, all of these data were collected before 1980 while characteristics of the commercial hunt in Canadian waters and the hunt in Greenland waters have changed over the intervening years.

Accurate estimates of harp seal abundance and population dynamics are the basis for any management and conservation initiatives. The population model used to estimate the abundance of harp seals in the northwest Atlantic requires information on pup production, pregnancy rates and catch statistics from the commercial hunt. As is the case of most large mammals, there are little or no data on mortality rates for harp seals so, until recently, all sources of unreported mortality were considered a component of natural mortality and estimated by the

model. Stenson et al. (1999) examined the impact of different struck and loss rates on the harp seal population; however, these estimates were preliminary and more data are required if this source of unreported mortality is to be explicitly accounted for in future harp seal stock assessments. Marine Mammal personnel working for the Department of Fisheries and Oceans (DFO) have attempted to collect struck and loss information as part of their ongoing research activities since the early 1980s. In 1998, a more directed study monitoring the commercial hunt was initiated, and in addition, the Fisheries Observer Program assigned personnel to several vessels to monitor the hunt and to collect statistics (including loss rates). This manuscript provides estimates of struck and loss rates based on these observations. In many cases sample sizes are often small (especially for seals taken in the water) and represent only limited coverage of the hunt. However, these data are useful from a comparative perspective and provide current estimates of struck and lost estimates that can be incorporated into harp seal population modeling initiatives.

Materials and Methods

In recent years the commercial harp seal hunt has been prosecuted by inshore sealers using small boats <35 ft. and by sealing crews aboard 35–65 ft. longliners off the northeast coast of Newfoundland and in the southern Gulf of St. Lawrence. The majority of the TAC (total allowable catch) is taken by the longliner crews from early April to mid May in Newfoundland waters. Information on harp seals killed or fatally wounded and not recovered (struck and lost) during the commercial hunt comes from four main sources: 1) DFO personnel and fisheries observers aboard commercial longliners during the spring hunt; 2) DFO personnel aboard large vessels (>65 ft.) during the late winter prior to whelping and on the molting patch in April or May; 3) DFO personnel accompanying small boat sealers during the spring hunt, and 4) DFO personnel interviewing small boat sealers when they returned to port.

Longliners were chartered by DFO in either April or May of 1982, 1983, and 1984. Although the primary objective of these trips was to collect morphometric information on young seals (beaters), all age-classes of seals were taken, a professional sealing crew was used in all years, and hunting activities were conducted using the same methods as those used during the commercial hunt. In 1998, DFO personnel accompanied the commercial sealing crews during routine spring hunting trips along the northeast coast of Newfoundland (n=3 trips). In 1999, a DFO observer accompanied a longliner crew for one trip during the spring hunt in the southern Gulf of St. Lawrence. Fisheries observers were assigned to longliners working the northeast coast of Newfoundland during mid March to mid April in 1989 (6 trips) and 1999 (4 trips). The observer's primary responsibility was to monitor the hunt and maintain a daily logbook of all general hunting activities including the number and age of seals struck and lost. All trips were approximately 10 – 15 days in duration.

Large vessel charters were conducted during late winter (January or February) or in the spring (April or May) of 1983, 1992-95, and 1998. Trip duration varied between 10-14 days. A professional hunter shot seals from the bow of the ship as it moved slowly through the ice. Crew members recovered the carcasses either by jumping over the side of the vessel on to the ice or by using a speedboat. On all trips DFO personnel documented struck and loss information (age class of the seal shot and whether it was taken on ice or in the water) and collected biological samples.

During April 1999, DFO personnel made 23 day trips with small-boat hunters from some of the major sealing communities along the north and northeast coast of Newfoundland (n=20) and in the Les Escoumins region of Quebec (n=3). If it was not possible for DFO personnel to accompany the sealers, informal interviews were conducted when the hunters returned to port. Information on an additional 55 hunting trips made in Newfoundland waters were obtained in this manner. General catch statistics, biological samples and information on the number of seals struck and lost were collected in both situations.

Results and Discussion

Young Harp Seals

A summary of young harp seals (beaters) struck loss rates based on observations made by DFO observers during the commercial longliner hunt is presented in Table 1. From a total of 712 seals taken over a period of 4 years the overall loss rate was 1.4%; those shot in the water had a higher loss rate than those taken on the ice (3.2% vs. 1.2% respectively). During the spring seal hunt of 1998 and 1999 fisheries observers monitored 10 commercial longliner trips in Newfoundland and Labrador waters and one in the southern Gulf of St. Lawrence. Although the level of detail reported by the observers varied somewhat, there were good quality data from each trip. Information summarized in Table 2 is primarily for beaters with the exception of Trip 3 (note: there were no age-class data for seals lost on Trips 1,7 or 8). Estimated losses for beaters in Newfoundland and Labrador varied from 0 – 2.0% with no apparent differences between years (Table 2). Based on comments in the logbooks, most or all seals taken in both years were shot or killed with a hakapik on the ice. During the hunt in the southern Gulf of St. Lawrence 0.7% (33/4926) of the ragged jackets/beaters struck on the ice were lost.

At least one seal was stuck and lost on 45.0% (9/20) of the small boat trips monitored during the spring hunt in Newfoundland waters in 1999 (Table 3). When data from all Trips were pooled regardless of whether beaters were struck while on the ice or in the water the loss rate was 1.6% (3/190). When killing location was taken into account, the number of beaters lost from the ice was 1.9% (3/160) while

none were lost in the water (0/29; the killing location was unknown for 1 seal). In some cases it was possible to obtain age-specific information on a daily trip basis from comment in the logbooks; for Trips 12, 13 and 19, beater loss rates from the ice were 4.8% (1/21), 3.7% (1/27) and 5.3% (1/19) respectively.

Interviews conducted by DFO personnel with sealers when they returned from their hunt indicated that at least one seal was lost on 21.8% (12/55) of small boat trips. Table 4 summarizes the number of seals struck and lost for days when seals where not recovered. When data from all trips were pooled regardless of whether seals were struck while on the ice or in the water, the loss rate for beaters was 0.9% (7/761). When killing location was taken into account, there were no beater losses from the ice (0/235) while 2.2% (2/93) were lost in the water (this summary was based only on information from Trips 6 – 12). The overall loss rate for beaters taken by DFO personnel working from larger vessels was 2.9%; there were no losses when seals were taken on the ice while 10% (1/10) were not recovered from the water (Table 5).

These data on loss rates of beaters taken on the ice from longliners, small boats and larger vessels are consistent with Rowsell's (1977) estimate of 1.3% (1/77). The somewhat higher rates associated with the large vessel hunt and the lower rates estimated by the observers may in part be a reflection of the number of seals taken/trip; small in case of the DFO data sets and very large for the other data sets. Although there are only two years of observations from the fisheries observers, it appears that sealers who prosecute the fishery on a large scale from longliners can achieve low struck and loss rates when beaters on the ice are targeted. In general, the loss rates for beaters taken in the water were somewhat higher than for seals taken on the ice; however, the difference is not as great as in older seals (see below). It is important to note that the sample sizes for beaters taken in the water were low for all vessel types; more observations are needed to firmly establish the difference between 'on ice' and 'in water' loss rates. This is an issue of concern because during the early 1990s the proportion of beaters in the commercial catch has varied from a low of 41.0% to a high of approximately 83.0% (Stenson et al. 1999). The hunt catch statistics underscore the need to identify and understand the ecological factors that strongly influence beater haul out behavior (e.g. time of season, freezing rain, floe size and ice tightness).

When Lavigne (1999) estimated the number of beaters struck and lost during the commercial hunt he used two figures - 10.0% and 25.0%. He selected a lower and a higher estimate to reflect the uncertainty associated with proportion of beaters in the water at the time of the hunt. Since the author could not find struck and loss data for beaters he assumed his estimates were reasonable given what was known about the loss rates of older seals. Based on Rowsell's estimate and the information presented here, it appears that a 10% "low end" estimate for beaters taken on the ice is too high. Until there are additional data on loss rates of beaters taken in the water it will be difficult to further evaluate Lavigne's 25.0% estimate. However, based on the information presented here, it is likely too high.

Older Harp Seals

In general, the numbers of 1+ aged seals struck and lost were more variable and often higher than for beaters. The overall loss rate for older seals as observed by DFO personnel during the commercial longliner hunt was 43.4% (23/53; Table 1); however, there is a notable difference in the rate depending on whether the seal was taken on ice or in the water. Those taken on ice had a loss rate of 11.1% while 50.0% of those shot in the water were not recovered. As previously noted, fisheries observers on longliners collected very little data for 1+ aged seals struck on the ice in 1998 and 1999 because 10/11 trips they were assigned to targeted beaters (Table 2). However, on Trip 3 a significant number of older seals were taken and the estimated loss rate was 1.3% (Table 2). A relatively small number of 1+ aged seals were taken on other Trips by speedboat crews working with the longliner; however, since the crew's activities were not monitored by the observers (i.e. the speedboat was out of view), these data were not included here. During the southern Gulf of St. Lawrence hunt 21.6% (8/37) of older seals taken on the ice were not recovered.

The overall loss rate for 1+ aged seals taken during the Newfoundland small boat hunt as observed by DFO personnel in 1999 was 15.7% (13/83). When the kill location was taken into consideration, 4.9% (2/41) of the seals were lost from the ice and 29.0% (11/38) in the water (note: in four cases there was no information on where the seal was lost). In some instances age-specific information was obtained from the logbooks; for Trips 2, 4, 7 and 18 the loss rates for 1+ aged seals shot in the water were 100% (1/1), 55.6% (5/9), 30.0% (3/10) and 100% (1/1) respectively. Loss rates for 1+ aged seals shot on the ice were 16.7% (1/6) and 6.3% (1/16) for Trips 17 and 19 respectively (Table 3). The three small boat trips monitored in the Les Escoumins region of Quebec were made prior to the breeding season and away from the main whelping location; all animals were taken in the water and thought to be 1+ aged seals. The overall loss rate was 5.0% (2/40); losses for individual trips were 0/6, 0/12 and 9.1% (2/22).

Based on 55 interviews conducted by DFO personnel with sealers when they returned from their hunts, the overall loss rate for older seals was 13.4% (9/69). If kill location was known, and taken into account, 36.4% (8/22) of seals were lost in the water and there were no losses from the ice (0/49; this summary was based only on information from Trips 6 - 12). The overall loss rate for 1+ aged seals taken by DFO personnel working from larger vessels was 3.2% (41/1296); there was a difference in the shot and loss rate depending on whether the seal was taken on ice (2.9% loss) or in the water (13.8% loss; Table 5).

A wide range of loss rates can be found in the scientific literature for 1+ aged seals shot in the water; Barchard (1978) documented losses from 50 – 85% and Malouf (1986) reported estimates from 0 – 65%. The overall loss rate for

older seals taken in the water from longliners, small boats and larger vessels in this study varied from 5.0 – 50%. These estimates fall at the lower end of the range documented by Barchard (1978) and at the low end or middle of the range reported by Malouf (1986). A similar interpretation was obtained if on ice and water losses were pooled and then compared to the published estimates (in this study overall losses varied from 3.2% - 43.4%). However, when making these generalized comparisons it is important to note that given the paucity of both historical and current data it is not possible to adequately account for potentially significant geographic and seasonal differences. The overall loss rate of 3.2% for older seals taken on DFO large vessels is considerably lower than the longliner data and almost all published estimates. This is most likely a result of low sample sizes in the longliner data set and the extremely variable sample sizes for the large vessel data set.

The estimates of overall loss rates for 1+ aged seals struck on the ice from longliners, small boats and larger vessels varied from 0 – 21.6% and were, as expected, considerably lower than in water loss rates. With the exception of seals lost during the Gulf of St. Lawrence commercial hunt, all estimates were less than 11.1%. There appears to be no published reports of loss rates for older seals taken on ice for further comparison. Several factors may contribute to the higher loss rates for older seals taken on the ice; sealers feel these seals tend to be more wary and dive for the water faster than beaters making it more difficult to get a good shot. If a killing shot is not delivered, older and larger seals often make a lunge into the water even when fatally wounded while beaters tend to remain on the ice allowing a second shot to be taken. The size of the ice floe and the location of the seal on the floe (i.e. proximity to crack or open water) may also be important from this perspective. Killing methods could also explain much of the difference; high numbers of beaters were killed with a hakapik while older seals were usually shot (based on comments noted in observer logbooks).

Lavigne (1999) estimated the number of 1+ aged harp seals shot and lost in the Northwest Atlantic using two figures – 20% and 50%. He considered a 50% loss rate to be a conservative estimate for older seals taken in the water by Canadian and Greenlandic hunters. The 20% loss rate acknowledged that a significant proportion of the 1+ aged seal hunt was prosecuted during the molting period when seals were on the ice. Information presented here on loss rates for older seals taken on the ice suggests that an estimate of 20% is likely high. Given the variability of loss rates for older seals taken in the water observed in this study, and in the literature, it is not possible to further evaluate the 50% estimate but it appears to be reasonable.

Data Quality and Comparability

The information collected on seals stuck and lost by DFO personnel accompanying sealing crews during the spring longliner hunt in 1998 and the small

boat hunt in 1999 is well documented and seals were taken by professional hunters during the peak of the spring commercial hunt. DFO personnel did not knowingly alter the hunting activity and routine duties of the commercial sealing crews and the observations and information collected on loss rates from longliners during the spring hunt are as representative as possible. Given there is only one year of information on the small boat hunt, it is difficult to evaluate the usefulness and accuracy of data obtained from interviews with small boat hunters. However, it should be noted that the loss rates for beaters and older seals observed by DFO personnel were consistent with those obtained from the interviews. The hunters seemed to be able to remember how many seals were lost but often did not recall if the animal was struck while on the ice or in the water.

Information on loss rates collected from DFO chartered longliners in the early 1980s is of similar quality and relevance as the 1998 data. Hunters were requested by DFO to take beaters when possible during these trips; all other aspects of the crew's hunting activity were routine. This request for beaters was not restrictive or unusual given that in recent years beaters are often targeted by the sealers during the spring longliner hunt anyway.

Struck and loss data collected from DFO large vessel charters are not as directly comparable to routine hunting activity of commercial longliners from a technical perspective (e.g. different shooting techniques, longer time taken to recover seals, and variable behavioral responses of seals to the vessel). However, it is important to note that during the spring the vessel was used as a hunting platform in the molting patch where most of the longliner sealing activity was also concentrated. Therefore, the hunting conditions in terms of local weather, ice characteristics, and availability of hauled out seals were typical and comparable to those experienced by longliners in the area. It is quite likely that the technical aspects of hunting from a large vessel compared to a longliner are most similar when hauled out seals are targeted (as was the case in 1998). At present, there is not enough data to quantitatively evaluate how important some of the technical differences might be, but they are probably not serious enough to compromise the integrity of the data set for some preliminary comparisons.

Overall the fisheries observers did a good job monitoring the 1998 hunt and minor adjustments in observation protocol improved the quality of the stuck and lost information collected in 1999. In some cases there were inconsistencies among observers as to the detail and type of data recorded. Most notably, some observers did not clearly and consistently indicated the age class of the seal lost. However, this was usually not a problem because virtually the entire catch was beaters and therefore it was possible to confidently assume that most of the seals lost were beaters. In other cases observers provided sporadic daily shot and lost figures that clearly indicated what age classes were being hunted that day. This type of information was useful when trying to evaluate the shot and lost rate for the entire trip.

In some logbooks it was often unclear whether seals were taken on the ice or in the water; however, when the Sea Watch observers were questioned, they confirmed that in both 1998 and 1999 most, or all seals, were taken on the ice. And finally, in some logbooks it was difficult to determine if the entire days catch was monitored (i.e. as evidenced by one or two crews hunting from speedboats while the observer was aboard the longliner). This was a more difficult problem to address because to fully account for the activities of the speedboat crews the observers would have had to note in their logbooks what proportion of their take was actually monitored. Given that this was not always done in sufficient detail, information collected in 1998 has been conservatively summarized taking this limitation into account. Observations made on days when a speedboat crew was operating were not included in the data set. In 1999 the problem was addressed and observers clearly indicated what proportion of the days catch had been monitored.

Literature Cited

Barchard, W. W. 1978. Estimates of historical stock size for northwest Atlantic harp seals. MSc. Thesis, University of Guelph, Guelph, Ontario, Canada. 164 pp.

Lavigne, D. M. 1999. Estimating total kill of northwest Atlantic Harp seals, 1994-1998. Mar. Mam. Sci. 15(3):871-878.

Lien, J., G. B. Stenson, and I. H. Ni. 1988. A review of incidental entrapment of seabirds, seals and whales in inshore fishing gear in Newfoundland and Labrador: a problem for fishermen and fishing gear designers. Pages 67-71. *In:* The Proceedings of the World Symposium on Fishing Gear and Fishing Vessel Design. Marine Institute, St. John's, Newfoundland.

Malouf, A. 1986. Seals and sealing in Canada. Report of the Royal Commission. 3 Vols. Supply and Services Canada, Ottawa.

Rowsell, H.C. 1977. 1977 Sealing Activities by Newfoundland Landsmen and ships on the Front. Rep. To Comm. Seal Sealing and Can. Fed. Humane Soc. 24p.

Sergeant, D. E. 1991. Harp seals, man and ice. Canadian Special Publication of Fisheries and Aquatic Sciences. 153 pp.

Stenson, G.B., B. Healy, P.A. Shelton and B. Sjare. 1999. Recent Trends in the Population of Northwest Atlantic Harp Seals, *Phoca groenlandica*. Can. Stock Ass. Sec. Res. Doc. 99/107.

Stenson, G. B., B. Sjare, and D. Wakeham. 1999. Catch-at-age of northwest Atlantic harp seals. Can. Stock Assess. Sec. Res. Doc. 99/105.

Table 1. Estimates of harp seal struck and loss rates based on observations made by DFO personnel on longliners during the commercial hunt in April and May (no. lost/total no. struck).

Year	Beaters		1+ Aged Seals	
	Ice	In water	Ice	In water
1982	NA	1/8	NA	1/1
1983	0/1	0/40	NA	13/29
1984	NA	I/2	NA	8/10
1998	8/648	0/13	1/9	0/4
Total	8/649 – 1.2%	2/63 – 3.2%	1/9 – 11.1%	22/44 – 50.0%
Grand. Total	Beater 10/712 – 1.4%		1+ Aged Seals 23/53 – 43.4%	

Table 2. Estimates of harp seal struck and loss rates based on data collected by fisheries observers on longliners during the commercial hunt in April and May of 1998 and 1999.

Trip No.	Age Class of Seals		No. Lost/Total No. Struck	Trip Loss Rate %
	Beaters	> 1 year old (1+)		
1998				
Trip 1	1824	229	40/2053	2.0
Trip 2	1995	0	16/1995	0.8
Trip 3	7	1398	18/1405	1.3
Trip 4	680	0	0/680	0
Trip 5	1978	3	7/1981	0.4
Trip 6	888	15	0/903	0
1999				
Trip 7	542	7	2/549	0.4
Trip 8	466	31	8/497	1.6
Trip 9	335	0	4/335	1.2
Trip 10	702	0	4/702	0.6
*Trip 11	4926	37	41/4963	0.8

(*Note - Trip 11 occurred in the southern Gulf of St. Lawrence; a total of 33/41 lost seals were ragged jackets/beaters)

Table 3. Estimates of daily struck and loss rates for harp seals taken on the ice or in the water by small sealing boats (<35 ft) based on observation by DFO during the commercial hunt in April 1999 (number lost/total number struck; UK – kill location unknown).

Trip	Beater			1+ Aged Seals			Trip Loss Rate %	
	Ice	In Water	UK	Ice	In Water	UK		
1		0/1					0	(0/1)
2					1/1		100	(1/1)
3		0/2			0/2		0	(0/4)
4		0/3			5/9		41.7	(5/12)
5						0/2	0	(0/2)
6	0/1						0	(0/1)
7		0/1			3/10		27.3	(3/11)
8					1/7		14.3	(1/7)
9			0/1			0/2	0	(0/3)
10	0/4			0/1			0	(0/5)
11	0/2	0/1		0/1			0	(0/4)
12	1/21	0/8					3.5	(1/29)
13	1/27	0/3		0/3			3.0	(1/33)
14	0/3	0/4		0/1			0	(0/8)
15	0/6						0	(0/6)
16	0/17	0/2		0/2	0/2		0	(0/23)
17	0/43			1/6	0/2		2.0	(1/51)
18	0/17	0/2		0/8	1/1		3.6	(1/28)
19	1/19	0/2		1/16			5.4	(2/37)
20				0/3	0/4		0	(0/7)
Total	(3/160) 1.9%	(0/29) no loss		(2/41) 4.9%	(11/38) 29.0%			
Grand Total	Beaters (3/190) – 1.6%			1+ Aged Seals 15.7% (13/83)				

Table 4. Summary of harp seals struck and lost for days when seals where not recovered based on interviews with small boat (35 ft) hunters during the Newfoundland commercial hunt in April 1999 (no. lost/total number struck; UK – kill location unknown).

Trip	Beater			1+ Aged Seals			Trip Loss
	Ice	Water	UK	Ice	Water	UK	Rate %
1			1/42				2.4
2			1/35				2.9
3			2/5				40.0
4			1/74				1.4
5			0/4			1/2	16.7
6		1/3					33.3
7	0/1	0/1			2/2		50.0
8	0/1				1/1		50.0
9					3/3		100.0
10		0/1			1/1		50.0
11		1/2			0/3		20.0
12	0/2				1/2		25.0

Table 5. Estimates of harp seal struck and loss rates based on observations made by DFO personnel on large vessels during the late winter and spring (no. lost/ total no. struck).

Year	Beaters		1+ Aged Seals	
	Ice	In water	Ice	In water
1983	0/14	NA	1/7	NA
1992	0/8	NA	10/506	NA
1993	0/1	NA	8/97	2/20
1994	NA	0/2	0/85	2/9
1995	0/1	NA	1/5	NA
1998	NA	1/8	17/567	NA
Total	0/24 – no loss	1/10 – 10.0%	37/1267 – 2.9%	4/29 - 13.8%
G. Total	Beaters 1/34 – 2.9%		1+ Aged Seals 41/1296 – 3.2%	