

IMPORTANT

This report is one of a large number commissioned on behalf of the *Sea Empress* Environmental Evaluation Committee. Any views expressed here, however, are not necessarily representative of the views of the committee or its advisory task groups - which will be basing their conclusions on results from the whole programme of studies.

COMMON SCOTER *Melanitta nigra* MONITORING IN CARMARTHEN BAY FOLLOWING THE *SEA EMPRESS* OIL SPILL

CCW CONTRACT NO. FC 73-02-53

Final Report to
SEA EMPRESS ENVIRONMENTAL EVALUATION COMMITTEE
managed by
COUNTRYSIDE COUNCIL FOR WALES

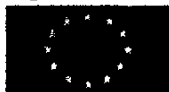


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November 1997

This research has received financial support from the
European Community.





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1 SUMMARY

Following the *Sea Empress* oil spill in Milford Haven, Pembrokeshire, land-based counts of Common Scoters *Melanitta nigra* in nearby Carmarthen Bay were conducted at two week intervals between 22 February 1996 and 23 March 1997. When surface oil slicks entered Carmarthen Bay from the west on 24 February 1996, approximately 8,000 Common Scoter were present in the bay, approximately half in the north west of the bay between Saundersfoot and Pendine, the remainder off Rhossili and Whiteford in the east. Thus most of the 4,700 Common Scoter affected by the oil spill were thought to originate from the Saundersfoot to Pendine flock. The remaining birds were located mainly off Rhossili Bay, an area not usually utilised by large numbers of Common Scoters. An influx of some 6,000 birds occurred in early April, when total numbers in the bay swelled to around 10,000 birds, some 3-5,000 of which were located in the previously heavily oiled Saundersfoot to Pendine stretch of coast.

During the 1995/96 winter, land-based counts peaked at 10,631 birds on 22 March 1996 immediately following the oil spill. Since some 4,700 birds had already been killed or transported to rehabilitation centres by this time, at least 15,000 birds used the bay during the 1995/96 winter. The following winter, land-based counts peaked at 4,323 birds on 25 November 1996 and February/March counts did not exceed c.3100 birds. Thus, peak counts in 1996/97 were some 6,000 birds lower than the previous year. Furthermore, in 1996/97 most birds occurred well offshore with none in intertidal areas.

Possible causes for the lower numbers of Common Scoter in 1996/97 include direct and indirect mortality from the *Sea Empress* oil spill and/or a high turnover of birds due to a low food availability in intertidal areas of the bay. However, a lack of baseline data on Common Scoter numbers and benthic invertebrate communities in Carmarthen Bay prior to the *Sea Empress* oil spill, limited data on the effects of oiling on benthic invertebrates, and the naturally high level of variation in scoter numbers in the bay, preclude firm conclusions being drawn. Nevertheless, it appears likely that over one year after the oil spill, some areas of Carmarthen Bay, particularly intertidal areas, remain unsuitable, or at least unprofitable, for foraging Common Scoters.

Land-based surveys provided a more effective means of obtaining total counts of Common Scoters in Carmarthen Bay during 1996/97 than aerial surveys. Aerial surveys located relatively few birds not visible from land and counted fewer birds in total probably due to birds being missed between transect lines. Aerial surveys, however, do provide a more accurate, quicker and easier means of plotting the distribution of birds at sea. Both land-based and aerial surveys of Common Scoter in Carmarthen Bay should therefore continue in a synchronised manner, to provide data on both numbers and distribution of Common Scoter. This will also provide information needed to determine factors affecting Common Scoter usage of Carmarthen Bay.



2 INTRODUCTION

Large volumes of oil from the stricken *Sea Empress* tanker entered Carmarthen Bay on 24 February 1996 and affected some 4,700 Common Scoters of which 2,900 were rescued alive (Parr *et al.* 1997). Approximately 1,100 of these birds were subsequently rehabilitated and released (T. Thomas *in litt.*), giving a minimum casualty figure in the region of 3,600 birds. Following the oil spill, a monitoring programme was immediately established by the Countryside Council for Wales to record numbers and distribution of Common Scoters in Carmarthen Bay. Scoters generally prefer feeding in waters <10m deep (Cramp & Simmons 1977) and previous aerial surveys in Carmarthen Bay have shown that most birds feed inshore of the 10m depth contour (Lovegrove 1976, Stewart 1996a) which extends some 6-10km offshore (Figure 1). As Common Scoters can only be identified and counted from land up to a range of 6km (B. Stewart *pers. obs.*), both land-based counts (conducted by WWT) and aerial surveys (conducted by RSPB) were initiated to provide complete coverage of the bay. This account reports the findings of fourteen months monitoring between 22 February 1996 and 23 March 1997, makes a qualitative assessment of the accuracy of data obtained using each survey method, and discusses the effect of the *Sea Empress* oil spill on Common Scoter numbers and distribution.

3 METHODS

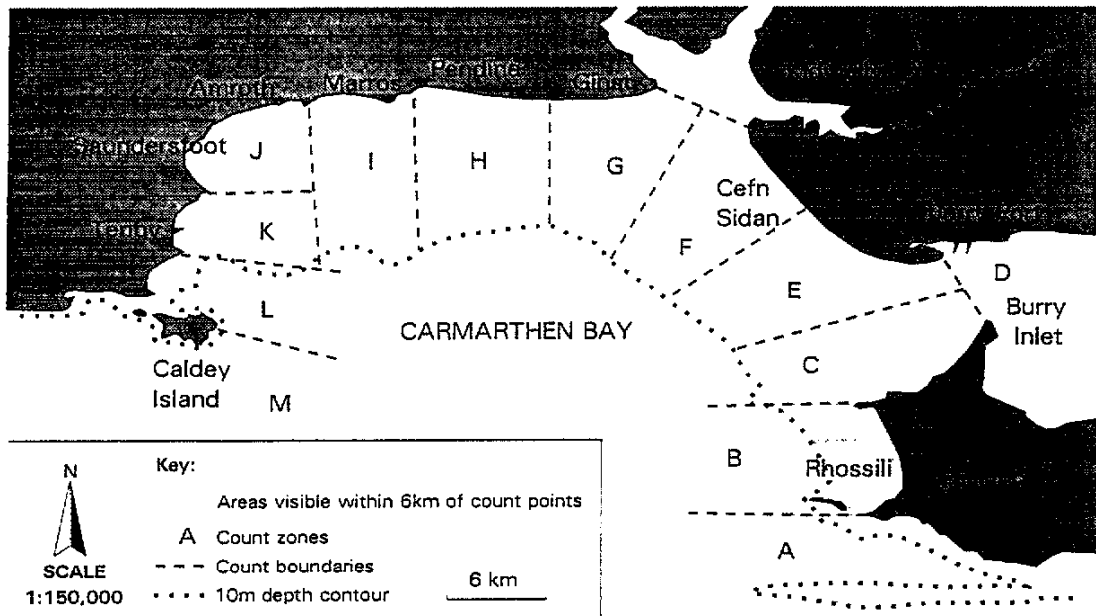
A total of 30 land-based counts were conducted at two week intervals between 23 February 1996 and 1 April 1997. For monitoring purposes, the bay was divided into 13 sectors and each counted from vantage points collectively covering all coastal areas of the bay (Figure 1). Birds were counted as near to high tide as possible and, when possible, the whole bay was covered in the same day. On seven occasions, however, counts of different sections of the bay were conducted on separate days, and in these cases birds may have been either double counted or missed. However, as flocks are observed within discrete feeding areas, usually for several weeks (B. Stewart *pers. obs.*), such bias is thought to be negligible. On four occasions, a full count was not possible (usually a result of inclement weather).

Six aerial surveys of Carmarthen Bay were conducted by RSPB using a high-wing Cessna 185 aircraft flying at 120m and 90 knots. For compatibility with previous surveys in 1976, aerial surveys followed a circular route of the bay with transect lines some 3-5km apart (see Figure 2). As birds were only visible at distances up to 500m either side of the aircraft,



this survey route provided an index of scoter numbers and distribution rather than a total count. Two observers recorded Common Scoter flocks onto standard recording sheets divided into separate transect sections by longitude and latitude.

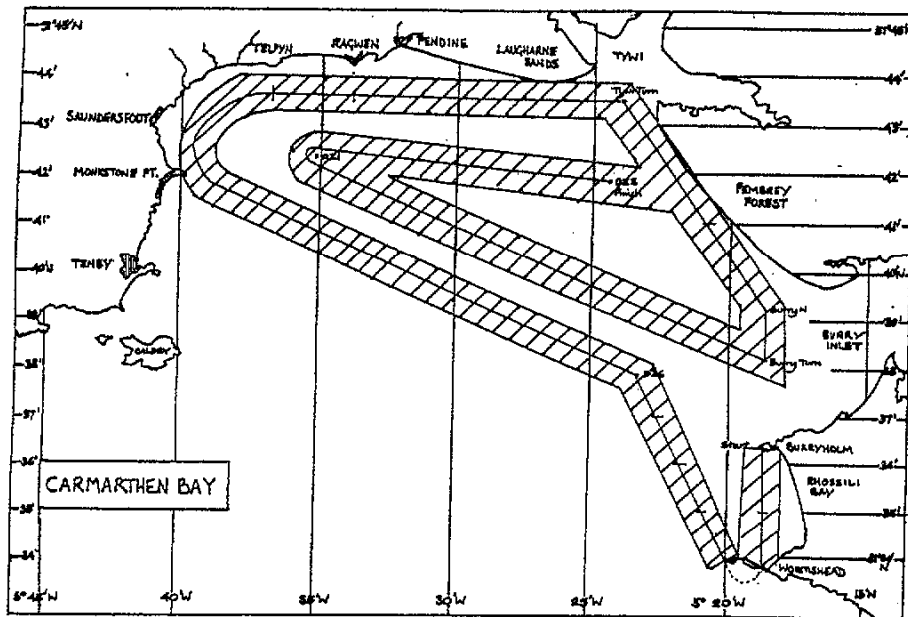
Figure 1. Count zones and range of land-based observations during Common Scoter monitoring in Carmarthen Bay, 23 February 1996 - 1 April 1997.



The first two aerial surveys were conducted during the oil spill on 22 and 27 February 1996, then on 15 September 1996, 10 November 1996, 8 February 1997 and 23 March 1997. Four were synchronised with land-based counts, but as numbers of Common Scoter were only estimated rather than counted accurately on one, three aerial counts remained for comparison with land-based counts. These were compared by simply expressing the difference between the two counts as a percentage of the aerial count total. An assessment of the number of birds out of range of land-based vantage points was made by comparing the limit of land-based counts (see Figure 1) with locations of birds mapped to the nearest 100m using a Global Positioning System (GPS).



Figure 2. Survey route taken during aerial surveys of Common Scoter in Carmarthen Bay, 22 February 1996 - 23 March 1997.



4 RESULTS

4.1 COMMON SCOTER NUMBERS AND DISTRIBUTION

When surface oil slicks entered Carmarthen Bay on 24 February 1996, approximately 8,000 Common Scoter were present (Figure 3), approximately half in the north west of the bay between Saundersfoot and Pendine (mainly Sectors H, I and J - see Figure 4), the remainder off Rhossili and Whiteford (Sectors B and C) in the east. Approximately, 4,700 Common Scoter were affected by the oil, 3,600 of which died and 1,100 which were rehabilitated and released. Thus it appears that most of the flock off the Saundersfoot to Pendine coast was oiled. The remaining birds off Rhossili and Whiteford were joined by another 6,000 birds in early April when total numbers in the bay swelled to around 10,000 birds (Figure 3). However, some 3-5,000 of these birds moved to the previously heavily oiled Saundersfoot to Saundersfoot stretch of coast after the amount of surface oil had decreased (Table 1). By the end of April, most birds had left the bay on their northward breeding migration. Common Scoter then reappeared in the bay in June and numbers built to around 1,000 birds during July, August and September as birds gathered to moult, mostly off Cefn Sidan (Table 1, Figure 1). Winter concentrations then formed from late September onwards with birds again frequenting the Rhossili area as well as their usual feeding areas from Pendine to Saundersfoot. Over the whole study, the Rhossili area

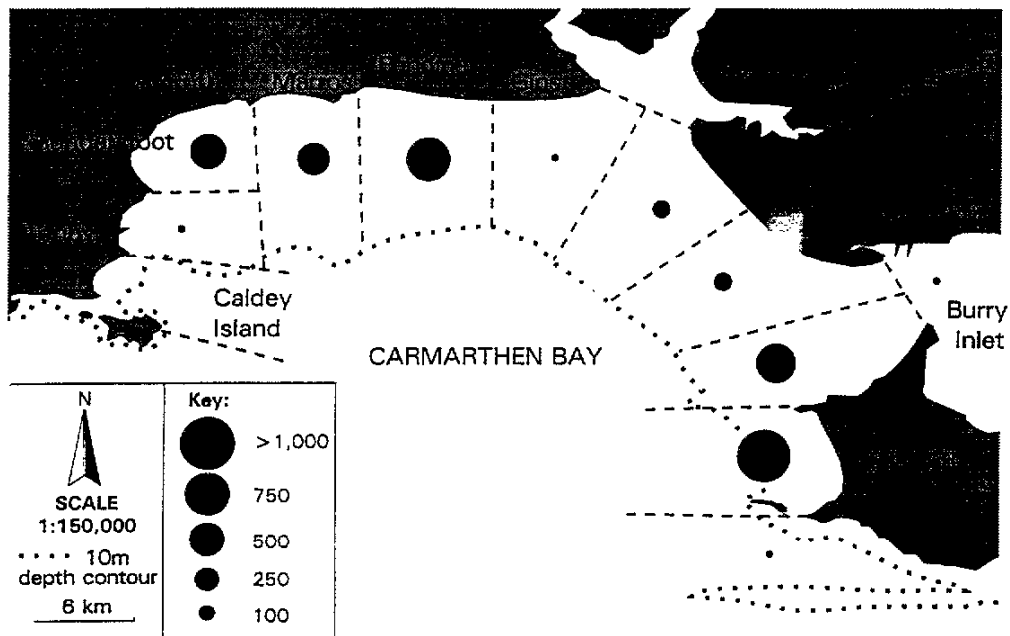


Table 1. Common Scoters usage of Carmarthen Bay, 23 February 1996 to 1 April 1997. Sector totals are maxima per two week period. Only count zones holding reasonable concentrations of birds included (see Figure 1). Hyphens represent uncounted sections. Note that as birds will have moved between sectors within each two week period, totals over all sectors do not correspond to coordinated count totals in Figure 3.

FORTNIGHT ENDING	B	C	E	F	H	I	J
23/2/96	3750	0	20	12	2090	340	2200
8/3/96	5066	2497	10	4	28	0	34
22/3/96	6005	1899	0	0	1817	205	765
5/4/96	7642	2570	0	0	2100	780	594
19/4/96	796	410	0	0	3000	100	12
3/5/96	1045	150	200	0	0	0	1
17/5/96	0	6	12	0	0	0	0
31/5/96	7	0	0	0	0	0	0
14/6/96	0	0	0	0	-	-	-
28/6/96	0	0	0	210	0	0	0
12/7/96	0	0	5	421	0	0	0
26/7/96	0	0	29	830	-	-	-
9/8/96	100	7	626	0	1	0	0
23/8/96	102	0	240	349	12	0	0
6/9/96	82	1	550	45	12	0	0
20/9/96	125	32	453	60	77	299	34
4/10/96	230	6	0	0	120	274	155
18/10/96	212	0	75	30	888	1229	745
1/11/96	120	0	-	-	-	-	-
15/11/96	1070	78	99	18	1108	1221	1174
29/11/96	440	35	37	121	1308	1400	982
13/12/96	562	25	0	0	80	905	96
27/12/96	891	0	-	-	-	-	-
7/1/97	1253	20	0	5	834	892	124
21/1/97	1267	0	0	70	840	180	490
4/2/97	576	126	0	46	410	220	380
18/2/97	450	203	0	14	1250	445	660
4/3/97	744	0	0	16	540	179	500
18/3/97	1210	82	0	0	512	137	231
1/4/97	323	6	6	0	140	315	193
	B	C	E	F	H	I	J
Sum	34068	8153	2362	2251	17167	9121	9370
%	41%	10%	3%	3%	21%	11%	11%
Mean	1136	272	84	80	660	351	360
SD	1909	707	174	181	830	436	510



Figure 5. Mean number of Common Scoter per count section in Carmarthen Bay over 30 land-based counts between 23 February 1996 and 1 April 1997.



During the 1995/96 winter, land-based counts peaked at 10,631 birds on 22 March 1996 immediately following the oil spill (Figure 3). Since some 4,700 birds had already been killed or transported to rehabilitation centres by this time, at least 15,300 birds used the bay during the 1995/96 winter. The following winter, land-based counts peaked at only 4,323 birds on 29 November 1996 and March counts did not exceed *c.* 3,100 birds. Thus, March counts in 1997 were some 12,200 birds lower than in 1996. Although birds frequented the same count sectors during the 1996/97 winter as they had the previous year, birds were located noticeably further offshore with almost no birds observed feeding in the intertidal zone.

4.2 EFFECTIVENESS OF LAND-BASED AND AERIAL COUNTS

On the three occasions when land-based and aerial surveys were conducted simultaneously, land-based counts recorded 37-517% more birds than aerial surveys (Table 2, Figure 3). During the six aerial surveys, no Common Scoters were recorded out of range of land on four occasions, with the other two counts locating only 4 and 169 birds further than six kilometres offshore (representing 0.1 and 7% of the aerial count totals). Thus, land-based counts failed to register only negligible numbers of birds.



Table 2. Aerial and land-based counts of Common Scoters in Carmarthen Bay during 1996/97. Land-based counts are only stated for dates on which aerial surveys were conducted simultaneously. Differences between land-based and aerial counts are expressed as percentages of aerial counts. Percentages of birds not visible from land (>6km from nearest shoreline vantage point - see Figure 1) are estimated from aerial count totals.

DATE	LAND	AIR	DIFFERENCE (%)	NO. OF BIRDS OUT OF SIGHT FROM LAND (%)
22/2/96	-	c. 4,500	-	0
27/2/96	-	No count	-	0
15/9/96	1001	506	495 (98)	0
10/11/96	4070	2575	1495 (37)	169 (7)
8/2/97	-	4,112	-	4 (0.1)
23/3/97	1352	219	1133 (517)	0

5 DISCUSSION

5.1 COMMON SCOTER NUMBERS AND DISTRIBUTION

Immediately following the *Sea Empress* oil spill, many of the Common Scoters in Carmarthen Bay moved to the Rhossili area (an area not usually utilised by large numbers of Common Scoters) and numbers peaked at over 10,000 birds, some 8-10 times higher than recorded previously in that area (Stewart *unpublished data*, Grenfell 1960-1994). However, significant numbers of birds also returned to feed in the previously heavily oiled Pendine to Saundersfoot stretch once the surface oil had dispersed. Although it was likely that birds were also feeding on contaminated food (both Common Mussel *Mytilus edulis* and Common Cockle *Cerastoderma edule* in scoter feeding areas in Carmarthen Bay had elevated levels of total hydrocarbons (THCs) in their tissues (Law *et al.* 1997)), THC levels involved were not thought to be high enough to affect Common Scoter through direct toxicity (R. Milne *pers. comm.*).

A lack of coordinated counts prior to 1996 and substantial natural year-to-year variation in numbers of Common Scoters using Carmarthen Bay hamper year-on-year comparisons, but there are a number of inconsistencies between data pre- and post-*Sea Empress*, both in terms of the numbers of birds counted and their distribution within the bay. Following the natural absence of Common Scoter from Carmarthen Bay during the 1996 breeding



season, the number of birds returning to moult and winter in the bay was much lower than in previous years (Stewart 1996a, 1996b). Birds (mostly males) typically display a summer build up in Carmarthen Bay during their southward migration (Stewart 1996b). This all but failed to occur in 1996 with moulting numbers off Cefn Sidan peaking at 1,000 birds, compared with previous peaks of over 11,000 birds (B. Stewart *unpublished data*).

The 1996/97 winter peak of about 4,300 birds was some 6,300 birds fewer than the peak 1995/96 count or some 11,000 less taking into account birds which had been affected by the oil. The 1996/97 peak was also considerably less than the mean of three complete counts of the bay in the mid-1970s (mean = 8,541 birds, $n = 3$). Numbers do, however, fluctuate naturally between years, sometimes markedly, and the 1996/97 peak is probably within the normal range of variation. However, as scoter numbers in Carmarthen Bay have been much higher in recent winters (e.g. 17,600 in 1994/95 and 12,000 in 1995/96), it seems somewhat unlikely that the low numbers present during 1996/97 (i.e. post *Sea Empress*) were not, in some way, a result of the effects of the oil spill.

Direct mortality accounted for some 3,600 birds (Parr *et al.* 1997) and, as post-release survival of oiled, cleaned seabirds is reported to be low (Sharp 1996, Wernham *et al.* 1997), many of the 1,100 birds cleaned and released may also have died. However, reduced Common Scoter numbers in Carmarthen Bay in 1996/97 may also be attributable to a higher turnover of birds caused by low food availability in the bay. In winters prior to the *Sea Empress* oil spill, Common Scoters in Carmarthen Bay fed mainly in intertidal areas, particularly favouring the Pendine to Saundersfoot coast. However, although birds returned to the same areas of the bay in 1996/97, most birds occurred well offshore with none in intertidal areas. Although the reasons behind this atypical distribution are unknown, the available invertebrate food supply in intertidal areas may have been more reduced after the spill than in subtidal areas. High levels of residual oil were still present in much of the intertidal sediments in the western half of Carmarthen Bay in March 1997 (A. Muxworthy *pers. comm.*) and virtually all intertidal macroinvertebrates, including Banded Wedge Shells *Donax vittatus* and Common Cockle on which scoter feed (Hughes *et al.* 1997), were relatively uncommon (A. Muxworthy *pers. comm.*). Also, as birds diving over subtidal sediments appeared to be feeding normally, that is diving repeatedly and successfully in the same area and remaining in such areas for a number of weeks, presumably until the food supply was exhausted, one may assume that subtidal invertebrate communities still



provided a profitable food resource.

In conclusion, lack of baseline data on benthic invertebrate communities prior to the *Sea Empress* oil spill, plus limited data on the subsequent effects of oiling on intertidal and subtidal invertebrates, preclude firm conclusions being drawn regarding the rôle of the *Sea Empress* oil spill on Common Scoter numbers and distribution in Carmarthen Bay pre- and post-spill. However, it appears likely that over a year after the oil spill, some areas of Carmarthen Bay, particularly inshore intertidal areas, remain unsuitable, or at least unprofitable, for foraging Common Scoters. Research into the distribution and abundance of benthic invertebrates in the bay, and how these determine Common Scoter usage, both temporally and spatially, is urgently required.

5.2 EFFECTIVENESS OF LAND-BASED AND AERIAL COUNTS

Although based on few data, land-based surveys provided a more effective means of obtaining total counts of Common Scoters in Carmarthen Bay during 1996/97 than did aerial surveys. There are two possible explanations for this: a) birds were undercounted from the air, and b) birds were missed between survey transects. Bräger *et al.* (1995) noted that Common Scoter were undercounted from the air by comparing counts by three different observers with aerial photographs over 31 aerial surveys. However, it is unlikely that differences between aerial and land-based surveys during this study could be explained simply by observer error alone, especially as both observers had more than 100 hours experience of surveying birds from the air. It is much more likely that birds were missed between aerial survey transect lines, which were some 3-5km apart compared with the 2-3km recommended by Pihl & Frikke (1992) in their handbook of aerial survey techniques. Even transect lines 2-3km apart, however, would involve counting birds with the naked eye at distances of up to 1.5km (from a height of 120m). Given that observers during this study suggested that birds could not be counted at distances greater than 500m, it seems advisable to review the aerial survey route during 1997/98 surveys. It may also be advisable to fly at a higher altitude, perhaps 180m, to reduce disturbance.

Between 0 and 7% of Common Scoter counted from the air in Carmarthen Bay were estimated to be out of range of land, compared with a mean of 9.4% (range 0-30.2%, 0-290 birds) during five aerial surveys conducted in 1994/95 (WWT *unpublished data* - Table 3). It is difficult to draw sensible conclusions from such small sample sizes, but the



observation of only 86 birds out of sight of land from a total aerial count of 16,605 birds on 29 December 1994 would suggest that birds prefer inshore areas. Furthermore, a total of eleven aerial surveys have located a maximum of 290 birds offshore and on six of the eleven aerial counts no Common Scoter were located in areas not visible from land. Data in the available literature (Grenfell 1960-1994), extensive casual observations between 1992 and 1995 (B. Stewart *pers. obs.*), and detailed coordinated counts during this survey also suggested that Common Scoter in Carmarthen Bay prefer inshore areas. However, this is not the case in other areas, such as off the Baltic coasts of Denmark and Germany, where most birds occur out of sight of land (Pihl & Laursen 1994, Bräger *et al.* 1995).

Table 3. Estimated numbers of birds out of sight of land during five aerial surveys of Common Scoters in Carmarthen Bay during 1994/95. All birds located more than six kilometres from the nearest vantage point are assumed to be out of sight of land.

DATE	TOTAL NO. OF BIRDS COUNTED	NO. OF BIRDS OUT OF SIGHT FROM LAND
29/12/94	16,605	86 (0.5%)
12/2/95	960	290 (30.2)
26/3/95	1,433	230 (16.1)
24/6/95	100	0
12/8/95	56	0

Despite the fact that fewer Common Scoter were counted from the air than from land, given a comprehensive transect route, aerial surveys can provide a more accurate, quicker and easier means of plotting the distribution of birds at sea. The use of GPS allows the position of all Common Scoter flocks throughout the bay to be pinpointed exactly within 50 minutes, while we estimate that plotting scoter distribution from land using triangulation would take two fieldworkers one full day. Thus, in order to provide comprehensive information on both numbers and distribution of Common Scoter in Carmarthen Bay synchronised land-based and aerial surveys need to be conducted. The aerial survey route also requires modification, perhaps to north-south transects at 1 km intervals.



6 ACKNOWLEDGEMENTS

Many thanks to Rob Colley, Stuart Devonald, Graham Rees, and Rob Taylor who carried out counts of Common Scoter during this project. Thanks also to Ian Morgan and Steve Parr of CCW for their help and advice. Mark Underhill, Mark Rehfisch and Jane Hodges provided useful comments on an earlier version of this manuscript.

7 REFERENCES

- Bräger, S., Meißner, J. & Thiel, M. 1995. Temporal and spatial abundance of wintering Common Eider *Somateria mollissima*, Long-tailed Duck *Clangula hyemalis*, and Common Scoter *Melanitta nigra* in shallow water areas of the southwestern Baltic Sea. *Ornis Fenn.* 72:19-28.
- Cramp, S. & Simmons, K.E.L. 1997. *The Birds of the Western Palearctic, Volume 1*. Oxford University Press, Oxford.
- Grenfell, H. 1960-1994. *Gower Birds*. Gower Ornithological Society.
- Hughes, B., Stewart, B., Brown, M.J. & Hearn, R.D. 1997. The effect of the *Sea Empress* oil spill on wintering Common Scoter *Melanitta nigra nigra* in Carmarthen Bay, Pembrokeshire. Final report to the Sea Empress Environmental Evaluation Committee.
- Law, R.J., Kelly, C.A., Graham, K.L. & Woodward, R.J. 1997. Hydrocarbons and PAH in fish and shellfish from southwest Wales following the *Sea Empress* oil spill. Pp. 205-211 In: *Proc. 1997 International Oil Spill conference, Fort Lauderdale, Florida, April 7-10 1997*. American Petroleum Institute Publ. No. 4651, Washington.
- Lovegrove, R.R. 1976. Scoter in Carmarthen Bay. Unpubl. report to Nature Conservancy Council.
- Parr, S.J., Haycock, R.J. & Smith, M.E. 1997. The impact of the *Sea Empress* oil spill on birds of the Pembrokeshire coast and islands. 1997 International Oil Spill conference, Fort Lauderdale, Florida, April 7-10 1997. American Petroleum Institute Publ. No. 4651, Washington.
- Pihl, S. & Frikke, J. 1992. Counting birds from aeroplane. Pp. 8-20 In: *Manual for aerial and ship surveys of waterfowl and seabirds* (Komdeur, J., Bertelsen, J., & Cracknell, G., Eds.). IWRB Spec. Publ. 19.
- Pihl, S. & Laursen, K. 1994. Midwinter counts in the Baltic part of Denmark in 1991 and 1992. IWRB Seaduck Research Group Bull. 4:39-41.
- Sharp, B.E. 1996. Post-release survival of oiled, cleaned seabirds in North America. *Ibis* 138:222-228.
- Stewart, B. 1996a. *Common Scoter Survey 1994/95, Carmarthen Bay*. Unpubl. report to Countryside Council for Wales.
- Stewart, B. 1996b. A Review of Common Scoters *Melanitta nigra* in Carmarthen Bay. *Carmarthenshire Birds*, 1995, Number 4.
- Wernham, C.V., Peach, W.J. & Browne, S.J. 1997. Survival rates of rehabilitated Guillemots. BTO Research Report No 186. Confidential final report by BTO to CCW.