3.4
REPORT OF THE SCIENTIFIC COMMITTEE WORKING GROUP ON ABUNDANCE ESTIMATES

The Working Group met at the Marine Research Institute, Reykjavík during 21-23 February 1997, under the chairmanship of Nils Øien (Norway). The meeting was attended by members of the Working Group: Þorvaldur Gunnlaugsson (Iceland), Pia Barner Neve (Greenland), Nils Øien (Norway), Jóhann Sigurjónsson (Iceland), Gísli Víkingsson (Iceland), as well as invited participants David Borchers and Louise Burt from the Mathematical Institute, University of St Andrews, UK.

1. TERMS OF REFERENCE

The Working Group was established by the Scientific Committee at its fourth meeting in Tórshavn, Faroe Islands in February 1996 and was given the task:

(i) "to review the analyses and where relevant also to analyse data from NASS-95 to ensure its compatibility, both between NASS-95 survey areas, as well as with data from other sightings surveys, in order to provide a basis for calculating abundance estimates for the relevant cetacean stocks in the North Atlantic", and

(ii) "to monitor stock levels and trends in stocks of all marine mammals in the North Atlantic".

The Working Group coordinated its work by correspondence (led by J. Sigurjónsson, Iceland until replaced by N. Øien). The meeting in Reykjavik was the first and only meeting of the Working Group, and focused on describing synoptic distributions of the cetacean species encountered during NASS-95, and abundance estimates for minke, fin, sei and pilot whales.

2. PLANNING THE NASS-95 SURVEY

In 1987 and 1989 synchronized large scale cetacean sightings surveys were conducted on board vessels and aircraft allocated by the Faroe Islands, Greenland, Iceland, Norway and Spain known as the NASS-87 and NASS-89 (North Atlantic Sightings Survey) surveys, respectively (see e.g. *Rep.int.Whal.Commn* 39 (1989):395-455; *Rep.int.Whal.Commn* 41 (1991):134-138). In addition to scientists from the sponsoring laboratories, scientists from Japan, New Zealand, UK and USA were also involved in the planning and conduct of the surveys. As a result of these joint research efforts, the first synoptic view of distribution and abundance of cetaceans was obtained that covered deep and shallow areas of the northern North Atlantic Ocean from the coast of Spain in the south to the Barents Sea in the north, and as far west as to the coasts of Iceland and West Greenland south to 50°N. The surveys were planned and the results were analysed in cooperation with members of the International Whaling Commission (IWC) Scientific Committee.

In 1993 the North Atlantic Marine Mammal Commission (NAMMCO) Council decided that a North Atlantic sightings survey should be conducted under the auspices of the NAMMCO Scientific Committee. The Council requested the Scientific Committee to plan joint cetacean sightings surveys in the North Atlantic by coordinating national research programmes with the aim to obtain new abundance estimates of the principle whale species in the northern North Atlantic. The Committee decided that the survey was to take place during July-August 1995 and established a Working Group to plan the NASS-95 under the chairmanship of F. Larsen (Greenland).

The Working Group had three meetings in 1994 and 1995 (NASS-95 Working Group Report 1994a; 1994b; *NAMMCO Annual Report* 1995:121-124) to plan and coordinate activities in the NAMMCO member countries and to establish cooperation with scientists and laboratories in other relevant countries and organisations, particularly the IWC Scientific Committee and the International Council for the Exploration of the Sea (ICES). A joint meeting with experts from both organisations was held in December 1994, where theoretical and practical aspects of the survey were discussed in detail. The Norwegian part of the NASS-95 survey, NILS-95 (Norwegian Independent Line-Transect Survey), was subject to special consultations within the IWC Scientific Committee (*Rep.int.Whal.Commn* 46 (1996):61-62).

At the outset it was decided that the design and planning of NASS-95 was to be compatible with the earlier surveys in order to allow for comparison of abundance and distribution in time. During the planning phase, an increase in the area coverage to the western North Atlantic compared to earlier surveys (see Figures 1 and 2) was considered an important goal. However, efforts failed to obtain simultaneous participation by the relevant countries in the western North Atlantic. In contrast to the surveys in 1987 and 1989, no surveys were conducted off West Greenland in 1995. However, an aerial survey was conducted in that area in 1993, and reported by Larsen (1995). Observations from that survey have been used for distributional maps to indicate the extent of known distributions.

2.1 Target Species of the Survey

As in earlier surveys, the participating countries had different species priorities. Norway still had minke whale (*Balaenoptera acutorostrata*) as the main target species. The Faroe Islands had greatest interest in long-finned pilot whales (*Globicephala melas*), but secondary interest in bottlenose dolphins (*Tursiops truncatus*) and northern bottlenose whale (*Hyperoodon ampullatus*). Iceland attached greatest emphasis to minke, fin (*B. physalus*) and sei whales (*B. borealis*), the last mentioned species having however less importance than the first two. It was recognized that while abundance estimation might be possible for other cetacean species observed during these surveys, the design and conduct of the survey might to a varying degree facilitate such estimation, depending on both the species and areas in question.

2.2 Area Coverage and Timing

Figure 2 shows the areas covered by the NASS-95 surveys by participating countries as well as the survey blocks, where the nations had synchronised their efforts according to

available resources and the over all goal. One Faroese vessel participated during the period 3 July-6 August, covering a similar area as the single vessel conducting the survey in 1989 with an additional extension to the southwest. Eleven Norwegian vessels participated during the period 5 July-8 August, covering the same areas as in 1989 as well as an extension westwards to the drift ice off East Greenland, including the Jan Mayen area. The Icelandic survey, carried out with two vessels during the period 22 June-4 August, had the main sightings effort and area coverage somewhat similar to the 1987 Icelandic survey, but earlier and more to the north than the Icelandic survey in 1989.

The Icelandic aerial survey component (7-25 July, see SC/4/17), aimed at minke whales in the coastal (depth less than 600-1,000 m) waters of Iceland, was similar both in coverage and timing as the 1987 survey (Donovan and Gunnlaugsson 1989). The track lines and survey blocks are shown in Figure 4.

3. METHODOLOGY

3.1 Shipboard Surveys

The basic methodology used was the line-transect survey method (Buckland et al. 1993a). The Icelandic shipboard survey was conducted in a delayed-closure mode with one barrel and the upper bridge as the search platforms (Sigurjónsson et al. 1996b).

The Faroese surveys were carried out in passing mode with a random sample collected in delayed-closure mode to estimate school sizes of pilot whales (for further details, see Desportes et al. 1996). Two independent observation platforms were used, a primary platform (searched with naked eye within 1,000 m from vessel) and a tracker platform (searched with binoculars ahead and beyond 1,000 m from vessel), that operated according to a specific protocol (Buckland and Turnock 1992).

The details of the Norwegian survey design and sighting protocols are given in Øien (1995, 1996). The survey was operated in passing mode with basically two independent observer teams on watch during acceptable conditions, although minor parts of the survey were run in a one-platform configuration. Vessel speed on effort was intentionally 10 knots.

3.2 Aerial Survey

The tracks were originally (1987) set out according to a procedure by Cooke and Hiby (1987), where an objective function is used to specify the drawing of the tracks such that the probability of any given point being covered can be calculated as a function of its position. The estimated population size is then calculated as the sum of reciprocals of the coverage probabilities for all the sightings. The survey was conducted (Sigurjónsson et al. 1996a) from a twin-engine high wind *Partenavia Observer P-68*, with a plexiglass bubble window on each side. The plane operated generally at an altitude of 750 feet when conditions permitted and at a speed of around 90 knots (167 km/hr).

3.3 Analyses

3.3.1 Shipboard Surveys

The Icelandic and Faroese data as well as the Norwegian fin whale data have basically been analysed using the Distance software package (Laake et al. 1994). The analysis of the Norwegian minke whale data are described in Schweder et al. (1996).

3.3.2 Aerial Surveys

Only minke whale abundance estimation was attempted based on the data obtained by the aerial survey around Iceland. The analysis carried out (SC/5/AE/2) is based on the cue-counting method (Hiby and Hammond 1989) as described in Buckland et al. (1993a), using the computer programme DISTANCE (see Buckland et al. 1993a).

4. SURVEY RESULTS

4.1 Distribution of effort

The on-effort track lines for all survey areas are shown in Figure 3 and compiled by survey blocks and country in Table 1.

The on-effort track line of the two Icelandic vessels was 6,125 n miles compared to a planned track line of 8,400 n miles. Of these 3,336 n miles were sailed in 0-3 Beaufort and the remaining 2,849 n miles in Beaufort 4-7. The total Icelandic survey area was 443,813 sq. n miles.

The Faroese on-effort vessel track line amounted to 1,662 n miles of which 1,153 and 509 n miles were under wind speed Beaufort 0-3 and 4-5, respectively. The total Faroese survey area was 341,183 sq. n miles.

Table 1. *NASS-95 shipboard surveys: Distribution of effort by nations and survey area (see also Figs 3 and 4). Data are also given for Greenland 1993 aerial survey and Iceland aerial survey in 1995.*

Nationality	Block size (sq. n miles)	On-effort (n miles)
Faroe Islands	341,183	1,662
Iceland	443,813	6,125
Norway	824,336	13,522
Iceland-aerial 1995	76,080	5,500 (approx.)
Greenland-aerial 1993	110,140	3,600 (approx.)

The total Norwegian vessel survey area was 824,336 sq. n miles. The eleven participating vessels traveled on primary effort 13,522 n miles, i.e. under "acceptable" weather conditions for conducting minke whale sightings (Beaufort 4 or less; visibility greater than 1 n mile).

In total the Icelandic aerial survey comprised 5,500 n miles on-track effort.

4.2 Minke Whale Sightings

4.2.1 Distribution

The distribution of minke whales based on NASS-95 is shown in Figure 5. Although a considerable survey effort was allocated to southern areas southwards to 52°N, the southern limit of the minke whale distribution approximately follows the 1,000 m depth contours from Greenland to the British Isles. The distribution within the area is primarily over continental shelves, but nevertheless the abundance over the deep waters of the Norwegian Sea is considerable. The NASS surveys therefore seem to give a complete picture of the summer distribution of minke whales in the northeast Atlantic.

Compared to earlier surveys, a shift in distribution was observed in the Barents Sea, as few minke whales were seen in the southeastern part off the Kola peninsula in 1995, while this was an area of high density in 1989. Around Iceland the highest densities of minke whales were found over the shelf areas and were thus covered by the aerial surveys. In the 1993 Greenland aerial survey most of the minke whale sightings were made in central and southern coastal areas, which confirms the general patterns from surveys made in earlier years.

4.2.2 Abundance

Abundances of minke whales are summarised in Table 2.

The coastal areas around Iceland were surveyed by aircraft and are tabulated as "X (AIR)". The Icelandic shipboard blocks 5 and 6 were restratified correspondingly for this analysis to avoid overlap in estimates. Thus the numbers tabulated for blocks "5 and 6" exclude the aerial survey block, and a shipboard estimate was calculated for the remaining parts of these blocks and tabulated as "X (SHIP)". "X (AIR)" includes coastal areas not part of "X (SHIP)". Since the Icelandic shipboard survey was conducted with one platform only on each of the two ships, no information is available to evaluate the bias introduced in the analyses by assuming g(0)= 1. The Icelandic shipboard survey estimates were calculated at the meeting. The overall estimate for the Icelandic ship survey blocks were 17,871 (CV = 0.225; 95% CI 11,555-27,639).

The minke whale estimates based on the Norwegian shipboard survey (Schweder et al. 1996) have been the subject of a major review by the IWC Scientific Committee (*Rep.int.Whal.Commn 48*, in press). The Working Group did not feel that they could add much to those discussions, and the estimates agreed by the IWC/SC were tabulated at face values. The over all estimate for the Norwegian survey blocks was 118,299 (CV= 0.103; 95% CI 93,746-138,720).

There were only two minke whale sightings contained in the Faroese survey data set, and thus no estimate was calculated for those blocks.

4.3 Fin Whale Sightings

4.3.1 Distribution

The distribution of fin whale sightings made during NASS-95 are shown in Figure 6. As in previous surveys, highest densities are found in the area between Iceland and East Greenland and significant numbers were also found on the Jan Mayen Ridge and near Spitsbergen. Within the Icelandic survey area, the distribution pattern is similar to those from previous surveys, although the relative 1995 density is even higher in block 9 (Denmark Strait - Irminger Basin) than in the 1987 and 1989 surveys.

4.3.2 Abundance

Abundance estimates for fin whales are given in papers SC/5/AE/4 (Norwegian survey area) and SC/5/AE/1 (Icelandic and Faroese areas), and summarised in Table 3. The total estimate for the Norwegian survey area is 3,080 fin whales (CV= 0.248) based on a standard line transect analysis approach. The total abundance estimate for the Icelandic/Faroese survey area is 19,708 fin whales (CV =0.166). Adding the estimated abundance from Norwegian blocks JMC (76, CV= 0.445) and NVN (332, CV= 0.652) and subtracting 2/3 of the abundance from the Faroese blocks (as the Faroese block A is not a part of the East Greenland-Iceland (EGI) area), gives a total estimate of 18,932 (CV= 0.160) fin whales within the part of the EGI schedule stock area surveyed in 1995. This is the largest estimate for the EGI stock of fin whales to date. In particular, the abundance is considerably higher in the area between East Greenland and Iceland than in the 1987 and 1989 surveys, respectively. In fact the abundance in block 9 alone in 1995 is higher than the total abundance in all blocks from either of the previous surveys.

4.4 Sei Whale Sightings

4.4.1 Distribution

The distribution of sei whale sightings made during NASS-95 is shown in Figure 7. Only two sightings (one primary sighting) were made by the Norwegian survey vessels, three sightings were made onboard the Faroese vessel and 103 sightings onboard the two Icelandic vessels. The distribution corresponds well with that of the 1987 and 1989 surveys, with consistent low abundance in both Norwegian and Faroese survey areas. However, the 1989 Icelandic survey was conducted somewhat later in the season when the species typically migrates into the area west off Iceland and covered areas further south with significant densities of sei whales.

4.4.2. Abundance

Paper SC/5/AE/1 gives the abundance estimates for sei whales by survey blocks, resulting in a total estimate of 9,249 animals (95% CI: 3,700 - 23,116), see Table 4. Of these, 722 animals (CV=0.80) were estimated in the Faroese survey area, while the rest is derived from the Icelandic survey area. Although the majority (about 70%) of the 1989 estimate (10,600, CV=0.27) were derived from survey blocks south of the 1995 survey, the two surveys are not inconsistent in light of wide confidence limits and difference in timing.

4.5 Pilot Whale Sightings

4.5.1 Distribution

The NASS-95 distribution of pilot whales is shown in Figure 8. This distribution is complementary to the minke whale distribution; i.e. the sightings were made south of the ridge Greenland-Iceland-Faroe Islands, with a few stragglers off the Norwegian coast. This indicates that the NASS surveys cover the northernmost areas of pilot whale distribution in the northeast Atlantic.

4.5.2 Abundance

The abundance of pilot whales by block is given in Table 5.

The estimate (SC/5/AE/3) is based on application of a conventional line transect method. Data from all blocks were pooled for estimating the effective search width, while encounter rate and school size were estimated by block. The total abundance over all blocks is 215,000 animals (CV= 0.26).

In the areas covered by Norwegian vessels, only two primary sightings of pilot whale groups were made, of which one comprised a group of an estimated 150 individuals.

4.6 Other species

Several other species were considered from a distributional point of view. The NASS-95 distribution of humpback (*Megaptera novaeangliae*), blue (*B. musculus*), sperm (*Physeter macrocephalus*), northern bottlenose (*Hyperoodon ampullatus*), killer (*Orcinus orca*), harbour porpoises (*Phocoena phocoena*) and small *Delphinidae* (*Lagenorhynchus* sp. and similar species) are shown in Figures 9-15.

5. TRENDS IN DISTRIBUTION AND ABUNDANCE

5.1 Minke whale

Although the point estimates for the aerial surveys for coastal Iceland differ by a factor of nearly 3, that is roughly 20,000 whales from NASS-87 vs. roughly 56,000 whales from NASS-95, a large part of the difference is due to the fact that the NASS-87 aerial survey covered a substantially smaller area. There is a continuity in distribution of minke whales from Icelandic coastal areas towards the ice edge at Greenland and Jan Mayen, which may give cause for substantial movement in and out of the aerial survey area, and taking the high variances associated with the point estimates into consideration, no conclusion about trends can be made.

For the Norwegian survey blocks, large differences occured between the 1989 and 1995 estimates, most notably the block off the Kola coast in the southeastern Barents Sea, which, from being the largest contributor to the total abundance estimate in 1989, was the least important in 1995. However, aggregated on a small management area level, the abundance estimates are consistent between the two years, the 1995 estimates being roughly twice the 1989 estimates; 118,000 as compared to 68,000 animals. Although the number of minke whales within the area may have increased from increased immigration or natural rate of increase, most of the difference is probably related to the fact that the

1995 estimate was derived from a designed survey with independent teams of observers and there was no need to extrapolate from ancillary survey data as was necessary for the 1989 estimate.

5.2 Fin whale

The 1995 point estimate of 19,642 (CV=0.20) in the Icelandic and Faroese survey areas appears to be higher than the estimates derived from earlier surveys. The increase in abundance is particularly noticable in the southwestern part of the survey area, between East Greenland and Iceland (Block 9). Sightings made in high Beauforts contribute significantly to the large abundance estimate in Block 9 in 1995, but the implications of this are unclear.

The abundance estimate of fin whales from the Norwegian survey area (3,080, CV= 0.25) is not significantly different from the earlier NASS surveys. In 1991 the Scientific Committee of the IWC tabulated an estimate of 15,614 fin whales in the EGI stock area, based on combined data from the 1987 and 1989 surveys (*Rep.int.Whal.Commn* 42 (1992): 600). The estimate from the NASS-95 of 18,932 fin whales is considerably higher even though the 1995 survey did not cover a large area where a significant number of fin whale sightings were made in 1989. This may reflect a true increase in the stock, while discontinuity in distribution towards the south of the survey area may indicate that the 1995 survey captured the peak of the fin whale migration to these waters better than earlier surveys.

5.3 Sei whale

The estimates from the Icelandic/Faroese parts of the NASS-89 and NASS-95 surveys of 10,600 and 9,249 sei whales, respectively, appear to be in good agreement. However, the 1995 survey did not cover the south-westernmost parts of the 1989 survey area from which around 70% of the 1989 abundance estimate was derived. Although comparisons of abundance in identical subareas in the three sightings surveys may indicate an increase and/or northward shift in abundance, interpretations should be made with caution due to the relatively wide confidence limits and difference in timing of surveys. It is unlikely that any of the surveys covered the total distribution of the stock, and the species is known for relatively large between-year variations in abundance in Icelandic waters.

5.4 Pilot whales

Previous surveys of long-finned pilot whales were conducted in 1987 and 1989 (Buckland et al. 1993). The area surveyed in 1995 covered a similar area to that surveyed in 1987 and extended as far south, in the eastern part of the survey area, as the 1989 survey. The total abundance estimate in 1987 was 123,000 (CV= 0.29). Excluding blocks in the 1989 survey so that the estimate was comparable to the total estimate from the 1987 data, the 1989 estimate was 191,000 animals (CV= 0.33). If the Faroese block B is excluded from the analysis, so that the 1995 estimate is broadly comparable to the 1987 and 1989 estimates, the total abundance estimate in 1995 is 181,440 (CV=0.26). The 1995 estimate is therefore consistent and not significantly different from previous estimates for the area covered.

6. ACKNOWLEDGMENTS

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7. WORKING GROUP DOCUMENTS

SC/5/AE/1 Borchers, D.L. and Burt, M.L. 1997. Sei and fin whale abundance in the North Atlantic, estimated from NASS-95 shipboard survey data.

SC/5/AE/2 Borchers, D.L., McCracken, M., Gunnlaugsson, Þ. And Burt, M.L. 1997. Estimates of minke whale abundance from the 1987 and 1995 NASS aerial surveys.

SC/5/AE/3 Burt, M.L. and Borchers, D.L. 1997. Pilot whale abundance in the North Atlantic, estimated from NASS-95.

SC/5/AE/4 Øien, N. And Skaug, H.J. 1997. Abundance estimates from Norwegian shipboard data 1995.

8. REFERENCES

Buckland, S.T., Anderson, D.R., Burnham, K.P. and Laake, J.L. 1993. Distance sampling: estimating abundance of biological populations. *Chapman & Hall, London.*

Buckland, S.T., Bloch, D., Cattanach, K.L., Gunnlaugsson, Þ., Hoydal, K., Lens, S. and Sigurjónsson, J. 1993. Distribution and abundance of long-finned pilot whales in the North Atlantic, estimated from NASS-87 and NASS-89 data. *Rep.int.Whal.Commn (Special Issue 14):* 33-49.

Buckland, S.T. and Turnock, B.J. 1992. A robust line transect method. *Biometrics 48:*901-909.

Cooke, J.G. and Hiby, L. 1987. Some suggestions for survey design for the North Atlantic Sightings Survey summer 1987. Paper prepared for the 3rd Planning meeting for the 1987 North Atlantic Sightings Survey, Bournemouth, June 1987.

Desportes, G. et al. 1996. NASS-95. Preliminary report from the Faroese cruise. NAMMCO - SC/4/16.

Donovan, G. and Gunnlaugsson, T. 1989. North Atlantic sightings survey 1987: Report of the aerial survey off Iceland. *Rep.int.Whal.Commn 39:*437-441.

Hiby, A.R. and Hammond, P.S. 1989. Survey techniques for estimating abundance of cetaceans. *Rep. int.Whal.Commn (Special Issue 11):*47-80.

Laake, J.L., Buckland, S.T., Anderson, D.R. and Burnham, K.P. 1994. DISTANCE User's guide V2.1. Colorado Cooperative Fish & Wildlife Research Unit Colorado State University, Fort Collins, CO. 84pp.

Larsen, F. 1995. Abundance of minke and fin whales off West Greenland, 1993. *Rep.int.Whal.Commn 45:*365-370.

NAMMCO Annual Report 1995, North Atlantic Marine Mammal Commission, Tromsø. 186pp.

NASS-95 Working Group Report, 1994a. Tromsø, 25 February 1994. NAMMCO - SC/3/9.

NASS-95 Working Group Report, 1994b. Tromsø, 2 December 1994. NAMMCO - SC/3/7.

Øien, N. 1995. Norwegian independent line transect survey 1995. *Havforskningsinstituttet, interne notat, nr. 8 - 1995.*

Øien, N. 1996. Cruise and data report from the Norwegian sighting survey 1995 (NILS-95). *Int.Whal. Commn Scientific Paper SC/48/NA3.*

Rep. int. Whal. Commn 39, 1989. International Whaling Commission, Cambridge.

Rep. int. Whal. Commn 41, 1991. International Whaling Commission, Cambridge.

Rep. int. Whal. Commn 42, 1992. International Whaling Commission, Cambridge.

Rep. int. Whal. Commn 46, 1996. International Whaling Commission, Cambridge.

Rep. int. Whal. Commn 48, in press. International Whaling Commission, Cambridge.

Schweder, T., Skaug, H.J., Dimakos, X.K., Langaas, M. and Øien, N. 1996. Abundance of northeastern Atlantic minke whales, estimates for 1989 and 1995. *Int.Whal.Commn Scientific Paper SC/48/NA1.*

Sigurjónsson, J., Gunnlaugsson, Þ., Víkingsson, G. and Guðmundsson, H. 1996. North Atlantic Sightings Survey 1995 (NASS-95): Aerial survey in coastal Icelandic waters. July 1995. NAMMCO - SC/4/17.

Sigurjónsson, J., Víkingsson, G., Gunnlaugsson, Þ. and Halldórsson, S.D. 1996. North Atlantic Sightings Survey 1995 (NASS-95): Aerial survey in coastal Icelandic waters June-July 1995. Preliminary cruise report. NAMMCO - SC/4/18.

Table 2. Abundance of minke whales by survey block, management area and for the total survey area. Block 9 contributes to both management areas CG and CIP.

NATION	BLOCK	ABUNDANCE	CV	MANAGEMENT AREA	ABUNDANCE	CV	TOTAL ABUNDANCE	CV
ICELAND	4	na		CIP	(contribution from block 9)			
	7	na						
	8	na						
	3	na						
	9	4,757	0.293	9 Õ both CG and CIP	4,757	0.293		
	2	na						
	X (SHIP)	7,837	0.333	CIC	55,922	0.310		
	X (AIR)	55,922	0.310					
	5 and 6 outside X	5,277	0.313	CM	11,451	0.241		
NORWAY	JMC	1,339	0.560					
	NVN	4,835	0.429					
	SVI	2,691	0.285	ES	25,969	0.112		
	SV	4,719	0.163					
	NON	3,357	0.260					
	VSI	345	0.406					
	VSN	1,672	0.195					
	VSS	1,959	0.233					
	BJ	7,164	0.234					
	BAW	4,062	0.265					
	BAE	16,101	0.299	EB	56,330	0.136		
	GA	10,615	0.216					
	KO	962	0.567					
	FI	5,974	0.296					
	NOS	22,678	0.156					
	LOC	2,462	0.228	EC	2,462	0.228		
	NSC	7,070	0.236	EN	27,364	0.206		
	NS	20,294	0.258					
FAROE ISLANDS	A & B	2 primary sightings		A Õ EN B Õ CIP				
							184,255	0.116

Table 3. Abundance of fin whales by survey block, management area and for the total survey area. The East Greenland-Iceland stock area comprises the areas surveyed by Iceland, the Norwegian JMC and NVN blocks, as well as one third of the Faroese A and B blocks.

NATION	BLOCK	ABUNDANCE	CV	MANAGEMENT AREA	ABUNDANCE	CV	TOTAL ABUNDANCE	CV
ICELAND	4	204	0.771	EAST GREENLAND - ICELAND STOCK	18,932	0.160	**22,789**	0.147
	7	301	0.550					
	3	1,146	0.199					
	9	13,745	0.221					
	8	831	0.320					
	2	117	0.619					
	6	143	0.461					
	5	1,445	0.545					
NORWAY	JMC	76	0.445	NORTH NORWAY STOCK	2,673	0.254		
	NVN	332	0.652					
	SVI	151	0.648					
	SV	553	0.334					
	NON	68	1.702					
	VSI	15	1.206					
	VSN	203	0.456					
	VSS	88	0.723					
	BJ	563	0.340					
	BAW	na						
	BAE	131	1.967					
	GA	277	1.072					
	KO	na						
	FI	425	1.037					
	NOS	142	0.440					
	LOC	57	0.712					
	NSC	na		WEST NORWAY & BRITISH ISLES STOCKS	1,184	0.308		
	NS	na						
FAROE ISLANDS	A & B	1,776	0.308					

Table 4. Abundance of sei whales by survey block, management area and for the total survey area. One third of the Faroese A and B blocks is added to the Iceland-Denmark Strait management area.

NATION	BLOCK	ABUNDANCE	CV	MANAGEMENT AREA	ABUNDANCE	CV	TOTAL ABUNDANCE	CV
ICELAND	4	2,914	0.85					
	7	2,173	0.681	ICELAND-DENMARK STRAIT	8,768			
	3	0						
	9	3,262	0.856					
	8	146	1.246				**9,249**	0.494
	2	32	0.836					
	6	0					(3,700-23,116)	
	5	0						
NORWAY	NOS	1 primary sighting		EASTERN STOCK	481	0.80		
FAROE ISLANDS	A & B	722	0.80					

Table 5. Abundance of pilot whales by survey block and for the total survey area.

NATION	BLOCK	ABUNDANCE	CV	TOTAL ABUNDANCE	CV
ICELAND	4	7,585	0.803		
	7	19,490	0.443		
	3	na			
	9	45,057	0.460		
	8	42,940	0.855		
	2	na		**214,840**	0.26
	6	na			
	5	na			
NORWAY	LOC	2 primary sightings, one group 150 animals			
FAROE ISLANDS	A & B	99,768	0.630		

FIGURE LEGENDS

Fig 1. Area coverage for NASS-87, NASS-89 and NASS-95.

Fig 2. Stratification of survey blocks for NASS-95.

Fig 3. Realised effort for shipboard part of NASS-95.

Fig 4. Aerial survey transects off West Greenland in 1993, and survey blocks and transect for the Icelandic aerial survey part of NASS-95.

Fig 5. Distribution of minke whale sightings during NASS-95. For West Greenland observations made during the 1993 aerial survey are plotted.

Fig 6. Distribution of fin whale sightings during NASS-95. For West Greenland observations made during the 1993 aerial survey are plotted.

Fig 7. Distribution of sei whale sightings during NASS-95. For West Greenland observations made during the 1993 aerial survey are plotted.

Fig 8. Distribution of pilot whale sightings during NASS-95. For West Greenland observations made during the 1993 aerial survey are plotted.

Fig 9. Distribution of humpback whale sightings during NASS-95. For West Greenland observations made during the 1993 aerial survey are plotted.

Fig 10. Distribution of blue whale sightings during NASS-95.

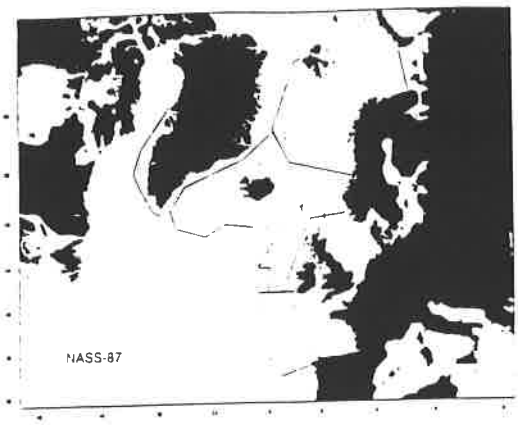
Fig 11 Distribution of sperm whale sightings during NASS-95. For West Greenland observations made during the 1993 aerial survey are plotted.

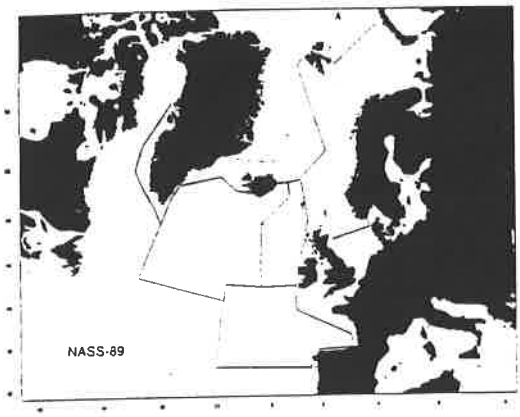
Fig 12 Distribution of Northern bottlenose whale sightings during NASS-95.

Fig 13 Distribution of killer whale sightings during NASS-95. For West Greenland observations made during the 1993 aerial survey are plotted.

Fig 14. Distribution of harbour porpoises sightings during NASS-95.

Fig 15. Distribution of small Delphinidae sightings during NASS-95.





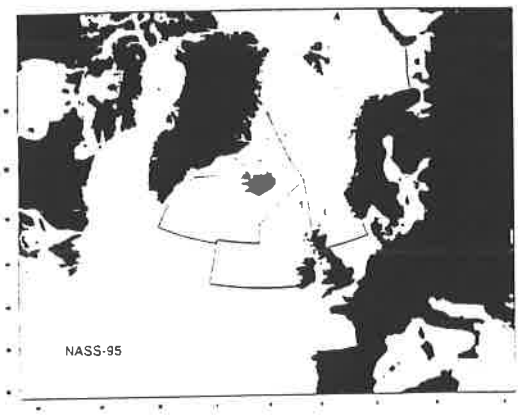


Fig 1. Area coverage for NASS-87, NASS-89 and NASS-95.

Fig. 2. Stratification of survey blocks for NASS-95.

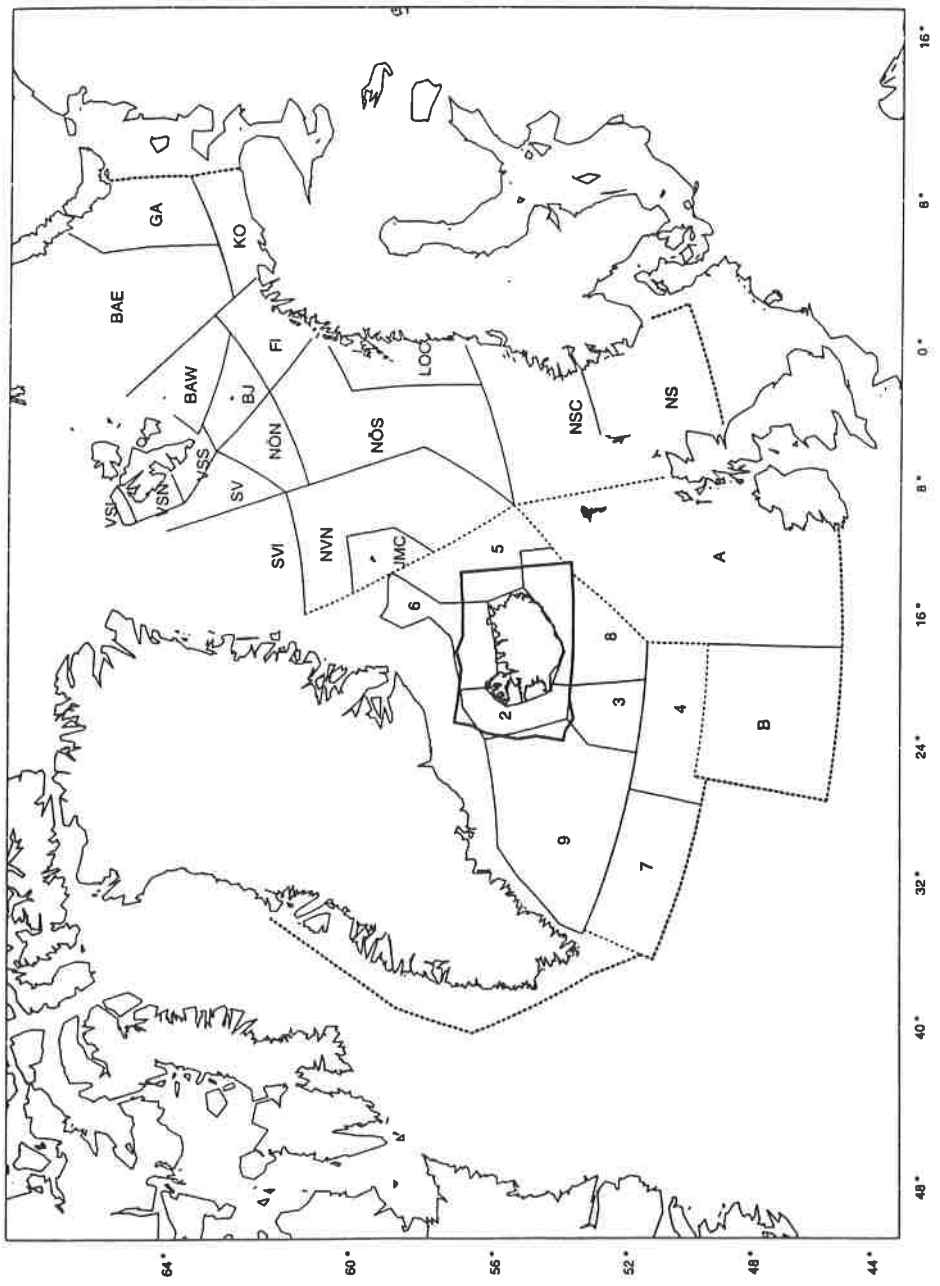
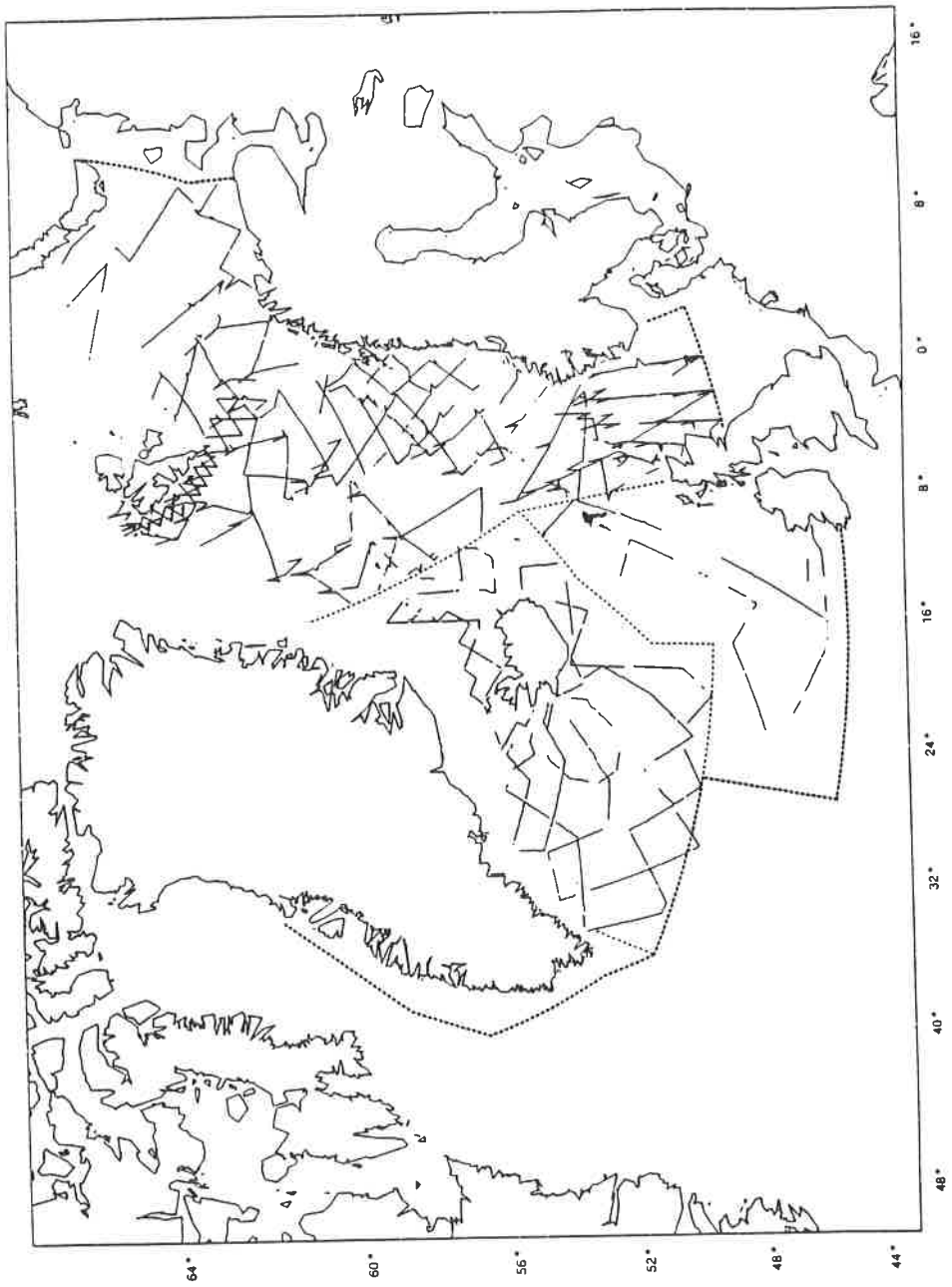


Fig 3. Realised effort for shipboard part of NASS-95.



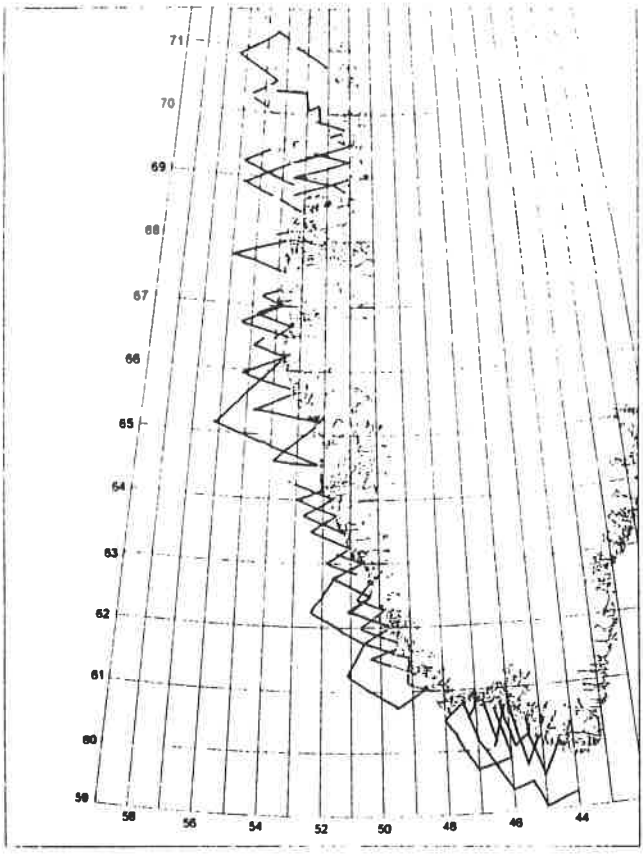


Fig 4. Aerial survey transects off West Greenland in 1993, and survey blocks and transects for the Icelandic aerial survey part of NASS-95.

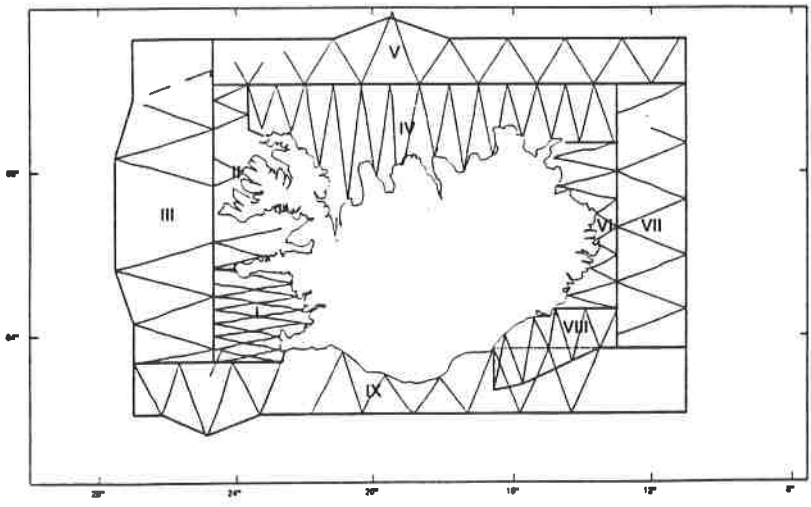


Fig 5. Distribution of minke whale sightings during NASS-95. For West Greenland observations made during the 1993 aerial survey are plotted.

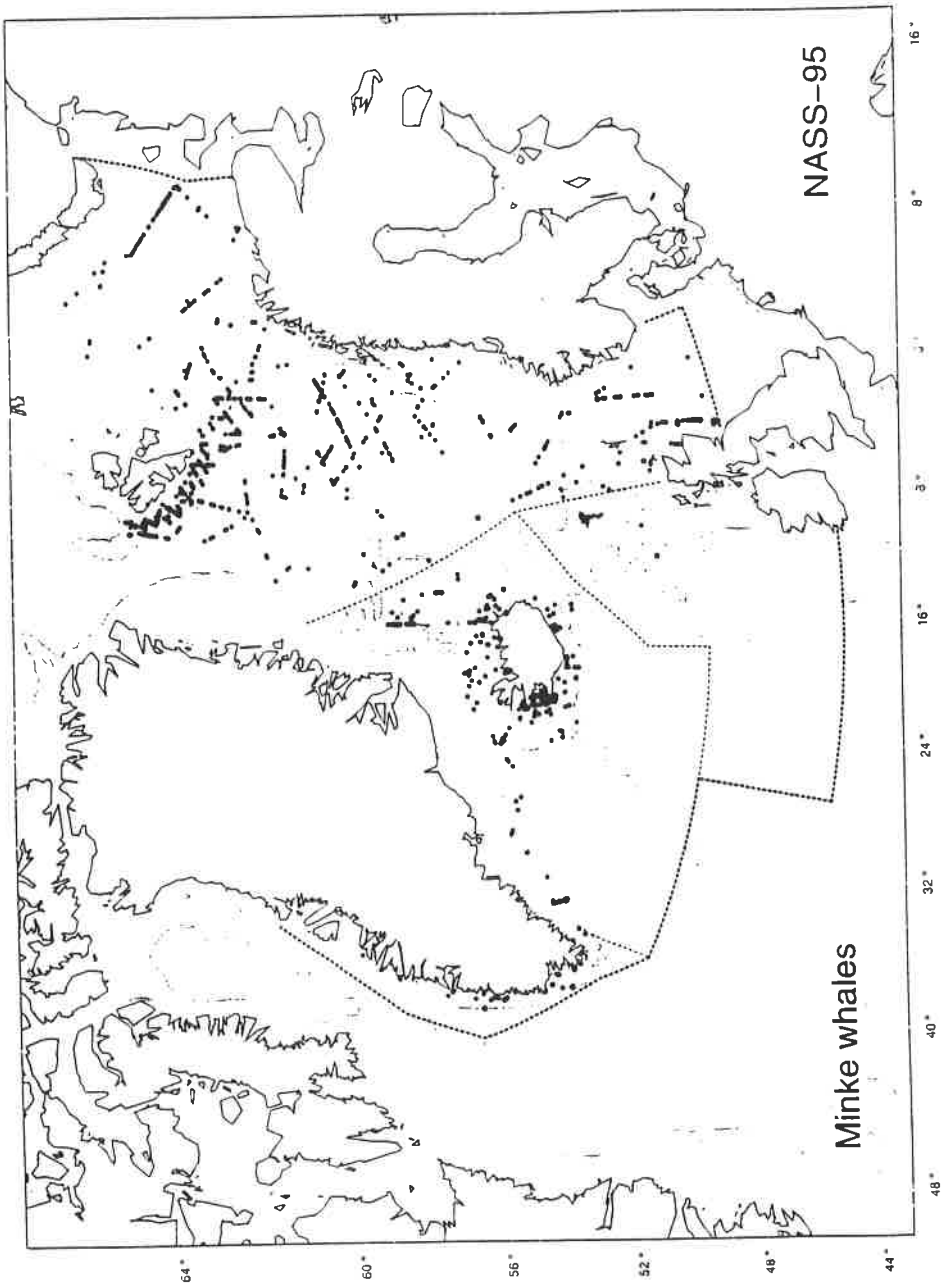


Fig 6. Distribution of fin whale sightings during NASS-95. For West Greenland observations made during the 1993 aerial survey are plotted.

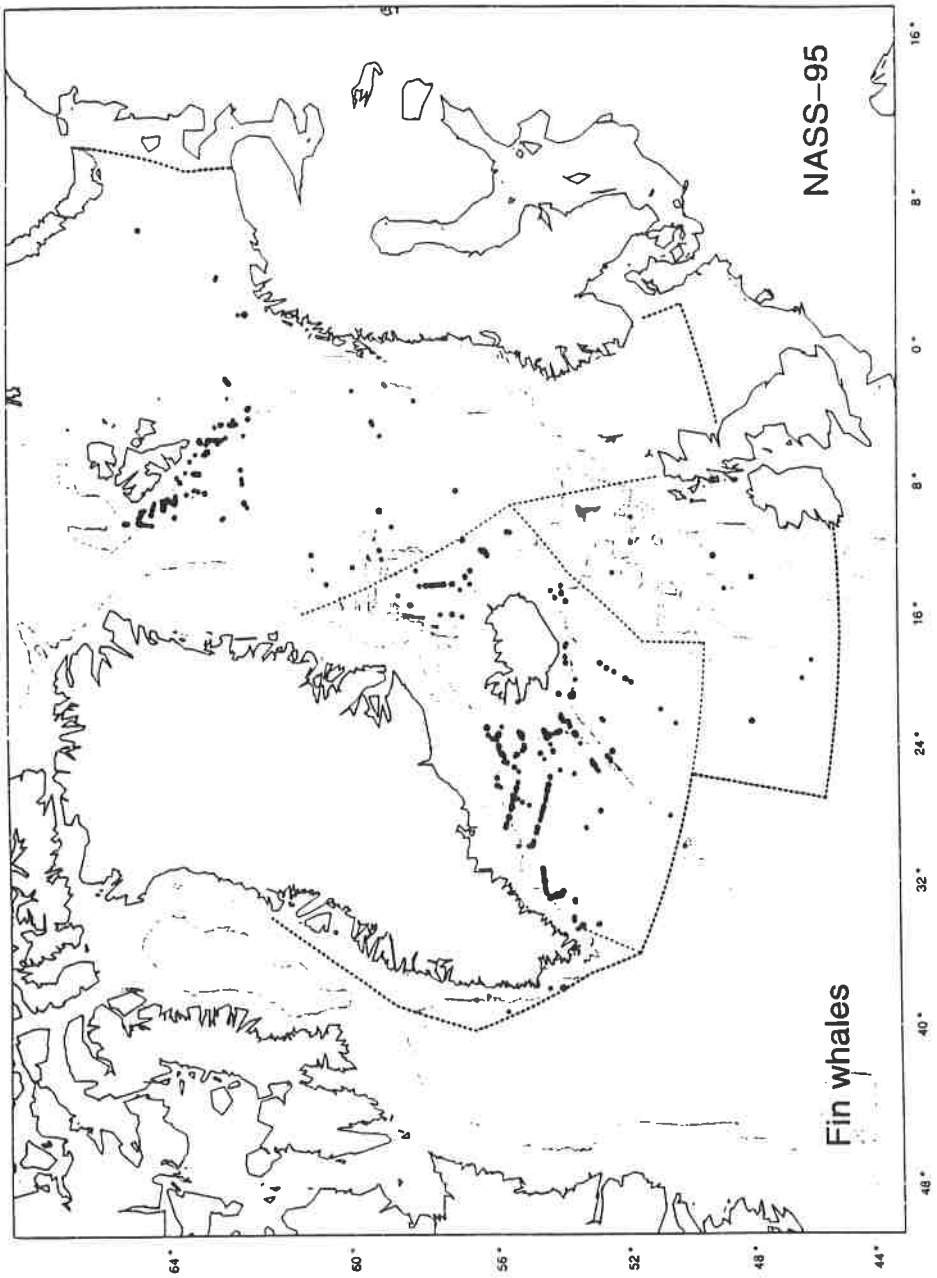


Fig 7. Distribution of sei whale sightings during NASS-95. For West Greenland observations made during the 1993 aerial survey are plotted.

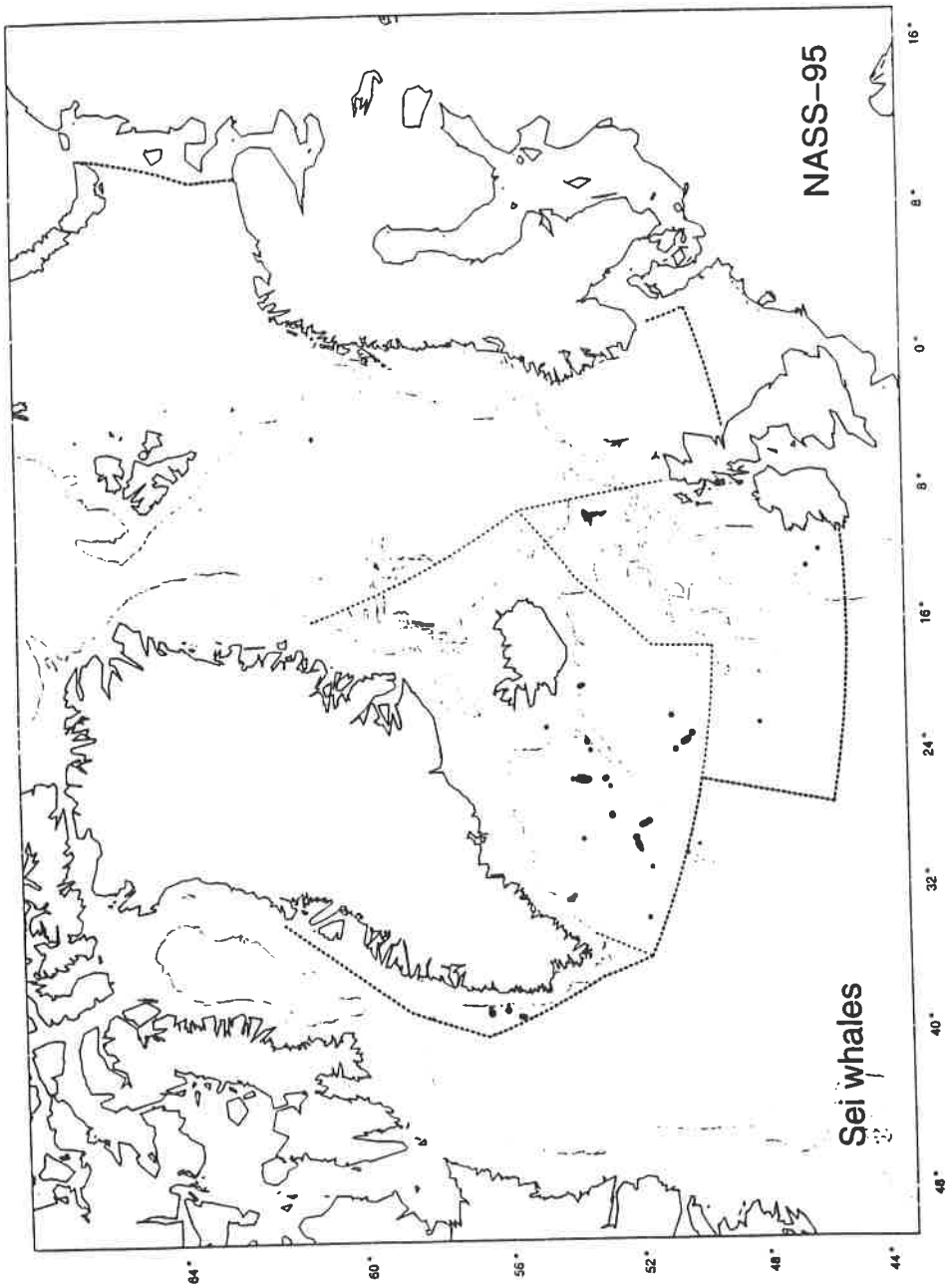


Fig 8 Distribution of pilot whale sightings during NASS-95. For West Greenland observations made during the 1993 aerial survey are plotted.

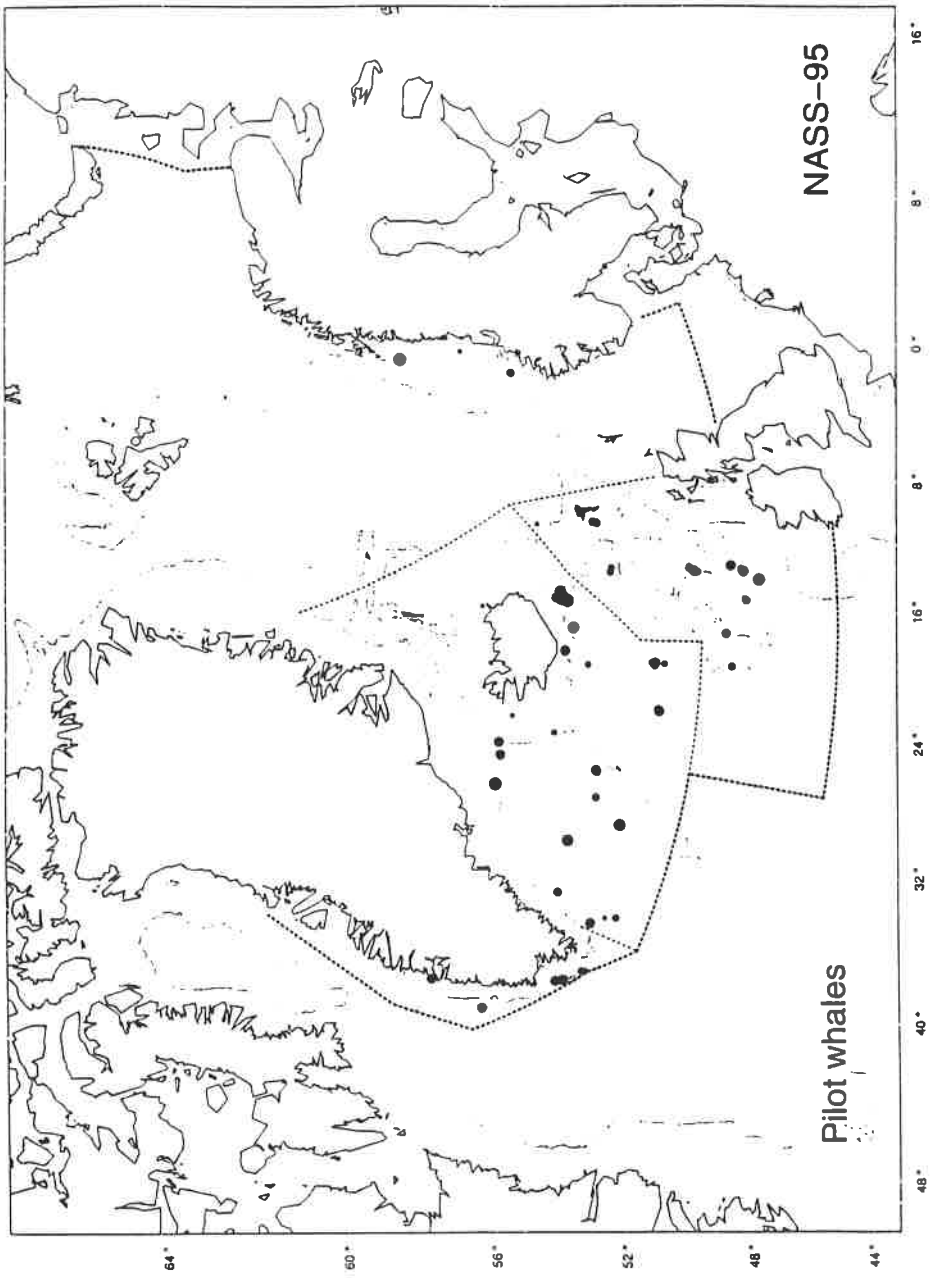


Fig 9.Distribution of humpback whale sightings during NASS-95. For West Greenland observations made during the 1993 aerial survey are plotted.

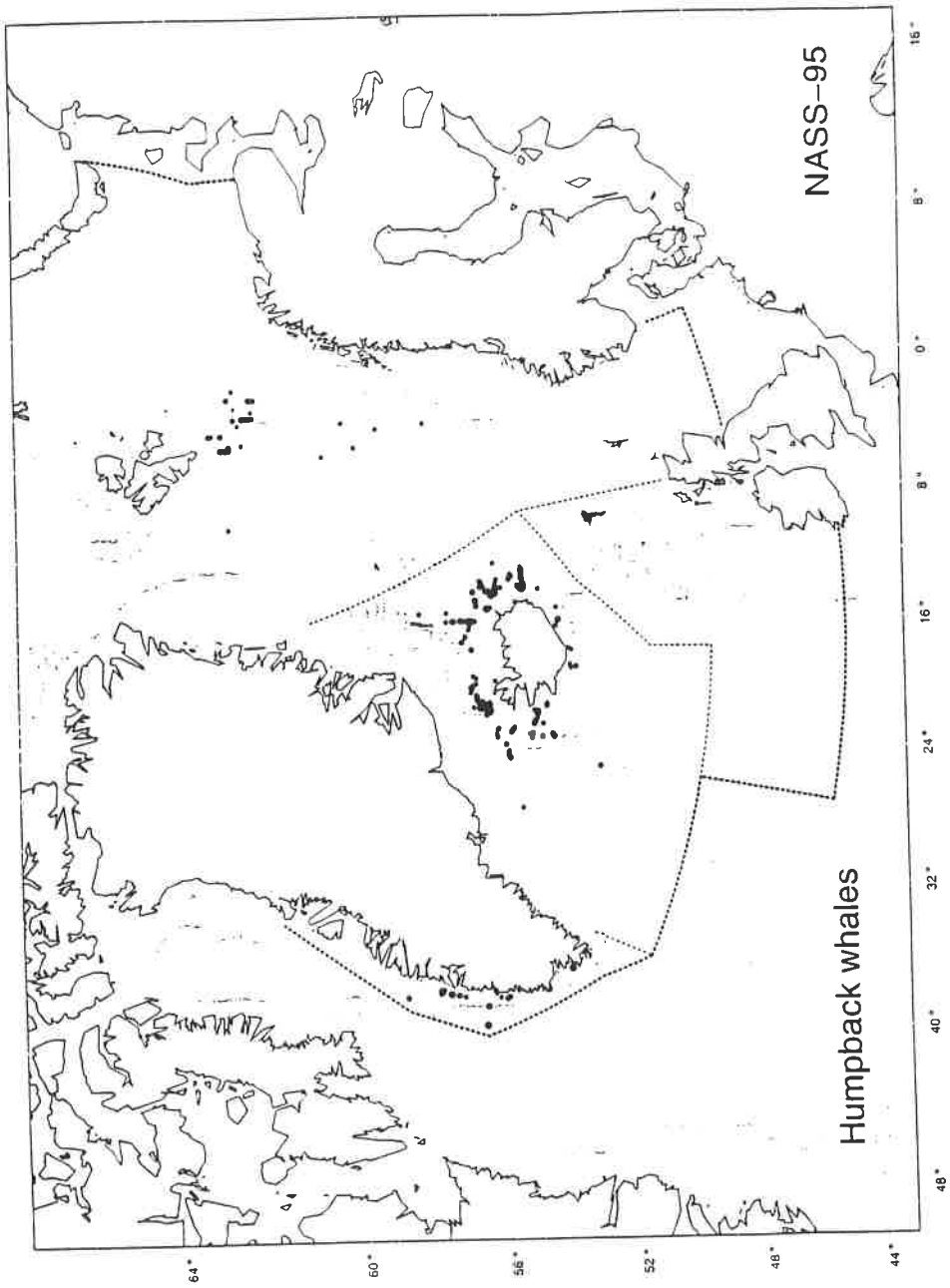


Fig 10 Distribution of blue whale sightings during NASS-95.

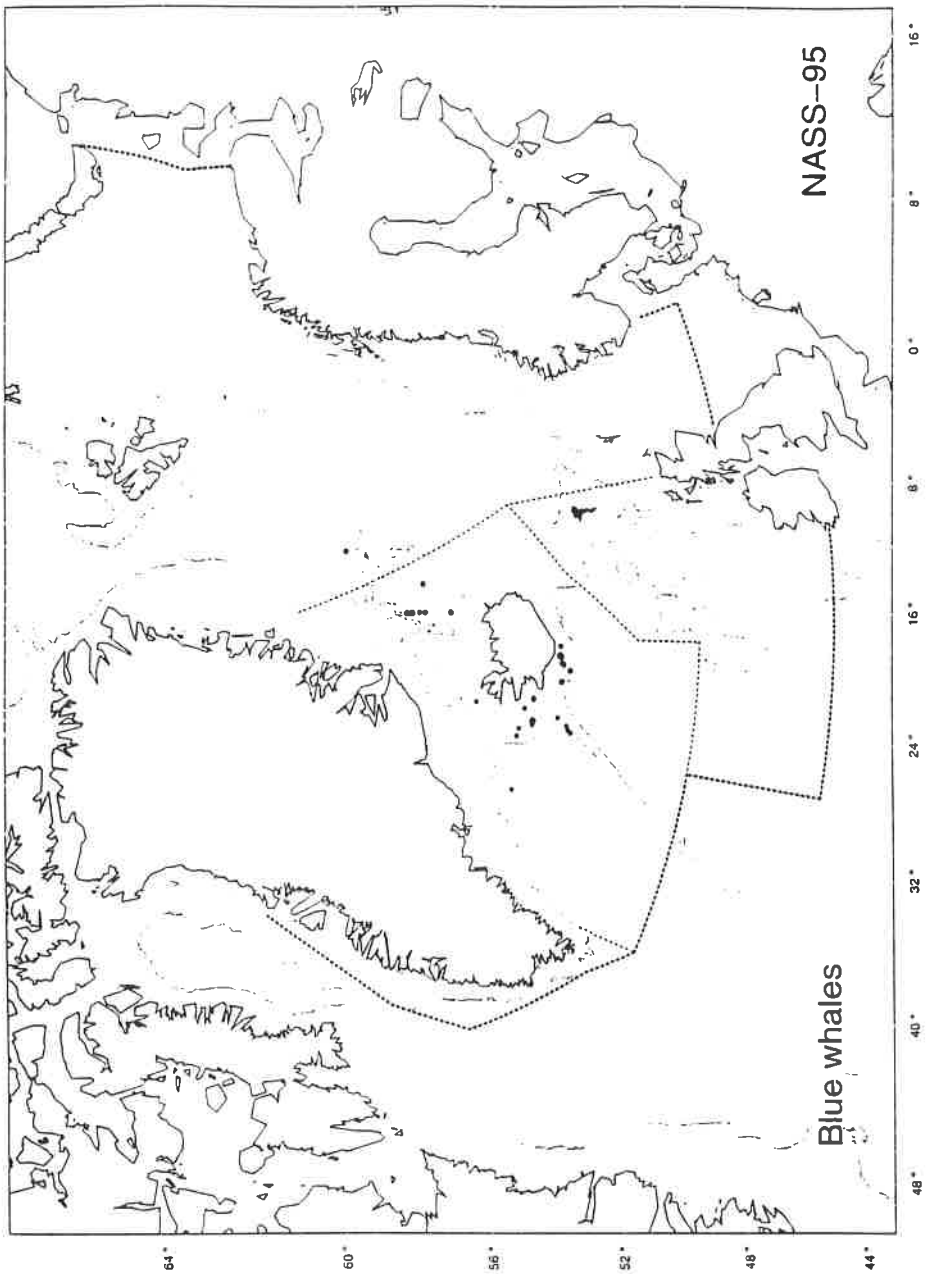


Fig 11 Distribution of sperm whale sightings during NASS-95. For West Greenland observations made during the 1993 aerial survey are plotted.

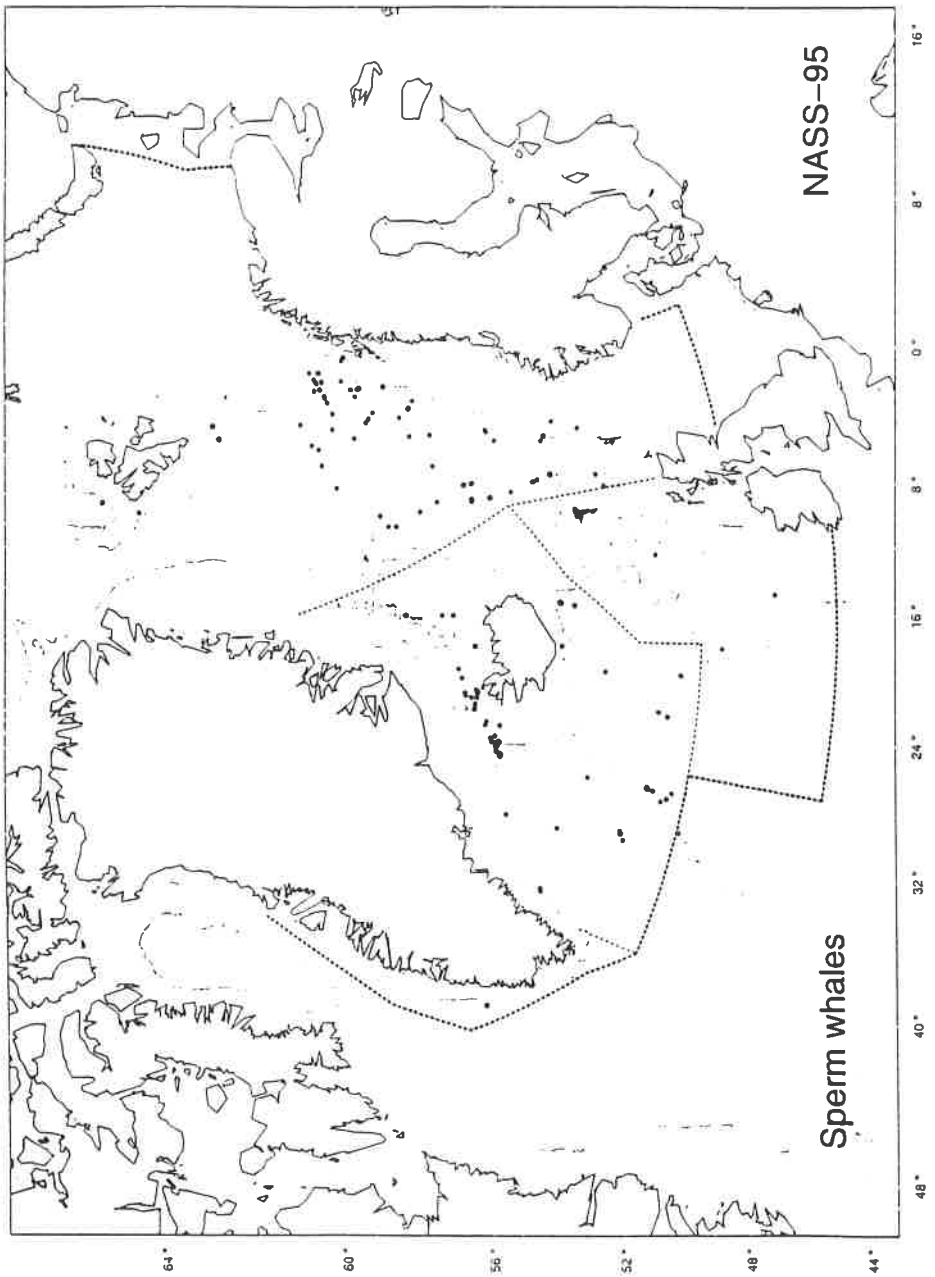


Fig 12. Distribution of Northern bottlenose whale sightings during NASS-95

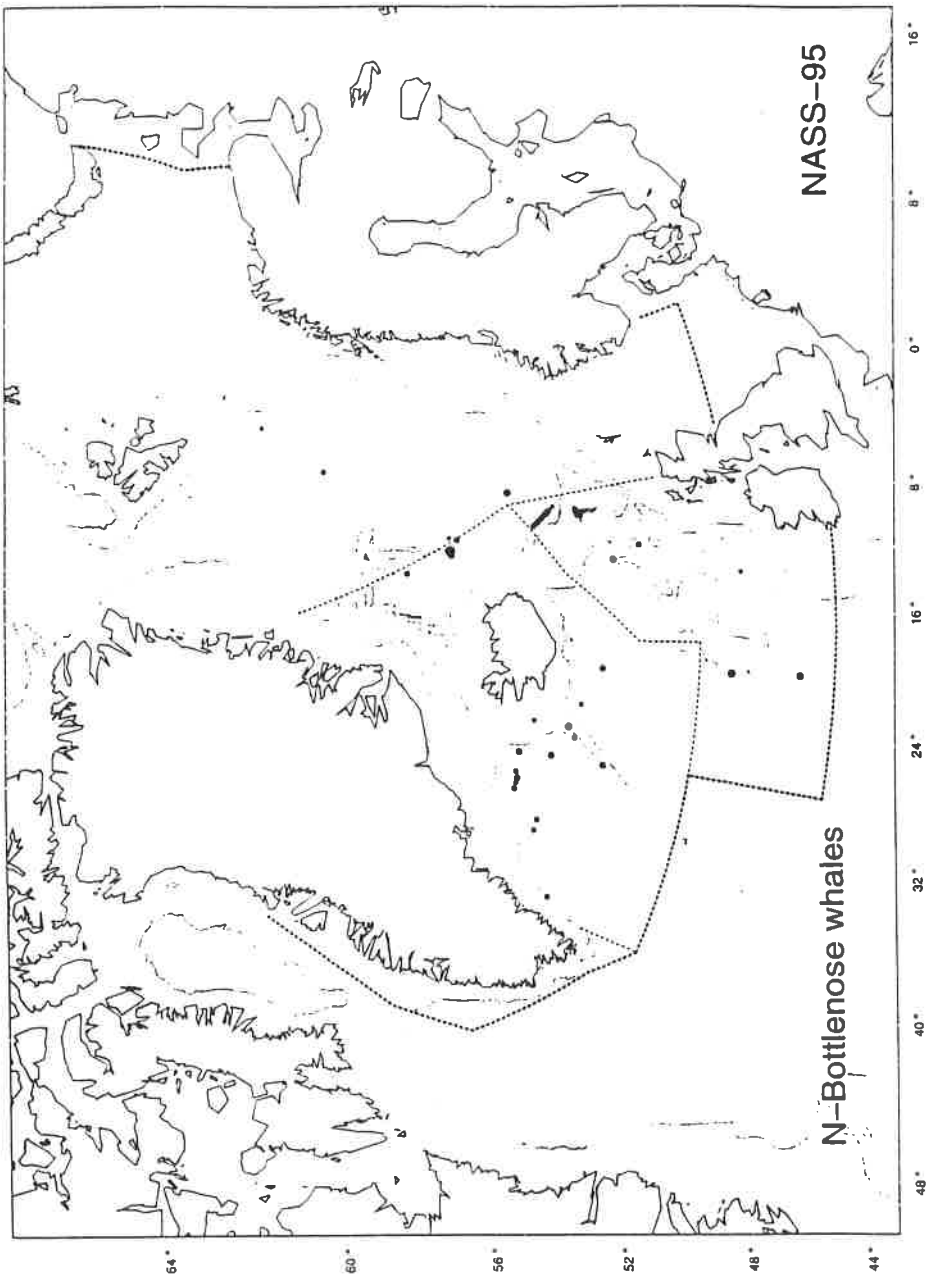


Fig 13 Distribution of killer whale sightings during NASS-95. For West Greenland observations made during the 1993 aerial survey are plotted.

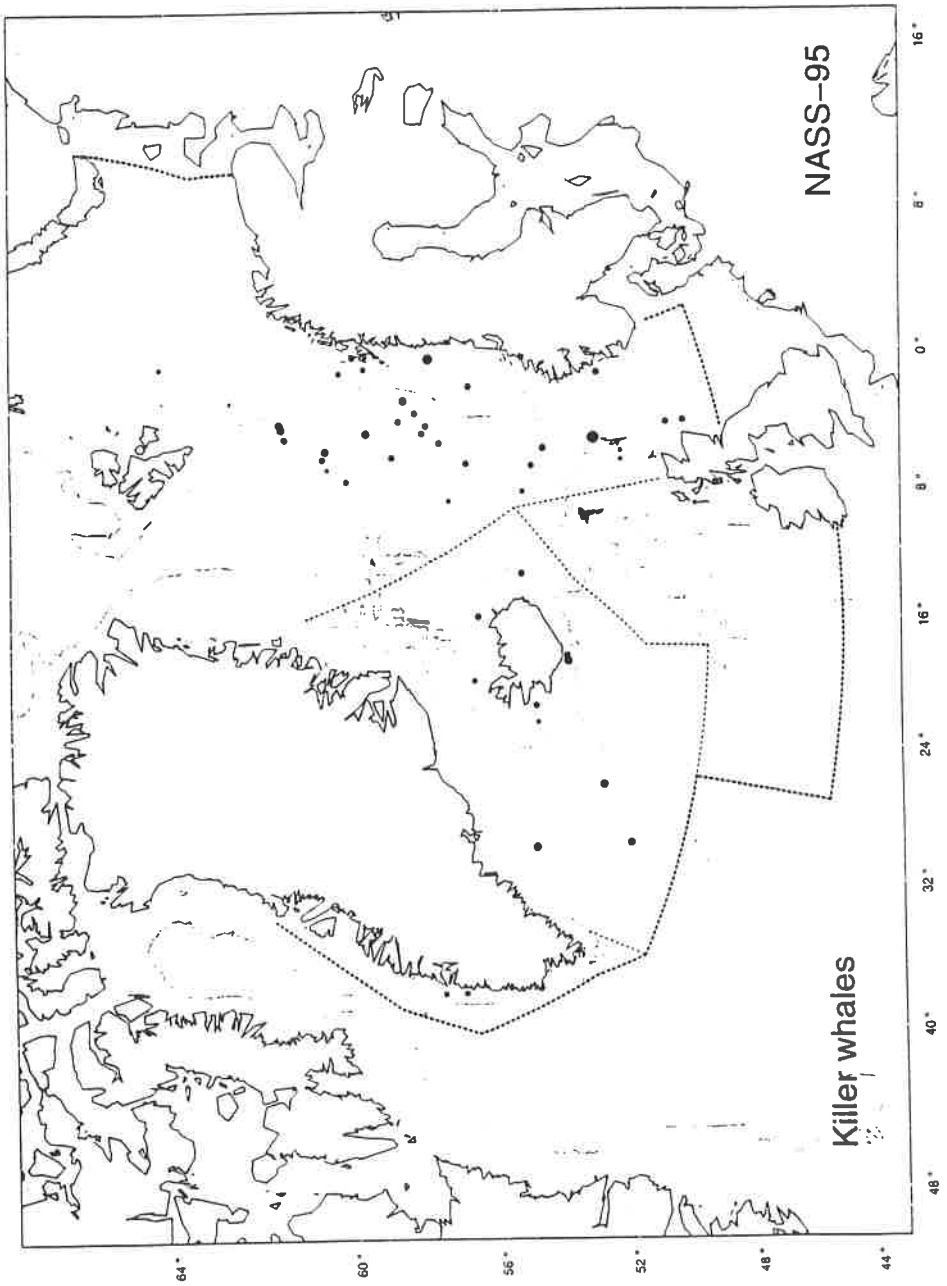


Fig 14 Distribution of harbour porpoises sightings during NASS-95.

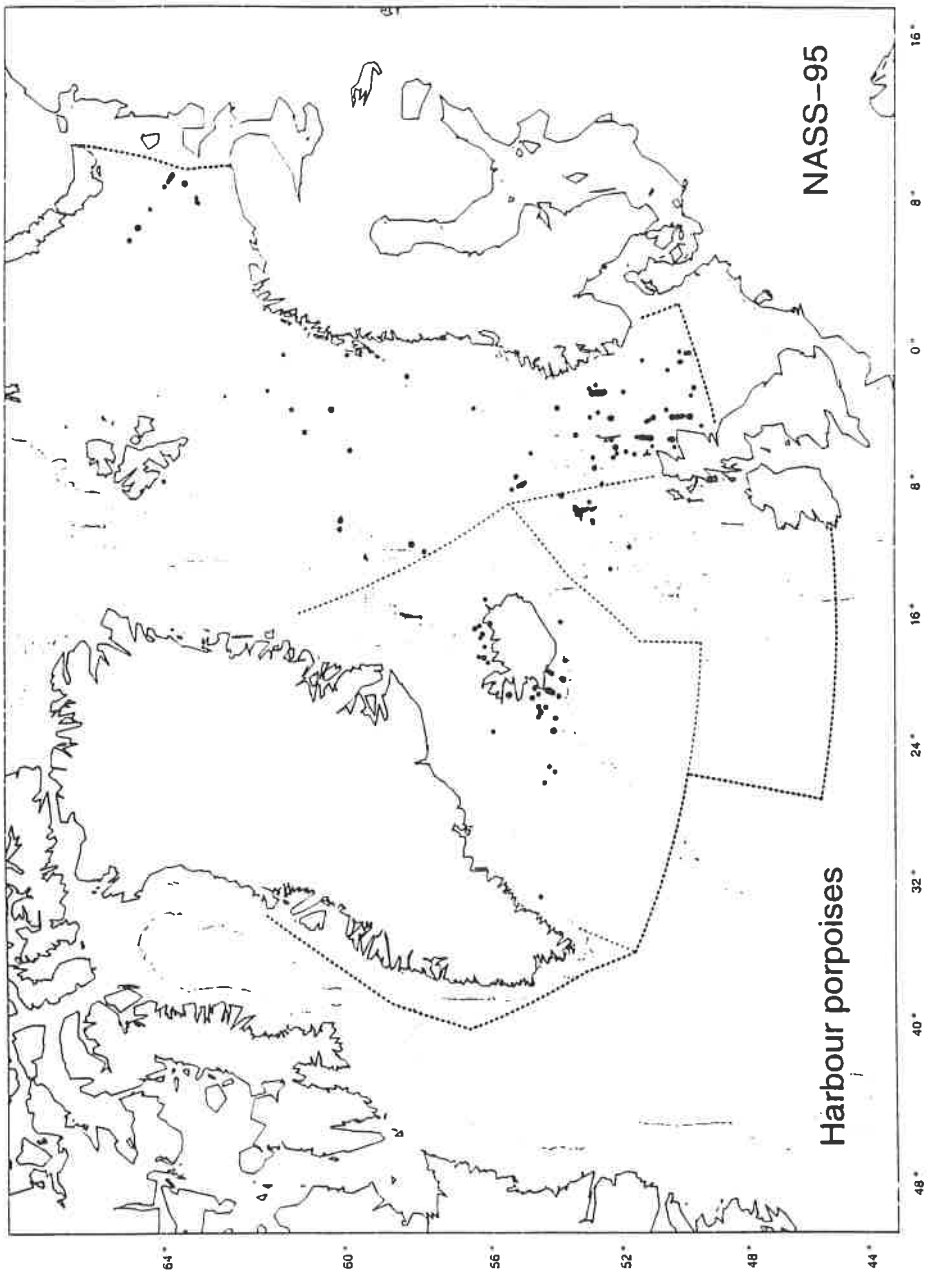


Fig 15. Distribution of small Delphinidae sightings during NASS-95.