

Basking Shark Survey: tagging and tracking

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Summary

The aims of the Basking Shark Survey 2009 were to extend the basking shark tagging program started in 2008 including the deployment of satellite tags. Secondary aims included collecting images useful for photo-identification and tissue samples for genetic analysis.

A total of 101 coloured numbered tags were deployed at three sites. Most tags were deployed off Inishowen in North Donegal and around the Blasket Islands, west Kerry. In addition two archival satellite tags were deployed off Sleah Head, west Kerry. A total of eight re-sightings of tagged sharks were recorded. Most of these were within a site between one and 10 days later but one re-sighting was between North Donegal and Tiree in the Inner Hebrides, a distance of 140km and duration of 22 days. In time it is expected more and longer distance/duration recoveries will be recorded.

The tagging project provided an unexpected opportunity to use mark-recapture modelling to estimate the abundance of basking sharks in Trawbreaga Bay, North Donegal. During three days fieldwork from 1-3 June we tagged 50 individual sharks. Twenty-three were tagged on 1 June, 17 on the 2 June and 12 on the 3 June. Of those tagged on 1 June four re-sighted on the 2 June which provided a crude estimate of around 135 basking sharks in Trawbreaga Bay during this period.

Images of 71 photo-identification images were obtained, which form the basis of an Irish Basking Shark Photo-ID Catalogue. Over one-half (56%) were considered good quality images but only 21% had marks useful for photo-identification. Most sharks are not well marked but the occasional well-marked individual can be used to check the longevity of tags as there is a chance this shark will be identified again from these wounds and thus it can be checked for the presence of tags.

Attempts were made to biopsy sample three sharks using the biopsy pole and two sharks with the crossbow in order to provide samples for genetic analysis. Only one sample was obtained but a sample of slime from one shark, which was scrapped off the bow of the research vessel after being hit by the tail after tagging was also recovered. DNA was extracted from this basking shark slime which demonstrated the value of shark slime for genetic work. A further five samples were obtained from basking sharks in the Blasket Islands using a modified mop handle and scourer pad. This technique was also used successfully in the Isle of Man and a paper is being prepared on this technique as it offers a non-invasive efficient method of obtaining samples for genetic analysis.

As part of this project we facilitated a film crew who are making a documentary on animal migration for RTE. In addition to this media opportunity a large number of interviews were carried out on radio and articles appeared in a number of Irish and UK papers. The level of interest in basking sharks in Ireland has been increased considerably.

The project team gained huge experience of basking sharks, tested and developed new techniques and enjoyed considerable media interest. There is no doubt that we have established a very important basking shark research project and a lot of people in Ireland are now aware and interested in basking sharks in Ireland. A number of recommendations were made on how to take this project forwarding future years.

Introduction

Basking sharks

The basking shark (*Cetorhinus maximus*) is the second largest fish in the world. It is one of only three species of shark that feed on plankton, the others being the whale shark (*Rhincodon typus*) and the megamouth (*Megachasma pelagios*). The morphology and anatomy of basking sharks was described by Matthews (1950) and Matthews and Parker (1950). Kunzlik (1988) carried out a review of basking sharks in the northeast Atlantic and more recently Simms (2008) updated this review.

Basking sharks are reported to have grown up to 12.2 -13.72m but most sharks do not exceed 10m in length. A maximum weight of 5-6 tonnes has also been reported but around 2 tonnes is more typical. The liver makes up between 15-25% of the body weight and was a target for many fisheries both historic and modern due to the presence of large quantities of squalene oil. The basking shark is a harmless plankton-eater whose appearance on the surface in Irish coastal waters coincides with the occurrence of high densities of zooplankton, especially the copepod *Calanus*, whose dense swarms often turn the water red. Sharks filter this plankton by cruising slowly with their mouth open. Inside the mouth are gill-rakers made from keratin (like baleen from the great whales). About every minute or so the shark closes its mouth and 'gulps', contracting the gill-arches, where the mass of plankton and mucus passes into the stomach. It has been estimated that a 7m shark, with an open mouth of 0.5m² and travelling at 2 knots could filter 1484 cubic metres of seawater every hour.

Until recently it was believed that basking sharks hibernated during the winter. This was thought to be a strategy to survive periods when plankton is very scarce and the squalene in the liver was a food deposit to sustain them during this period. This strategy was thought to lead to very slow growth and reproductive rates with a gestation period of 3.5 years suggested. As basking sharks are ovoviporous, bearing live young, and are thought to produce only around 6 young at a time, though this is based on the one account of a shark giving birth, soon after being harpooned in Norwegian waters. Sexual maturity is thought to be reached at around 6.8-8.1m in males and 7.7-8.2m in females. This equates to around 6-7 years for males and 10 years for females. These life-history characteristics suggested a very low reproductive rate, making them vulnerable to over-exploitation. Recent research has suggested these estimates are too extreme but it highlights how little we know about this elusive species.

Up until 2006, there had been no published studies on the worldwide genetic status of basking sharks to explore global population structure. Hoelzel et al. (2006) found genetic diversity in basking sharks to be comparatively low worldwide and suggested a lack of significant genetic differentiation among ocean basins based on mitochondrial markers. The recent transatlantic movement of a basking shark tagged in the Isle of Man (Gore et al., 2008) supports the idea of low population differentiation across the Atlantic. Interestingly, a genetic bottleneck was suggested as an explanation for the low variability in mtDNA haplotypes whilst a low effective population size was estimated for this globally distributed species (Hoelzel et al., 2006). More samples for genetic analysis are required throughout the world to explore this important issue in more detail.

Results from recent satellite telemetry have shown long distance movements between Cornwall and Scotland with one shark travelling 1,878 km in 77 days across the Celtic Sea and up the western seaboard of Ireland before the tag stopped transmitting in the Minches in the outer Hebrides (Sims *et al.* 2003). These tags also recorded sharks at up to 850m off the edge of the continental shelf and were active throughout the winter when they tend to occur in deeper water but in similar habitats as the summer. More recently Gore *et al.* (2008) tracked a female basking shark nearly 10,000km over 90 days from the Isle of Man to Newfoundland producing the first evidence of a trans-Atlantic movement.

The appearance of basking sharks on the sea surface provides an opportunity to carry out visual sighting surveys. Sighting schemes involving casual sightings often submitted by the public have identified important concentrations of basking sharks off southwest England and Scotland but satellite telemetry has shown other important concentrations may not be identified through surface sightings (e.g. Celtic Deep). A combination of both methods is best for identifying important habitats for this species (Southall et al.,

2005). Surfacing behaviour also facilitates behavioural studies and provides opportunities for tagging and tracking. Sims and Quayle (1998) suggested sharks feeding on fronts tended to be at the surface over 60 times more frequently than sharks feeding in stratified waters and these sharks were selective filter-feeders that chose the richest plankton patches within which to forage.

Basking sharks in Ireland

The Basking shark may seem an exotic and mysterious creature to many people in Ireland today but it was a very familiar sight to coastal communities along the western seaboard of Ireland, from Counties Donegal to Cork. The basking shark was traditionally called the sunfish, which should not be confused with the ocean sunfish *Mola mola*, which has become increasingly abundant in Irish waters in recent years due to climate change. The basking shark was known in County Kerry as *ainmhide na seolta* 'monster with the sails' and *liop an dá lapa* 'unwieldy beast with two fins'. More generally in the west of Ireland it was called *liabhán mór* (signifying a great leviathan) or the most evocative *liabhán chor gréine* 'great fish of the sun' (Went and Suilleabhain, 1967).

There is a bank, marked on old charts of the western seaboard about 30 miles west of North Conamara and west Mayo at 11°12'W, called 'The Sunfish Bank' (McNally, 1976). This was where shark fishermen ventured, especially from the Ballyconnelly region of Conamara, in six-man open boat or Galway hookers in the spring and early summer with hand-held harpoons to locate sharks. Once captured they would row back towing the shark behind them. Although the meat was used for food or fertiliser and its tough hide for moccasin type shoes, it was the shark's liver that was the most valuable prize. Basking shark liver may weigh up to one-third of the weight of the animal and is rich in squalene. This oil was used for dressing wounds, preserving wood, in manufacturing processes and most commonly for lighting. In 1742 the street lights of Galway and Waterford were lit with sunfish or basking shark oil.

The best documented basking shark fishery in the world was off Achill Island, Co Mayo (McNally 1976). Basking sharks were typically netted off Keem Bay on the west of the island. The nets were spread at right angles to the shore to trap the sharks and a lookout alerted the fishers who rowed around in their currachs and killed the shark with a jab of a lance behind the head. Between 1950 and 1964, 9000 sharks were killed with a record 1,808 killed in 1952 alone. From 1955 the catch declined and the fishery closed in 1975 after 12,342 sharks had been killed. The collapse of this fishery suggested a local stock had been over-fished, however Simms and Reid (2002) suggested this decline may have been due to long-term zooplankton decline in the north-east Atlantic. Basking sharks continued to be fished commercially by Norwegian vessels based in Co. Waterford up until 1986 when 2,465 sharks were killed, with boats often seen in the port of Dunmore East.

Basking shark sighting schemes

Records of sightings of basking sharks from Britain and Ireland have been collected since 1987 by the UK Marine Conservation Society (Doyle et al., 2005). In 1993 a survey of basking shark sightings (Berrow and Heardman, 1994) obtained 142 records of at least 425 sharks. Most sightings were from fishing boats especially off the southwest coast, with 20% of records coming from entanglement in fishing nets. A Irish basking shark database was established in 1993 containing 279 records of 868 animals. Since 1992 the Irish Whale and Dolphin Group have been receiving sighting records through their cetacean sighting schemes and to date they have 282 records of 955 sharks. Nearly one-half (43%) of these records were from 2007 which was a phenomenal year for basking shark sightings. The increase in basking shark sightings has continued which is likely to be a product of better recording but also possibly an increase in occurrence. Most records are in June (36%) and May (20%).

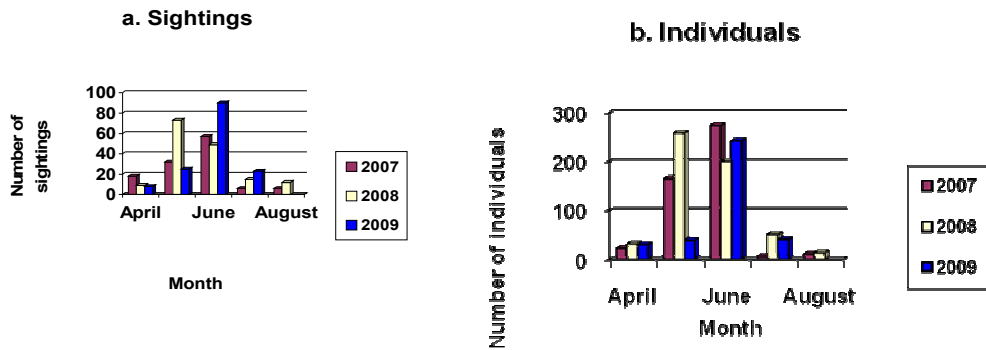


Figure 1. a. Number of basking shark sightings and b. Number of individual sharks reported 2007-2009.

If we compare the number of sightings reported to the IWDG during 2009 compared to the previous two years we can see that there was a large decline in sightings in May but an increase in July. This trend was even stronger in May if individuals are considered but numbers in June were greater than reported in 2008 but less than that reported in 2007 (Fig. 1).

Basking shark conservation

There are strong indications that the population of basking sharks in Irish waters was over-exploited and that populations are still depleted (McNally, 1976). However Sims and Quayle suggested this decline was due to a decline in zooplankton. Basking sharks are frequently caught in surface and bottom-set gillnets in Irish waters (Berrow, 1994). The recent ban on salmon drift-nets in Ireland should reduce this impact but the extent of other fisheries interactions is poorly known.

The basking shark was still target fished and taken as by-catch in EU waters until 2008 when a moratorium was brought in by the EU. Their liver oil is still valuable as it is extremely stable at high temperatures and pressures and the demand for shark fins to make shark-fin soup has led to a huge increase in landings of many shark species in recent years. The basking shark was added to Appendix of CITES (Convention on International Trade in Endangered Species) in 2002 which means that their products from them only be exported, re-exported or introduced from the high seas if a permit has been issued by the relevant national authorities. Such a permit may only be issued when the management authorities are satisfied that such trade will not be detrimental to the survival of the species. It is considered Vulnerable in the IUCN red List of Threatened Animals. The basking shark was given legal protection in UK waters in 1998. UK legislation (Schedule 5 of the Wildlife and Countryside Act of 1981) specifies that no basking sharks can be caught within 12 miles of the coast and none landed even if caught outside territorial limits. They are also protected in UK (Isle of Man) waters. There has been some interest in providing similar protection within the Irish 12 nml limit but no legislation has been enacted to date.

Basking Shark Survey 2009

The aims of the Basking Shark Survey in 2009 were to extend the basking shark tagging program started in 2008 including deployment of satellite tags. Secondary aims include collecting images useful for photo-identification and tissue samples for genetic analysis. It is hoped the increase in knowledge and interest in basking sharks will ultimately provide support for the legal protection of this species in Irish waters.

Methodology

Tagging

A total of 600 basking shark tags, all with a unique numbers, in four different colours were made for this study by Floy Tags, Seattle in the US. Colours were allocated to specific counties with YELLOW for Co Donegal, GREEN for Co Kerry, RED for Co Cork and WHITE for other counties. This was to facilitate tracking movements as even if only the colour of a tag was recorded we can allocate the shark to a county. Tags were deployed using two different types of tagging poles. Four extendable painter's poles measuring 3m in length were modified for attaching basking shark tags. An applicator supplied by Floy Tag was attached at the end of each pole using epoxy resin. Four 4m extendable fishing rods were also modified in the same way after the eyes and the last 0.25m of the rod were removed.

An underwater pole camera (SCUBAR-PRO) was used to try and determine the gender or to film sharks. Male sharks can be identified by the presence of claspers and the absence of claspers, were therefore female. This is especially important when deploying the satellite tags.



Example of basking shark tag



Tag mounted on tagging pole



Preparing to tag basking shark

Shark length was estimated to the nearest meter compared to the 6m research vessel. Length categories were consistent with those used by the MCS Sighting Schemes and other research groups namely: Category 1 = <2m, Category 2 = 3-4m, Category 3 = 5-6m, Category 4 = 7-8m, Category 5 = 8+m.

Satellite-tracking

Two satellite tags were available for this study, one each purchased by Crossing-the-Line Films and the Galway-Mayo Institute of Technology. Both were MK10 Archival Tags manufactured by Wildlife Computers. They were supplied by Mauvis Gore of Marine Conservation International, who is a collaborator on this project.

The satellite tags were deployed with an extendable pole at the base of the sharks' dorsal fin. Each tag was held in the shark with an anchor similar (but a little larger) to the coloured tags. The satellite tag was attached to the anchor with a short tether and programmed to detach from the shark after 215 days (7 months) at 1300 GMT. The tag also records time at temperature: 3, 4, 7, 9, 10, 11, 12, 13, 14, 15, 16, 18, 20, 20+ °C and time at depth: 0, 20, 50, 100, 200, 300, 400, 500, 600, 700, 800, 900, 1000, 1000+ m. This will produce 60 sec histogram sampling interval summarised into 12 hour histograms that begin at 0500 GMT.

These settings were the same as tags used for deployment in the Isle of Man and southwest Scotland in 2009 to facilitate direct comparison of data.

Photo-identification

Images of the sharks dorsal fin and adjacent back were obtained for photo-identification purposes. Most sharks are not well marked with only small nicks occurring on the dorsal fin. These can be very useful for short-term recognition when tagging to determine whether an individual has already been tagged during a session. Occasionally an individual has received significant damage and is very useful as

these could possibly be re-sighted between locations or over time, which is a very useful method of determining the longevity of coloured tags.

Images of basking sharks were obtained using a Canon D20 Digital camera with 70-200mm and x2 converter. Images of both sides of the dorsal fin were obtained if possible and any other features which may be useful in recognizing individual sharks.

Table 1. Categories for quality of images and marks used in this study (after Ingram, 2000).

Images		Marks	
1	Well lit and focused taken perpendicular to the dorsal fin at close range	1	Significant fin damage or deep scarring that were considered permanent
2	More distant, less well lit or slightly angled shots of dorsal fins	2	Deep tooth rakes and lesions
3	Poorly lit or out of focus shots taken at acute angles to the dorsal fin	3	Superficial rakes and lesions

Images were sorted and the best images of each side of the dorsal fin saved. The marks were scored using similar criteria used for dolphins (Table 1).

Genetics and Biopsy sampling

There is great interest in exploring the genetics of basking sharks in the North Atlantic and beyond. We have had requests for samples from two research groups (University of Aberdeen and University of Illinois at Chicago). Prior to this study only three archived tissue samples from basking sharks in Ireland were available.

Samples were taken from basking sharks stranded during the course of this study and attempts were made to biopsy sample sharks. Two methods of biopsy sampling were tested. A biopsy tip was mounted at the end of a 3m extendable painters pole with the aim of striking a shark if close enough to the research vessel. A standard crossbow (Barnett Panzer) with 150lb production with Fin Larsen arrows and biopsy tips, was also used. This crossbow has been successfully by SB for sampling large whales in Ireland.

A new method of obtaining samples for genetic analysis was developed during this project. This involves the recovery of slime from the sharks body. Basking sharks are covered in a thin black slime, which is often deposited on nets and ropes when captured. We developed a technique of scraping slime from the body with a coarse dish-cloth wrapped around a mop handle. The cloth is removed from the handle and ethanol added to preserve the DNA.

Raising awareness

An important objective of this project was to raise awareness and interest in basking sharks in Ireland. This was achieved by responding to enquiries from the public and journalists. The project is also facilitating a three part programme on animal migration in Ireland in Ireland produced by Crossing-the-Line films. This series is due for broadcast on RTE in October 2009.



Determining gender with a pole camera



The new shark slime sampling system !

Results

Basking shark fieldwork

Fieldwork was carried out between 20 May and 11 September 2009. Six sites were visited two in Co Donegal (Inishowen and Donegal Bay), two in Co Kerry (Blasket Islands and Tralee Bay) and two in Co Cork (Roaringwater Bay and South Cork) (Fig 2). Three of these locations were consistent with the proposed study sites, with the addition of Donegal and Tralee Bays and the South Cork coast, which were visited after reports of sharks in these areas.

Table 2. List of fieldwork carried out during the Basking Shark Survey 2009

Date	Location	Sharks Observed	Sharks Tagged	Comments
20 May	Blasket Islands, Co Kerry	NONE	-	Weather good
1 June	Malin Head, Co Donegal	8	23	
2 June	Malin Head, Co Donegal	6	17	
3 June	Malin Head, Co Donegal	5	12	
11 June	Roaringwater Bay, Co Cork	1	1	Re-sighted 15 June
15 June	Blasket Islands, Co Kerry	NONE	-	Weather good in morning, poor in afternoon
22 June	Tralee Bay, Co Kerry	NONE		Excellent conditions
23 June	Donegal Bay, Co Donegal	NONE		Excellent conditions
24 June	Donegal Bay, Co Donegal	NONE		Conditions OK initially then deteriorated
24 June	Dunaff Head, Co Donegal	6	3	
25 June	Trawbreaga Bay, Co Donegal	NONE	-	Too windy
2 July	Inistrahull, Co Donegal	6	2	Good conditions
3 July	Inistrahull, Co Donegal	3	0	Excellent conditions
4 July	Inistrahull, Co Donegal	1	0	Conditions poor
9 July	South Cork coast	NONE	-	Excellent conditions
14 July	Blasket Islands, Co Kerry	16	13	Satellite tags deployed
15 July	Blasket Islands, Co Kerry	1	0	
16 July	Blasket Islands, Co Kerry	2	0	
29 July	Blasket Islands, Co Kerry	20	16	Sea-state 4, large swell !
8 August	Blasket Islands, Co Kerry	4	11	
9 August	Blasket Islands, Co Kerry	8	3	
11 September	Inistrahull, Co Donegal	3	3	One from yacht

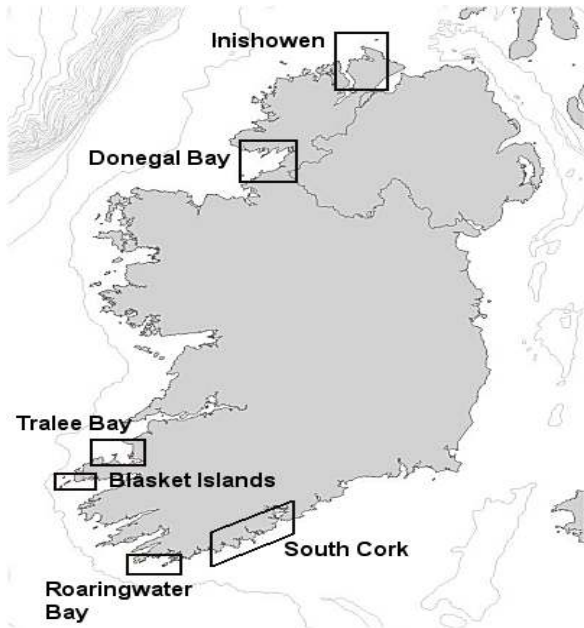


Figure 2. Map of areas surveyed during tagging trips.

Basking Shark Tagging

A total of 104 tags were deployed during 2009. Most of these (58%) were in Co Donegal, with 43 (41%) in Co Kerry and only one (1%) in Co Cork (Table 3) (see Appendix I for full details of tagged sharks). This brings the total number of basking sharks tagged in Ireland to 112 as eight sharks were tagged in 2008.

Table 3. Total number of basking shark tags deployed during 2009 and the total deployed in Ireland

County	Sharks tagged 2008	Sharks tagged 2009	Total
Donegal	6	60	66
Kerry	2	43	45
Cork	0	1	1
Total	8	104	112

It was observed during a pre-tagging line transect survey in Trawbreaga Bay carried out by EJ that the surfacing patterns of the sharks tended to coincide with slack tidal conditions. By looking at both 2008 and 2009 data from Donegal we noted that 92 % of sharks tagged in Donegal were tagged within approximately one hour either side of slack tide. This information could enable future tagging teams to concentrate their efforts in a limited coastal area.

The length categories of tagged sharks are shown in Fig 3. Most sharks tagged were between 5-8m. There was a tendency for the larger sharks (8+m) to be recorded in July compared to June but this may also reflect location as most sharks in June were tagged in North Donegal while most sharks in July were tagged in west Kerry.

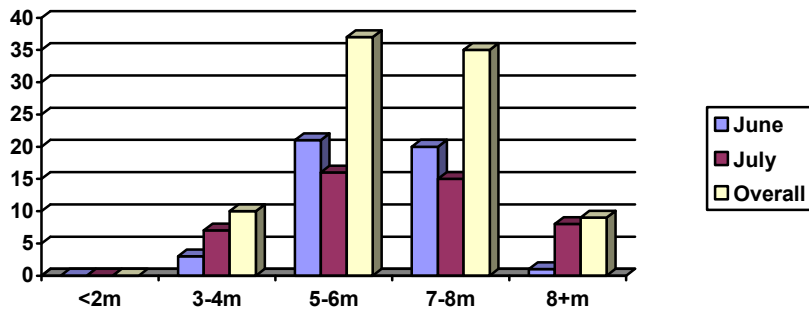


Figure 3. Length categories of tagged sharks 2009

A sample of zoo-plankton was obtained during the feeding aggregation observed of Slea Head on 14 July (52° 06'N/10° 25'W). This swarm of plankton had concentrated at the surface, close to the cliffs and were being fed upon by at least three and up to six basking sharks. The species were identified by Dr Cilian Roden as *Calanus* (most likely *Calanus finmarchicus*) with larval Euphausiids present too. *Calanus* are considered one of the most favoured prey of basking sharks in the British Isles due to their high protein concentrations and valuable omega-3 fatty acids.

Basking Shark Re-sightings

We had a total of seven confirmed re-sightings of tagged sharks and two unconfirmed records.

1. One shark tagged on 11 June off Clear Island, Co Cork was re-sighted four days later off Castle Point in Roaringwater Bay, Co Cork a distance of 10km. Given that there was only one shark tagged in County Cork, this re-sighting is remarkable and suggests the population is very small.
2. A yellow tagged shark was observed amongst a group of 20 sharks off Coll in the Inner Hebrides on 25 or 26th June. This was most likely one of the sharks tagged in north Donegal on 1-3 June, which equates to a distance of around 140km in 22 days. This was the first international re-sighting
3. Yellow tag was re-sighted by members of Inishowen sub aqua club on 14th 06 2009 in Trawbreaga bay, a minimum of 11 days after tagging.
4. A green tagged shark was observed off Slea Head on 20 July, six days after it was tagged approximately 3.5km away
5. Green 173 was re-sighted on 8 August off the Blasket Islands, 10 days after tagging, 4 km away
6. A yellow tag was recorded by Colin Speedie on 10 August off Ardnamurchan Point, Isle of Mull a distance of 140km. It is not known when this tag was deployed but it was at least one month later
7. Yellow tag 063 tagged on 12th September and re-sighted 13th September by diving group on submarine U-681 off Malin head giving a total distance of approx. 20 km in one day.
8. White tag (could be yellow) by Hebridean Whale and Dolphin Trust (unconfirmed)
9. White tag (could be yellow) Mauvis Gore off inner Hebrides (unconfirmed)

During three days fieldwork in Co Donegal from 1-3 June we tagged 50 individual sharks. Twenty-three were tagged on 1 June, 17 on the 2 June and 12 on the 3 June (Table 2). Of those tagged on 1 June four re-sighted on the 2 June. A very crude mark-recapture model would estimate that the abundance of sharks in Trawbreaga Bay during 1-2 June 2009 was around 135.



Preparing to tag



Tagged shark



Tagged shark

The shark tagged off Cape Clear Island on 11 June was re-sighted four days later on 15 June off Castle Point a distance of 10 km. Given that there was only one shark tagged in County Cork, this re-sighting is remarkable and suggests the population is very small. Also a tagged shark was re-sighted off Dunaff Head, Co Donegal on 16 June by divers. The tag was yellow but no number could be determined. This shark was tagged during 1-3 June. These re-sightings are remarkable and demonstrate the value of shark tagging and also suggest a small population.

Basking Shark Tracking

Two satellite tags were deployed on 14 July off Slea Head in Co Kerry. Both satellite-tags were deployed on sharks in the same feeding group. The first shark was 8m but gender could not be determined and the second shark measured 7m and was thought to be a male as claspers could be seen through the water (Table 4). Both tagged sharks were observed after the satellite tags were deployed and coloured numbered tags were also attached which be invaluable to explore the impact of tagging on these individual sharks should these tags be re-sighted.

Table 4. Details of satellite-tags deployed during Basking Shark Survey 2009

Sat-tag No.	Location deployed	Time	Length/Gender	Coloured Tag No.
08A0612	52° 05.835'N/10° 25.695W	15:54	7m/male	GREEN 159
08A0613	52° 05.843'N/10° 25.663W	15:40	8m/unknown	GREEN 161

The ARGOS satellite system has been advised on this deployment. They are now scanning the two relevant identifiers and will receive a signal from the tags once detached. It is hoped that the tags will remain on the sharks for the full deployment period of 215 days.

Photo-identification

We have obtained 71 photo-identification images, which form the basis of an Irish Basking Shark Photo-ID Catalogue (Appendix II). Over one-half (56%) were considered good quality images but only 21% had marks useful for photo-identification. Most sharks are not well marked but the occasional well-marked individual can be used to check the longevity of tags as there is a chance this shark will be identified again from these wounds and thus it can be checked for the presence of tags.

Photo-id can also provide information on interactions with humans as determined from the presence of damage attributed to propeller damage and cues about migration such as the presence of external parasites (e.g. *Penella*), which are associated with warm tropical waters. Two sharks were recorded with propeller damage and *Penella* was recorded on three individual sharks.



Poorly marked shark



Well marked individual



External parasite *Penella* on dorsal fin

Biopsy sampling

Attempts were made to biopsy sample three sharks using the biopsy pole and two sharks with the crossbow. One sample was obtained from the third shark sampled using the biopsy pole however this resulted in the pole breaking and no more attempts could be made. No samples were obtained from biopsy sampling using the crossbow despite one shark being hit from <5m. The arrow bounced off the shark but no skin sample was obtained. The barbs in the biopsy tip were bent from the impact with the sharks' tough skin.

Table 5. List of stranded basking sharks in Ireland and tissue samples obtained for genetic analysis during 2009.

Date	Location	Length	Gender	Sample
2 June	Trawbreaga Bay, Co Donegal	?	?	Slime recovered from tagged shark
13 June	Falcarragh, Co Donegal	8.5m	?	Skin sample
16 June	Teelin, Co Donegal	?	?	Entangled in nets, floating offshore
13 July	Derrynane, Co Kerry	3.5-4.0m	Female	Skin sample
14 July	Slea Head, Co Kerry		?	Biopsy sample
8 August	Blasket Islands, Co Kerry	6m	?	Slime sample from scourer (GREEN 181)
8 August	Blasket Islands, Co Kerry	5m	male	Slime sample from scourer (GREEN 182)
8 August	Blasket Islands, Co Kerry	9m	male	Slime sample from scourer (GREEN 187)
8 August	Blasket Islands, Co Kerry	3m	?	Slime sample from scourer (GREEN 188)
8 August	Blasket Islands, Co Kerry	4m	?	Slime sample from scourer (GREEN 189)

Three samples from archived tissues and five samples from the present study were sent to Dr Chrysoula Gubili at the University of Aberdeen together with a sample of slime from one shark, which was scrapped off the bow of the research vessel after being hit by the tail after tagging. It had been suggested (Noble *et al.* 2006) that DNA may be extracted from basking shark slime which occurs on the sharks' skin which could aid the collection on samples for genetics. Dr Gubili managed to extract DNA from the slime recovered from the side of the research vessel and to amplify it. A PCR was run to ensure the DNA came from a basking shark. This demonstrated the value of shark slime for genetic work.

A further five samples were obtained from basking sharks in the Blasket Islands on 8 August using a modified mop handle and scourer pad. This technique was also used successfully in the Isle of Man and a paper is being prepared on this technique as it offers a non-invasive efficient method of obtaining samples for genetic analysis.



Shark entangled in gillnet in Derrynane, Co Kerry and washed up in Falcarragh, Co Donegal

Publicity

Following the remarkable tagging success in Co Donegal at the beginning of June a number of media items were published. A good article in the Irish Times on 5 June led to a number of articles in the tabloid newspapers and interest from UK newspapers. Radio interviews were recorded for RTE 1, BBC NI, Newstalk and many local radio stations. This has led to increases awareness and interest in Basking Sharks in Ireland and the study.

Following this initial interest continued requests for comment and input was received from a number of newspapers including Observer and Guardian newspapers in the UK. A French film crew with Cannel Plus also made contact with the team, wishing to film sharks off Co Donegal. Due to time constraints, this crew has decided to return next year during the peak basking shark season to film.

The project facilitated film crew from Crossing-the-Line films on five days; 3 days in Co Donegal and one day each in Counties Cork and Kerry. The deployment of the satellite tags off Sleah Head, Co Kerry was filmed as well as the deployment of coloured numbered tags off Co Donegal and biopsy sampling and photo-identification.

A website www.baskingshark.ie has been established to promote the forthcoming Irish basking shark Seminar, it also provides primary information on basking sharks in Ireland and provides a media for people to report any sightings of tagged sharks.

The project team presented a paper on the work in Ireland to date at a conference in the Isle of Man from 2-5 August 2009 entitled *Basking Sharks – A Global Perspective* and will present the results from this year's survey which we feel will ensure Ireland remains a significant player in future basking shark research in Europe (See Appendix III for abstract).

Additional data collected

In addition to the primary aims of this study additional information was obtained on the diet of basking sharks and surfacing behavior. Sightings of other species including cetaceans, sunfish and a probable turtle (Table 6).

Table 6. List of additional sightings of marine megafauna recorded during 2009.

Species	Date	Location	Number	Comment
<i>Cetaceans</i>				
Minke whale	1 June	Trawbreaga Bay, Co Donegal	1	
Minke whale	2 June	Trawbreaga Bay, Co Donegal	2 (1 calf)	Probably one same as above
Harbour porpoise	2 June	Trawbreaga Bay, Co Donegal	1	
Harbour porpoise	11 June	Off Cape Clear, Co Cork	2	
Bottlenose dolphin	22 June	Brandon Head, Co Kerry	30	Identified as Shannon dolphins
Minke whale	24 June	Donegal Bay, Co Donegal	1	
Minke whale	24 June	Donegal Bay, Co Donegal	1	Probably same as above
Harbour porpoise	2 July	Trawbreaga Bay, Co Donegal	1	
Harbour porpoise	3 July	Dunree Head, Co Donegal	1	
Minke whale	3 July	Inistrahull Sound, Co Donegal	1	
Harbour porpoise	3 July	Inistrahull Sound, Co Donegal	1	
Harbour porpoise	9 July	Cork Head, Co Cork	4	
Harbour porpoise	9 July	Old Head of Kinsale, Co Cork	3	
Harbour porpoise	9 July	Old Head of Kinsale, Co Cork	1	
Minke whale	14 July	Great Blasket, Co Kerry	1	
Minke whale	15 July	Great Blasket, Co Kerry	1	Probably same as above
Common dolphins	15 July	Dingle Bay, Co Kerry	40	
Minke whale	29 July	Great Blasket, Co Kerry	1	
Harbour porpoise	29 July	Great Blasket, Co Kerry	6	
Common dolphins	29 July	Great Blasket, Co Kerry	12	
Sunfish	11 June	Mizen Head, Co Cork	1	Breached
Sunfish	14 July	Great Blasket, Co Kerry	2	
Porbeagle shark	2 July	Trawbreaga Bay, Co Donegal	3	
Porbeagle shark	3 July	Trawbreaga Bay, Co Donegal	2	
<i>Turtle</i>				
Unidentified Cheloniid	11 June	Off Cape Clear, Co Cork	1	

A total of 17 cetacean sightings, two Sunfish (*Mola mola*), two Porbeagle sharks and one probable turtle sightings were made during this survey. The sighting of around 30 bottlenose dolphins off Brandon, Co Kerry was of significance as they were identified as Shannon dolphins. Over 20 individual dolphins were identified from images and 13 of these had previously been recorded in the Shannon Estuary from comparison to the Shannon Dolphin Photo-ID catalogue held by the Shannon Dolphin and Wildlife Foundation. Shannon dolphins have never been recorded this far west, outside of the Shannon estuary (Ryan and Berrow, submitted). All cetacean sightings have been submitted to the Irish Whale and Dolphin Group.

The turtle was observed on three occasions off Cape Clear Island, Co Cork on 11 June but no images could be obtained. It was thought to be a Cheloniid turtle, probably a Loggerhead (*Caretta caretta*) and the data, including sunfish records, have been sent to Dr Tom Doyle of CMRC in Cork.

Discussion

The Basking Shark Survey 2009 has been very successful. A total of 101 coloured tags were deployed in three counties and two satellite tags off Co Kerry. Images of 71 individual sharks were obtained for photo-identification and ten tissue samples obtained for genetic analysis, five from the sharks slime – a new technique developed by this project.

The project team gained huge experience of basking sharks, tested and developed new techniques and enjoyed considerable media interest. There is no doubt that we have established a very important basking shark research project and a lot of people in Ireland are now aware and interested in basking sharks in Ireland.

Recommendations

1. Despite a large number of basking shark sightings in June 2009 it was still very difficult to be at the right location at the right time to encounter and tag sharks. Often sharks are at the surface for only a very limited period and conditions can change very dramatically within and between days. Even when weather conditions are similar between days the distribution and surfacing behaviour of sharks may be radically different constraining tagging attempts. An alternative strategy would be to remain in an area for extended periods rather than move to new locations as shark sightings are received.
2. For efficient location of sharks it is recommended that as well as the boat-based team an additional team member is stationed on land at a suitable vantage point, if available, to locate sharks and direct the research vessel to them. This worked very effectively in West Kerry when the project team were looking to deploy satellite tags on sharks.
3. Areas with concentrations of shark can be surveyed by vessel before and after tagging sessions to pre-determine surfacing patterns and potentially increase encounter rates.
4. More tags need to be deployed as the recovery rate is unknown. In many ringing/tagging studies the recovery rate can be less than 1% and the longevity of basking shark tags on sharks is not known. We recommend this tagging is continued for three years before a thorough evaluation of its effectiveness is carried out.
5. More satellite tags should be deployed to provide a baseline for the future. Deployment of Fast-Loc GPS tags should also be considered as these will provide finer scale tracks which can be used to identify important areas for basking sharks in Ireland.
6. Photo-identification of individual sharks is generally of limited value. Sharks with minor nicks or markings can be useful over a tagging session to identify sharks previously tagged but probably not useful over extended periods. Sharks with significant damage are rare but provide excellent opportunities for re-sightings through photo-identification.
7. If biopsy sampling is to be continued the biopsy tip will need to be modified to increase the chances of the tip obtaining a skin sample as shark skin is very tough. The biopsy pole probably offers the best option but the pole and tip will have to be much stronger to withstand the impact required to obtain a sample.
8. Slime from the sharks' body can be used to extract DNA. A method of obtaining a sample of this slime has been developed as a non-invasive system of obtaining samples for genetics and is considered a significant break through in the study of basking sharks
9. Such is the interest in basking sharks in Ireland we recommend a Basking Shark Study Group is created under the auspices of the Irish Elasmobranch Group to promote the research and

awareness of basking sharks in Ireland. This recommendation will be pursued through the Irish Basking Shark Seminar from 30-31 October 2009 to be held in the Fisheries College in Greencastle, Co Donegal.

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Appendix I: Log of tagged basking sharks 2009.

Tag No	Date	Location	Latitude	Longitude	Time Tagged	Length category	Tag site	Comments
YELLOW								
1	1-Jun-09	Trawbreaga Bay, Co Donegal	55 20.632	7 24.685	19:01	4	LHS	
resighting	2-Jun-09	Trawbreaga Bay, Co Donegal	52 21.172	7 23.398				
2	1-Jun-09	Trawbreaga Bay, Co Donegal	55 20.632	7 24.685	19:06			
3	1-Jun-09	Trawbreaga Bay, Co Donegal	55 20.632	7 24.685	19:10			
4	1-Jun-09	Trawbreaga Bay, Co Donegal	55 20.632	7 24.685	19:10			
5	1-Jun-09	Trawbreaga Bay, Co Donegal	55 20.632	7 24.685	19:10	3		
6	1-Jun-09	Trawbreaga Bay, Co Donegal	55 20.632	7 24.685	19:10	4		
7	1-Jun-09	Trawbreaga Bay, Co Donegal	55 20.632	7 24.685	19:10			
8	1-Jun-09	Trawbreaga Bay, Co Donegal	55 20.632	7 24.685	19:23	4		re-sighted 20:30
9	1-Jun-09	Trawbreaga Bay, Co Donegal	55 20.632	7 24.685	19:34			
10	1-Jun-09	Trawbreaga Bay, Co Donegal	55 21.175	7 25.272	19:45	3		re-sighted 20:45
11	1-Jun-09	Trawbreaga Bay, Co Donegal	55 21.117	7 25.490	19:45			
12		LOST TAG						
13	1-Jun-09	Trawbreaga Bay, Co Donegal	55 20.250	7 25.556	20:33	4	LHS	white edge of dorsal fin, dent at back of dorsal fin.
resighting	2-Jun-09	Trawbreaga Bay, Co Donegal	55 19.956	7 26.428		3	LHS	
14	1-Jun-09	Trawbreaga Bay, Co Donegal	55 21.248	7 25.780	20:00	4		
15	1-Jun-09	Trawbreaga Bay, Co Donegal	55 20.907	7 25.584	20:00	4	LHS	
resighting	2-Jun-09	Trawbreaga Bay, Co Donegal	55 19.956	7 26.428	20:38	4		
16	1-Jun-09	Trawbreaga Bay, Co Donegal	55 25.774	7 15.175	20:38	3		
17	1-Jun-09	Trawbreaga Bay, Co Donegal	55 25.773	7 15.173	20:00	3		
18	1-Jun-09	Trawbreaga Bay, Co Donegal	55 20.474	7 25.581	20:00			
19	1-Jun-09	Trawbreaga Bay, Co Donegal	55 20.474	7 25.581	20:00			
20		LOST TAG						
21	1-Jun-09	Trawbreaga Bay, Co Donegal	55 20.064	7 26.054	20:00	4	LHS	white spot on leading edge of dorsal fin
resighting	2-Jun-09	Trawbreaga Bay, Co Donegal	55 20.064	7 26.054	20:42	4		
22	1-Jun-09	Trawbreaga Bay, Co Donegal	55 20.064	7 26.054	20:00	4		
23	1-Jun-09	Trawbreaga Bay, Co Donegal	55 20.064	7 26.054	20:00			
24	1-Jun-09	Trawbreaga Bay, Co Donegal	55 20.064	7 26.054	20:00			
25	1-Jun-09	Trawbreaga Bay, Co Donegal	55 20.064	7 26.054	21:01			
26	2-Jun-09	Trawbreaga Bay, Co Donegal	55 26.086	7 18.712	8:51	4	LHS	2 white marks behind dorsal fin on body (port side)
27	2-Jun-09	Trawbreaga Bay, Co Donegal	55 22.641	7 24.182	9:29	5	LHS	
28	2-Jun-09	Trawbreaga Bay, Co Donegal	55 22.641	7 24.182	9:31			SAME AS Tag 001

29	2-Jun-09	Trawbreaga Bay, Co Donegal	55 22.641	7 24.182	9:36	3		
30	2-Jun-09	Trawbreaga Bay, Co Donegal	55 21.977	7 24.829	10:02	3	LHS	
31	2-Jun-09	Trawbreaga Bay, Co Donegal	55 21.099	7 23.525	10:09	4	RHS	tip of pole broke
32	2-Jun-09	Trawbreaga Bay, Co Donegal	55 21.692	7 26.535	10:52	3	RHS	penella on trailing edge of dorsal fin, male big claspers could be seen possibly breached 4 times EJ.Photos
resighting	2-Jun-09	Trawbreaga Bay, Co Donegal	55 19.809	7 27.715	20:38			
33	2-Jun-09	Trawbreaga Bay, Co Donegal	55 20.250	7 27.650	19:52	3	RHS	off Glaseedy Island
34	2-Jun-09	Trawbreaga Bay, Co Donegal	55 19.808	7 27.712	20:38	3	LHS	
35	2-Jun-09	Trawbreaga Bay, Co Donegal	55 19.957	7 26.345	20:45	3	LHS	
36	2-Jun-09	Trawbreaga Bay, Co Donegal	55 19.957	7 26.345	20:47			
37	2-Jun-09	Trawbreaga Bay, Co Donegal	55 20.098	7 25.068	20:59	4	LHS	tag on flank
38	2-Jun-09	Trawbreaga Bay, Co Donegal	55 20.126	7 25.609	21:07	3	LHS	
39	2-Jun-09	Trawbreaga Bay, Co Donegal	55 20.011	7 25.549	21:13	4	LHS	following another shark
40	2-Jun-09	Trawbreaga Bay, Co Donegal	55 20.387	7 25.330	21:35	2	RHS	
41	2-Jun-09	Trawbreaga Bay, Co Donegal	55 20.551	7 25.290	21:42	4	RHS	
42		LOST TAG						
43	2-Jun-09	Trawbreaga Bay, Co Donegal	55 20.576	7 25.198	21:42	4	LHS	
44	2-Jun-09	Trawbreaga Bay, Co Donegal	55 20.614	7 24.693	21:42	3		being followed by another shark (039)
45	3-Jun-09	Trawbreaga Bay, Co Donegal	55 22.39	7 24.364	8:31	4	LHS	
46	3-Jun-09	Trawbreaga Bay, Co Donegal	55 22.056	7 23.873	8:37	2	RHS	
47	3-Jun-09	Trawbreaga Bay, Co Donegal	55 22.087	7 23.777	8:39	2	RHS	
48		LOST TAG						
49	3-Jun-09	Trawbreaga Bay, Co Donegal	55 22.277	7 24.017	8:58	3		white scarring behind dorsal fin
50	3-Jun-09	Trawbreaga Bay, Co Donegal	55 21.225	7 23.099	9:05	3	LHS	
51	1-Jun-09	Trawbreaga Bay, Co Donegal	55 21.225	7 23.099	9:12	3		Resighted twice
52	3-Jun-09	Trawbreaga Bay, Co Donegal	55 20.999	7 24.215	9:21	3	RHS	
53	3-Jun-09	Trawbreaga Bay, Co Donegal	55 20.415	7 24.387	9:30	4	LHS	
54	3-Jun-09	Trawbreaga Bay, Co Donegal	55 20.317	7 24 433	9:40	4	LHS	
55	3-Jun-09	Trawbreaga Bay, Co Donegal	55 20.274	7 24.512	9:50	4	LHS	
56	3-Jun-09	Trawbreaga Bay, Co Donegal	55 19.998	7 24.801	10:03	4	RHS	
57	3-Jun-09	Trawbreaga Bay, Co Donegal	55 19.551	7 25.121	10:09	4	RHS	big white scar back of dorsal fin and trunk
58	3-Jun-09	Trawbreaga Bay, Co Donegal	55 19.414	7 25.522	10:36	3	back	30m water depth, 3 dots on RHS/ No resightings
61	11-Sep-09	Inistrahull, Co Donegal	55 18.23	7 8.98		2	LHS	Tagged by EJ
62	11-Sep-09	Inistrahull, Co Donegal	55 19.26	7 09.67				Tagged by EJ, small white patch on base of dorsal fin
63	11-Sep-09	Inistrahull, Co Donegal	55 15.157	7 33.03		3		Tagged by EJ
101	24-Jun-09	Dunaff Head, Co Donegal	55 15.342	7 32.539	20:01	3	LHS	
102	24-Jun-09	Dunaff Head, Co Donegal	55 16.161	7 32.157	20:05	3	LHS	no images
103		LOST/ BENT TAG						

104	24-Jun-09	Dunaff Head, Co Donegal	55 15.853	7 32.857	20:11	3	LHS	white on dorsal fin
105	2-Jul-09	Inistrahull, Co.Donegal	55 20.323	7 14.056	15:23	2	LHS	base of dorsal fin white scarring. At base of dorsal fin and tailing egde denting DF.
106	2-Jul-09	Inistrahull, Co.Donegal	55 26.325	7 14.053	15:46	3	RHS	base of dorsal fin, no images.
GREEN								
151	4-Jul-09	Blaskets , Co.Kerry	52 05.715	10 24.851	11:53	4	LHS	Green tag, Resighted at 17:50
152	4-Jul-09	Blaskets , Co.Kerry	52 05.834	10 25.605	15:59	5		Green tag
153	4-Jul-09	Blaskets , Co.Kerry	52 05.852	10 25.476	16:04	4	LHS	Green tag
154	4-Jul-09	Blaskets , Co.Kerry	52 05.982	10 25.153	16:12	5	LHS	
155	4-Jul-09	Blaskets , Co.Kerry	52 06.972	10 25.149	16:35	5	RHS	
156	4-Jul-09	Blaskets , Co.Kerry	52 06.009	10 25.020	16:49	4	RHS	
157	4-Jul-09	Blaskets , Co.Kerry	52 06.003	10 25.108	16:52	4	LHS	
158	4-Jul-09	Blaskets , Co.Kerry	52 0.123	10 24.613	17:02			
159	4-Jul-09	Blaskets , Co.Kerry	52 05.835	10 25.695	15:54	5	RHS	SAT TAG 08A0612, Green tag above sat tag, Nick in dorsal fin
160	4-Jul-09	Blaskets , Co.Kerry	52 05.874	10 24.168	17:50	4		Green tag, no photo of tag or shark
161	4-Jul-09	Blaskets , Co.Kerry	52 05.843	10 25.663	15:40	5	RHS	SAT TAG 08A0613, scarring on leading edges of pectoral and anal fins, green tag on opposite side of sat-tag
162	4-Jul-09	Blaskets , Co.Kerry	52 05.974	10 25.191	19:10	3	LHS	Green tag
163	4-Jul-09	Blaskets , Co.Kerry	52 05.994	10 25.104	19:12	3	LHS	Green tag
Sat tag 1	4-Jul-09	Blaskets , Co.Kerry	52 05.843	10 25.663	15:40	5	LHS	Sat tag 8m shark
Sat tag 2	4-Jul-09	Blaskets , Co. Kerry	52 05.835	10 25.695	15:54	5	RHS	7m shark
164	29-Jul-09	Blaskets , Co. Kerry	52 03.510	10 28.549	11:30	3	RHS	
165	29-Jul-09	Blaskets , Co. Kerry	52 03.521	10 28.636		4	LHS	
166	29-Jul-09	Blaskets , Co. Kerry	52 03.598	10 28.817		3	RHS	
167	29-Jul-09	Blaskets , Co. Kerry	52 03.679	10 28.875		4	LHS	
168	29-Jul-09	Blaskets , Co. Kerry	52 03.738	10 28.855		3	RHS	no images
169	29-Jul-09	Blaskets , Co. Kerry	52 03.815	10 28.871		3		behind dorsal fin white scarring, no image
170	29-Jul-09	Blaskets , Co. Kerry	52 03.866	10 29.087		3	RHS	
171	29-Jul-09	Blaskets , Co. Kerry	52 03.895	10 29.078		4	RHS	pale mark on leading edge
172	29-Jul-09	Blaskets , Co. Kerry	52 03.863	10 29.125		4	RHS	
173	29-Jul-09	Blaskets , Co. Kerry	52 03.843	10 29.108		3	RHS	female (pole camera - footage)
resighting	8-Aug-09	Blaskets , Co. Kerry	52 05.626	10 31.250				
174	29-Jul-09	Blaskets , Co. Kerry	52 03.845	10 29.132		5	RHS	
175	29-Jul-09	Blaskets , Co. Kerry	52 03.526	10 28.470		4	LHS	very white scarred nose
176	29-Jul-09	Blaskets , Co. Kerry	52 07.257	10 31.745		3	LHS	
177			52 03.871	10 30.624				same shark as Green 177
178	29-Jul-09	Blaskets , Co. Kerry				3	LHS	

179	29-Jul-09	Blaskets , Co. Kerry	52 03.549	10 30.614		2		white specks on left side of dorsal fin
181	8-Aug-09	Blaskets , Co. Kerry	52 06.049	10 28.904		3	LHS	
182	8-Aug-09	Blaskets , Co. Kerry	52 06.570	10 29.383	16:24	3	LHS	slime sample taken
183	8-Aug-09	Blaskets , Co.Kerry	52 05.886	10 28.716	16:47	3	LHS	Towards back,scraped on RHS - opposite to bag-throughb the water- approx 1m, no reaction. Some slime on brillo pad and on metal clip holding pad- that was also scraped. (Images)
184	8-Aug-09	Blaskets , Co.Kerry	52 06.032	10 28.825	17:39	4	LHS	near dorsal fin (lots of images)(small niches on dorsal fin and tail) pole camera- male
185	8-Aug-09	Blaskets , Co.Kerry	52 05.982	10 28.831	18:02	3	LHS	no images
186	8-Aug-09	Blaskets , Co.Kerry	52 05.925	10 28.830	18:06	2	RHS	some images, small individual approx 3-4m tagged on bottom rhs.
187	8-Aug-09	Blaskets , Co.Kerry	52 05.930	10 28.791	18:10	4	LHS	pole shack!!
188	8-Aug-09	Blaskets , Co.Kerry	52 05.575	10 28.346	18:14	3	LHS	(male) (nick on leading edge of dorsal fin) scraped as well, lots of images. Pole camera male,
189	8-Aug-09	Blaskets , Co.Kerry	52 05.187	10 27.887	18:50	2	LHS	(no images) very small individual, slime sample
190	8-Aug-09	Blaskets , Co.Kerry	52 04.681	10 27.465	19:10	2	LHS	small individual, some images, slime sample taken from boat
191	8-Aug-09	Blaskets , Co.Kerry	52 06.381	10 28.674	19:24	2	LHS	some images
192	8-Aug-09	Blaskets , Co.Kerry	52 05.716	10 31.081	20:07	3	RHS	some images
193	8-Aug-09	Blaskets , Co.Kerry	52 06.049	10 28.904		4	RHS	
194	8-Aug-09	Blaskets , Co.Kerry	52 06.570	10 29.383		4	RHS	
195	8-Aug-09	Blaskets , Co.Kerry	52 05.886	10 28.716		4	RHS	
RED								
301	11-Jun-09	Roaringwater Bay, Co.Cork	51 27.364	9 29.400	9:45	3	RHS	white marks on trailing edge of dorsal fin. No photos
resighting	15-Jun-09	Castle Point, Co Cork	51 29.68	9 37.43	21:00			10km/11 days

Appendix II. Basking sharks photo-identified during 2009.

Catalogue Number	Coloured Tag No.	Length Class	Side Photographed	Photo/Mark Quality
1	Yellow 1	4	R	2/3
2	Yellow 3		L	3/3
3	Yellow 4		R	3/2
4	Yellow 5	3	R	2/3
5	Yellow 6	4	L,R	3/3
6	Yellow 7		L,R	1/1
7	Yellow 8	4	L	3/3
8	Yellow 9		R	1/2
9	Yellow 10	3	L,R	2/2
10	Yellow 11		R	1/1
11	Yellow 13	4	L	3/2
12	Yellow 15	4	L	2/2
13	Yellow 16	3	R	2/1
14	Yellow 17	3	L	1/3
15	Yellow 18		L	1/3
16	Yellow 19		L	3/2
17	Yellow 20		L	3/3
18	Yellow 21	4	L	1/3
19	Yellow 22	4	R	2/3
20	Yellow 23		R	2/3
21	Yellow 24		R	3/3
22	Yellow 25		R	2/1
23	Yellow 26	4	L	2/3
24	Yellow 27	5	L	3/3
25	Yellow 29	3	R	3/3
26	Yellow 30	3	R	3/2
27	Yellow 31	4	L	3/2
28	Yellow 33	3	R	3/3
29	Yellow 34	3	L	3/2
30	Yellow 35	3	L	3/3
31	Yellow 36		L	2/3
32	Yellow 37	4	R	3/3
33	Yellow 40	2	L	3/2
34	Yellow 41	4	R	2/3
35	Not tagged		L	3/3
36	Yellow 43	4	L	3/2
37	Yellow 44	3	R	3/3
38	Yellow 45	4	L	3/3
39	Yellow 47	2	R	2/2
40	Yellow 49	3	R	3/3
41	Yellow 52	3	R	3/3

42	Yellow 54	4	R	2/1
43	Yellow 55	4	L,R	2/1
44	Yellow 56	4	R	3/2
45	Yellow 57	4	L	3/3
46	Yellow 58	3	L	2/2
47	Green 152	3	R	2/1
48	Green 154	3	L	1/1
49	Green 157	3	R	1/1
50	Green 158	3	L	½
51	Green 159	4	L	1/3
52	Green 163	3	L	3/2
53	Not tagged		L,R	2/1
54	Not tagged		L,R	2/1
56	Green 165	4	L,R	2/3
57	Green 166	3	R	2/3
58	Green 167	4	L	2/3
59	Green 170	3	R	3/3
60	Green 171	4	R	2/1
61	Green 172	4	L	2/2
62	Green 173	3	L	2/2
63	Green 174	5	L,R	1/1
64	Green 175	4	L,R	2/3
65	Green 176	3	L	2/3
66	Green 177 & 178	3	L	1/1
67	Green 179	2	R	3/3
68	Green 180	3	R	3/3
66	Green 181	3	L,R	2/2
67	Green 183	5	L,R	2/2
68	Green 186	4	L	2/3
69	Green 187	3	L,R	1/1
70	Untagged		L,R	1/1
71	Untagged	3	L	1/1

Appendix II: Paper presented at the *Basking Sharks – A Global Perspective* conference on the Isle of Man from 2-5 August 2009

Basking Sharks in Ireland: historical perspective and future research

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The basking shark was a very familiar visitor to coastal communities in Ireland. It was known as *ainmhide na seolta* ‘monster with the sails’ and *liop an dá* ‘unweildy beast with two fins’. More generally in the west of Ireland it was called *liabhán mór* (signifying a great leviathan) or the most evocative *liabhán chor gréine* ‘great fish of the sun’. It was locally known as the “sunfish”.

The best documented basking shark fishery was off Achill Island, Co Mayo. Between 1950 and 1964, 9,000 sharks were killed with a record 1,808 killed in 1952 alone. From 1955 the catch declined and the fishery closed in 1975 after 12,342 sharks had been killed. It has been suggested that the collapse of this fishery indicated a local stock had been over-fished but there is also evidence of changes in zoo-plankton distribution. Basking sharks were continued to be fished commercially by Norwegian vessels off Co Waterford up to 1986 when 2,465 sharks were killed. By-catch of sharks in static gillnets is still a cause of mortality in Ireland.

Sightings of basking sharks on the surface have been systematically collected in the UK and Ireland by the UK Marine Conservation Society since 1987. Of the 4,005 sighting records reported by 2002 only 71 were from the Republic of Ireland and 33 from Northern Ireland. In 1993 a sighting survey was carried out in Ireland and 140 sightings of 425 individual sharks were received with concentrations off the east, southwest and northern coasts. The Irish Whale and Dolphin Group (IWDG) have collected 442 basking shark records since 1992. There has been a rapid increase in sightings reported to the IWDG since 2004 which cannot be explained entirely by increased effort or reporting.

This increase in sighting records has resulted in an increase in research interest. In 2008 basking sharks were successfully tagged off Counties Kerry and Donegal with uniquely numbered, coloured tags. This pilot study provided knowledge and experience of basking shark tagging and was expanded significantly in 2009 when 71 tags were deployed in addition to two PAT archival tags. A photo-identification catalogue was established in 2009 with images of 60 sharks to date and three more tissue samples added to a tissue archive. In this paper we review present knowledge of basking sharks in Ireland and look at present and future research activities and opportunities.

393 words