THE VALUE OF PUBLIC SIGHTINGS RECORDING SCHEMES IN RELATION TO THE BASKING SHARK IN THE UNITED KINGDOM

by

Colin D. SPEEDIE (1)

ABSTRACT. - For a number of years, public sightings recording schemes have been utilised to gather simple data on occurrences of the basking shark (*Cetorhinus maximus*) in the UK, both on a national and local basis. These have emulated successful cetacean sightings recording schemes involving members of the public, and are recognised for contributing as much in terms of public awareness as in overall scientific understanding of the abundance and distribution of the species. This paper compares three years of results (1999-2001) obtained from a successful public sightings scheme in the south-west of England, with a boat based effort-related survey over the same period. Both sets of data cover the same spatial scale, and offer a comparison in terms of the incidence of sightings, overall numbers and temporal and spatial distribution of basking sharks. The results obtained in each survey have been examined and ways to improve such schemes are suggested.

RÉSUMÉ. - Valeur des programmes d'enregistrement des signalements de requins-pèlerins par le public au Royaume-Uni.

Depuis plusieurs années, des programmes d'enregistrement des observations faites par le public sont utilisés pour récolter, localement et au niveau national, des données sur la présence de requins-pèlerins (*Cehorhinus maximus*) dans les eaux du Royaume-Uni. De tels programmes impliquant le public ont été utilisés avec succès pour l'observation de cétacés et ils ont contribué à sa sensibilisation, mais ils participent aussi à l'amélioration de nos connaissances scientifiques sur l'abondance et la distribution des espèces. Le présent article compare les données récoltées par le public sur les côtes du sud-ouest de l'Angleterre entre 1999 et 2001, aux données recueillies, durant la même période, par les campagnes scientifiques utilisant des observateurs embarqués. Les deux bases de données ont la même échelle spatiale et permettent de comparer les observations, notamment le nombre des requins-pèlerins observés et leur distribution spatiale et temporelle. Les résultats de chaque campagne d'observation sont analysés et des solutions pour les améliorer sont proposées.

Key words. - *Cethorhinus maximus* - Basking shark - ANE - Abundance - Distribution - Sightings - Surveys.

In order to understand the spatial and temporal distribution of the basking shark within a given area, some method of quantifying their abundance must be devised. In the case of south Devon and Cornwall this has taken two distinctive forms.

The first takes the form of the Devon and Cornwall Wildlife Trust's Seaquest project, which encourages members of the public to report any sightings they make around the coast. These sightings tend not to be effort related, and therefore have a more limited value than sightings reports from properly structured effort-related surveys. However, experience from cetacean sightings schemes, such as those operated by the Sea Watch Foundation have shown that this type of data still has a value within certain parameters, such as providing general information on distribution and relative abundance status, as long as there is a relatively even geographical coverage of the observers (Evans, 1992).

It may also have value for further ecological analyses, including species distribution in relation to oceanographic features such as sea surface temperature, water depth, undersea topography, tidal rhythms or thermal fronts. Behavioural and ecological relationships with group size, location of breeding areas and the temporal movement of species between areas may also be examined (Evans, 1992).

This type of sighting scheme is effectively a low cost means of gathering large data sets regarding the distribution and relative abundance of the basking shark, and in the long term may provide valuable insights into the spatial and temporal distribution of the species. In addition, they may identify opportunities for more detailed investigations of particular localities through dedicated surveys.

The second form involves a dedicated boat based survey (The Wildlife Trusts Basking Shark Research Project) using line transect methods in which effort may be quantified to allow sightings to be expressed as an index of abundance per unit effort. Using standardised observation techniques and the same vessel throughout the period to keep variation to a minimum, and using trained observers, ensured that these surveys had a proper structure, allowing the determination of more robust results.

Both aspects of the survey work have proved to be effective in engaging the public imagination in the basking shark on a local basis. The Seaquest public sightings scheme has now been operating since 1995, and so was well established

(1) MER Consultants, College of Falmouth, Killigrew street, Falmouth, TRII 3QS, ENGLAND. [colin.speedie@mer.org.uk]

by the period (1999-2001) examined here. The boat-based surveys have been heavily covered in a variety of media. The development within this project of the benign research technique of photo-identification for this species has also been established, and has offered another aspect of public engagement and benign scientific research (Speedie, 2000) that has been widely reported.

Mobilising public opinion in this way has seen a remarkable turnaround in the fortunes of the basking shark in Britain, that has seen the species achieve protection under Section 5 of the Wildlife and Countryside Act 1981 within the UK 12 mile limits in 1999 after a long campaign. Further localised protection in England and Wales has been added to this legislation in the form of the Countryside and Rights of Way Act (2000) which specifically makes an offence of the harassment and disturbance of the basking shark.

On the international stage, the Isle of Man government first urged the UK government to propose the basking shark for a CITES listing at the 10th Convention of Parties in 1997. This was not pursued by the UK in that year, but an unsuccessful proposal was submitted to the 11th Conference in 2000. Following that failure, the UK government unilaterally placed the species on Appendix III of CITES, a level which had little significance other than minor localised protection, but much resonance in symbolic terms. The UK government returned with a revised proposal to the 12th Conference in November 2002, and were finally successful in achieving the addition of the species to Appendix II, which will come into effect in early in 2003. These successful developments have undoubtedly been driven by greater public awareness, arguably through the efforts of conservation Organisations in highlighting the plight of the basking shark in the UK.

MATERIALS AND METHODS

The Seaquest Project relies on sightings reported by members of the public, either by means of a sightings report form, a letter or by telephone. The sightings form is interrogative, and attempts to elicit extra information from the correspondent such as site, date, time, number of individuals, size, behaviour and weather conditions. In this way useful extra data may be gathered to accompany the sighting, although it is often the case that all boxes are not filled out. In the case of telephoned reports, questions may be asked of the correspondent of a similar nature to those on the sightings form. It remains the case, though, that these sightings have no element of quantifiable effort. The sightings scheme operates all year round, and has been widely supported, especially among divers, fishermen, yachts people, coastguards and other individuals who spend part of their lives near the sea.

In order to establish some sense of the spatial distribution of the basking shark from the data gathered in this way, the region's coastline has been broken down into eight sectors, from the Devon and Somerset border on the North coast, to the Devon and Dorset border along the South coast.

In the case of the boat based surveys, a minimum of four line transect surveys of six days duration were carried out in each year since 1999. One survey has been carried out in each of the months of May, June, July and August each season, to give a broad temporal scale. The study area extended from the Isles of Scilly in the West (49°52.40'N-06°27.00'W) to Torbay in the East (50°23.70'N-03°28.40'W), and between these points line transects have been established, using either prominent headlands as starting/finishing points, or offshore buoys and lighthouses. It was the aim of the project to complete each line transect at least twice per season.

Line transect surveys allow more precise examination of patterns of occurrence, and can be both inshore and offshore, permitting a wider understanding of the status of a population within a prescribed area. Line transects allow observations to be expressed as an index of abundance per unit effort (Evans, 1992), such as numbers of individual sharks per kilometre travelled, for comparison between seasons and areas.

The survey platform throughout has been an 11.7 m sailing vessel operating from Falmouth in Cornwall. On each survey a volunteer crew of at least six individuals has been carried to assist with the execution of the surveys. Volunteers have received training in observation techniques and data recording to ensure a homogeneous approach, and the following standard structure was developed and used at all times. Two observers scanned for basking sharks to right and left of the vessel, with a standard height of eye of 3 m. One member of the crew was responsible for recording a wide variety of data on a half-hourly basis, including position, environmental conditions, water depth and sea surface temperature. Sightings were recorded on specially developed separate sheets to ensure that as much data as possible was accurately gathered. Position was established via a Global Positioning System (Raytheon 390), and water depth and sea surface temperature via a sonar unit (Interphase TwinScope) with built-in through hull sensor.

The ability to sight basking sharks is highly dependent on sea conditions and visibility. For this reason, no transect was started if sea conditions exceeded sea state 4 (Beaufort scale), or was continued if sea conditions deteriorated to this level. Similarly, no transect was started if visibility was poor (less than 1 mile), or if visibility deteriorated to that level, in which case the transect was abandoned.

Between 1999 and 2001, a total of 92 line transects were completed in this manner, with a total of 209 hours of observation over a distance travelled of 2088 km.

RESULTS

Individual sightings

A comparison of the number of animals reported by the Seaquest public sightings scheme and our line transect surveys has been broken into two parts: the number of sightings in each case given in tables I and II, and the number of individuals recorded as a result of those sightings given in tables III and IV.

To enable an analysis of the spatial distribution of the basking shark, the coastline covered by the Seaquest sightings scheme has been broken down into eight sectors. As only five of these sectors fall within the area covered by the line transect surveys, only these areas have been included in this analysis (Fig. 1). The sectors covered are as follows: (1) Gwennap Head to Lizard Point (including the Isles of Scilly); (2) Lizard Point to St Anthonys Head; (3) St Anthonys Head to Dodman Point; (4) Dodman Point to Penlee Point; (5) South Devon.

Examination of the data presented in tables I-IV illustrates the relationship between the two sightings elements effectively. In the case of both the public sightings scheme and the line transect surveys, moderate levels of recordings occurred in May, peaked in June, followed by a steady decline until August. The sole major variation during this study period occurred in August 1999, when a large group were recorded on one of the line transect surveys.

It is recognised that basking sharks enter the English Channel area to feed at the surface on the high abundance of zooplankton that occurs in late spring (Sims *et al.,* 1997), followed by a steady decline as the season progresses, due to the warming of inshore waters, causing stratification to occur (Sims and Quayle, 1998), with a subsequent reduction in surface sightings. A number of potential explanations may be postulated for the more accentuated curve of the Seaquest elements, most prominent amongst which would be that the public sightings scheme operates continually, whereas the line transect surveys are only one per month. Additionally, double counting may have occurred in some cases, owing to the difficulty of identifying individual animals, or where records of a single animal or group of animals are submitted by several independent observers. These problems are far less prevalent when the sharks are viewed at close range from a vessel, where individuals may be easily identified by unique fin shapes and markings (Sims *et al*., 1997). This can be confirmed most effectively where photo-identification is employed for later analysis (Speedie, 2000).

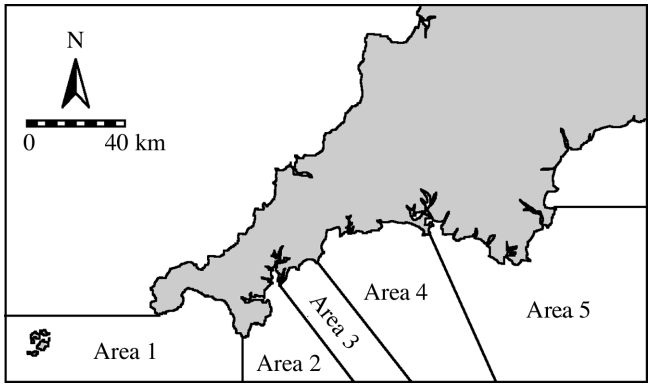

Figure 1. - Plan of survey areas for the basking shark observations off the South-West England.

Table I. - Number of recorded public sightings of basking sharks in 1999-2001, off the South-West England.

Month	Area					Total
	1	2	3	4	5	
May	51	13	0	4	9	77
June	109	40	2	10	16	177
July	64	29	2	10	5	110
August	39	6	2	2	1	50
Total	263	88	6	26	31	

Table II. - Number of sightings of basking sharks recorded during effort related surveys in 1999-2001, off South-West England.

Month	Area					Total
	1	2	3	4	5	
May	0	0	0	0	0	0
June	13	0	0	0	0	13
July	5	1	0	0	0	6
August	7	0	0	0	0	7
Total	25	1	0	0	0	

Table III. - Number of public sighted individuals of basking shark in 1999-2001, off South-West England.

Month	Area					Total
	1	2	3	4	5	
May	96	31	43	53	115	338
June	473	287	3	14	13	790
July	540	87	2	17	25	671
August	144	12	2	2	1	161
Total:	1253	417	50	86	154	

Table IV. - Number of individuals of basking sharks sighted during effort related surveys in 1999-2001, off South-West England.

Month	Area					Total
	1	2	3	4	5	
May	0	0	0	0	0	0
June	58	0	0	0	0	58
July	12	1	0	0	0	13
August	70	0	0	0	0	70
Total	140	1	0	0	0	

Both the Seaquest scheme and the line transect surveys show a strong westerly bias in terms of sightings, with areas 1 and 2 consistently showing the highest levels of both sightings and individuals. Both areas are known for their strong tidal streams, and a rocky, uneven seabed rising rapidly towards the shore, producing almost complete water mixing from the seabed to the surface. As a result, these regions are characterised as having a stratification index of less than 1.5, where fronts can be expected to form throughout the season (Southward and Boalch, 1988). Thermal fronts have been shown to be preferred feeding sites for the basking shark (Sims and Quayle, 1998), where the animals forage for the most substantial densities of plankton, with associated high levels of surface sighted sharks.

Over the majority of the Devon and Cornwall coastline, the stratification index is above 1.5, and throughout this area water may be expected to stratify in summer, as inshore water warms. This allows a layer of warm water to lie over a bottom layer of colder water separated by a sharp discontinuity called the thermocline (Southward and Boalch, 1988), and the disappearance of frontal effects at the surface as a result. This effect usually coincides with disappearance of surface sighted sharks in most of the area, as the sharks are believed to forage deeper in the water column along the interface of warm and cold water.

DISCUSSION

The Seaquest scheme follows a tested formula, which has been in use for many years for a number of species, including the basking shark. Indeed, basking shark sightings from around the UK on a national basis by the Marine Conservation Society since the 1980's. A high level of local interest has followed the establishment of the Seaquest scheme (in 1995), ensuring that the scheme was relatively mature and fully functional by the time this study took place. That the results from the Seaquest scheme resemble those obtained by the line transect surveys, especially in spatial and temporal terms is positive, although there are disparities which may well be explained by the lack of quantifiable effort, multiple counting and animal identification.

The Seaquest scheme offers a low cost, year round opportunity to engage the public in reporting this threatened species. The information gathered so far has been extremely valuable in identifying areas which deserve further, more detailed study in the near future, over a wider spatial scale beyond the study area which would have been difficult to achieve due to the cost limitations involved in boat based surveys. Therefore such data is worth collecting, and the sightings network should continue to be developed.

Public involvement and participation in the scheme has led to far greater public awareness of the basking shark in the local waters described here, and has delivered opportunities for the arguments in favour of greater protection of the species to achieve widespread coverage (Simmonds, 2000). The inclusion of the basking shark as a named species within the new Countryside and Rights of Way 2000 legislation, making it an offence to cause "reckless or intentional disturbance" of the species, is a clear reflection of public concern leading to Government action.

The line transect surveys have allowed a substantial amount of quantifiable, effort related data to be gathered, which has allowed a far more detailed understanding of the relative abundance in both spatial and temporal terms of the species in the waters of South Devon and Cornwall (Speedie, 2002). Key areas for the species have been identified in which further research must be carried out, to identify and quantify threats to the species, particularly those of an anthropogenic nature. Additionally, the boat based surveys offer far greater opportunities in a number of areas. It is, for example, far easier to ascertain animal size and sex from a close proximity encounter with a carefully handled vessel. It is also far easier to record specific behaviour at close quarters, as has been evinced by numerous sightings during the boat based surveys of groups engaged in nose-to-tail following behaviour that has been identified as being consistent with courtship behaviour (Harvey-Clark *et al*., 1999).

Both the Seaquest scheme and the boat-based study should be continued over the longer term, especially as there is concern that climate change may affect summer stratification in sea coastal regions (Wood and McDonald, 1997), potentially affecting the development of thermal fronts which are of vital importance to the basking shark. It is believed that some of those areas of fronts identified by this study may have an importance beyond simply acting as highly productive feeding areas for basking sharks, but also as areas where courtship and breeding takes place (Sims *et al*., 2000). Longer term studies offer an opportunity to anticipate and monitor any change that occurs.

A positive benefit could come from an amalgamation of these two types of study, if emphasis was to be placed on training some of the existing Seaquest network in more structured observation techniques. Land based effort related studies such as timed sea watches from coastal vantage points such as headlands, are relatively low cost to organize, and can be set up at short notice to take advantage of good weather conditions. Many of the best sites offer a high vantage point which allows sightings to be observed over a reasonable distance, and are often overlooking sea areas in which high levels of human activity take place, making them ideal positions to watch for evidence of disturbance.

Similarly, additional boat based operators could be encouraged to take part in effort related line transect studies wherever possible. Training via existing volunteers who have taken part in the three-year study described here could

be envisaged aboard suitable platforms of opportunity (ferries, pleasure craft, trip boats), to improve structured coverage of the area. It might even be possible to set up special "timed observation" weekends, involving effort related observations from a number of suitable shore sites throughout the region, combined with simultaneous line transect surveys over the same spatial scale, which would provide a more accurate assessment of relative abundance at that specific time. If this were to be carried out over a far wider area than presented within this study, covering the western seaboard of the UK, for example, it would be possible to include other existing sightings networks for cetaceans, or contributors to the Marine Conservation Society sightings scheme, potentially making for a substantial increase in our understanding of the species and its distribution.

Developments such as this would harness the best aspects of these two types of sightings scheme. Any improvement in the standard of shore based observation, to encourage the collection of effort related data, as opposed to simple casual recording would be a considerable advance, and should be employed on a much wider basis.

Acknowledgements. - The Seaquest project is operated by the Devon and Cornwall Wildlife Trusts. The boat based line transect surveys were supported by The Wildlife Trusts/WWF-UK Joint Marine Programme and The Shark Trust. The author would like to offer thanks to Dr P. Evans, Dr S. Pullen, Dr J. Edwards, S.L. Fowler, D. Marshall and Dr Miles Hoskin for their assistance, support and advice.

REFERENCES

EVANS P.G.H., 1992. - Status Review of Cetaceans in British and Irish Waters. 98 p. Oxford: The U.K. Mammal Society.

HARVEY-CLARK C.J., STOBO W.T., HELLE E. & M. MATTTSON, 1999. - Putative mating behaviour in basking sharks off the Nova Scotia coast. *Copeia*, 3: 780-782.

SIMMONDS M.P., 2000. - Chasing Dolphins! 20 p. Bath: The Whale and Dolphin Conservation Society.

SIMS D.W., FOX A.M. & D.A. MERRETT, 1997. - Basking shark occurrence off south-west England in relation to zooplankton abundance. *J. Fish Biol*., 51: 436-440.

SIMS D.W. & V.A. QUAYLE, 1998. - Selective foraging behaviour of basking sharks on zooplankton in a small-scale front. *Nature*, 393: 460-464.

SIMS D.W., SOUTHALL E.J., QUAYLE V.A. & A.M. FOX, 2000. - Annual social behaviour of basking sharks associated with coastal front areas. *Proc. R. Soc. Lond. B,* 267: 1897-1904.

SPEEDIE C.D., 2000. - The European basking shark photo-identification project. *In:* Proc. 4th EEA Meeting (Vacchi M., La Mesa G., Serena F. & B. Séret, eds.), pp. 157-160. ICRAM, ARPAT and SFI.

SPEEDIE C.D., 2002. - Marine ecotourism potential in the waters of South Devon and Cornwall. *In:* Marine Ecotourism: Issues and Experiences (Garrod B. & J. Wilson, eds.), pp. 204-214. Clevedon: Channel View Publications.

SOUTHWARD A.J. & G.T. BOALCH, 1988. - The marine resources of Devon's coastal waters. pp. 51-61. Published by Exeter Maritime Series.

WOOD C.M. & D.G. McDONALD, 1997. - Global Warming: Implications for Freshwater and Marine Fish (Wood C.M. & D.G. McDonald, eds.). Cambridge Univ. Press.

Reçu le 10 décembre 2002.
Accepté pour publication le 23 mai 2003.