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2000+ UK Shark Tagging Programme: An Angler Led Shark-tagging Initiative in UK Coastal Waters

(Elasmobranch Fisheries – Oral)

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Abstract

The 2000+ UK Shark tagging programme is unusual in that it was originally developed by anglers in order that they could better understand the distributions and behaviours of their target species. Since the start of the programme in 2000, 220 volunteer taggers have measured, weighed and sexed tagged 2374 sharks. Despite extremely limited funding this angler-centred programme is revealing something of the patterns of distribution of the eight common species of shark found around the UK. As well as providing data on distributions, movement rates and behaviour, the programme has developed a Length-Girth-Weight chart that allows anglers to estimate the weight of their catch without killing them. The programme is helping to promote the image of marine anglers both to the public and amongst themselves as 'Monitors of the Marine Environment'.

Keywords: shark-tagging, angling, conservation.

Introduction

In general, fisheries research programmes are driven by the need for knowledge that will facilitate economic and sustainable exploitation of a species, population or stock. This has resulted in a long history of research biased towards commercially important species such as cod, tuna, mackerel and herring. It is only in the last few years that substantial research effort has been directed towards understanding the effects of fisheries can have on non-target species (Jennings *et al*., 2001) and an appreciation has been gained for the huge ecological changes that have been caused by anthropogenic activities (Jackson *et al*., 2001). Elasmobranchs, with their relatively large size at maturity, slow growth rates and low reproductive outputs are likely to be vulnerable to perturbation (Musick *et al*., 2000). At the same time their large geographic ranges, lack of formal knowledge of their basic biology and uncertainty over how elasmobranch populations are reacting to recent rapid ecological shifts in many areas make management decisions other than "proceed with extreme caution" ill advised (Hurley, 1998; Musick *et al*., 2000).

Although anecdotal knowledge of shark movements and behaviours has existed amongst the UK sea-angling community for many years (e.g. Caunter, 1961), there have been relatively few formal studies of shark populations within UK waters (Holden, 1965, 1968; Stevens, 1976; Gauld, 1989; Stevens, 1990; Vas, 1990; Henderson *et al*., 2001). Reasons for this include the low value of shark flesh leading to unreported or misreported by-catch discard, the high cost of dedicated shark sampling using research vessels and the low priority of sharks in the pecking order of fisheries management. Complicated internal angling politics, simplistic (and often jingoistic) views of fisheries management and a general lack of confidence of anglers and angling charter boat skippers in the UK institutions responsible for fisheries management (Sea Angler, June 2002, p 3) has previously made collaboration between anglers and fisheries managers or scientists extremely difficult. However, concern amongst sea anglers over

declining catch rates and maximum sizes of fish captured has resulted in some anglers approaching researchers and fisheries managers with a less jaundiced eye. In addition there is a greater realisation amongst academics and fishery managers that data and anecdotal evidence from commercial fishers (Johannes *et al*., 2000) and angling organisations (Lucy and Davy, 2000; Johnson *et al*., 2001), along with other non-traditional sources of data (Pauly *et al*., 1998) have an important role to play in fisheries management. The growing desire amongst anglers to be viewed as 'Monitors of the Marine Environment' rather than blood-sport enthusiasts has resulted in a groundswell of support for initiatives that promote a positive image of anglers and that strengthen their position (BASS tagging programme, the British Conger Club and Mullet Club catch and release programs).

A recent review of shark tagging methodologies (Kohler and Turner, 2001) covered 64 shark-tagging schemes around the world. All of these schemes were initiated by researchers who either had to catch and tag fish themselves or persuade anglers to assist them. The UK Shark Tagging Programme differs from all of these other programmes in that it was initiated by and is led by anglers rather than fisheries managers and researchers. In this paper we discuss the aims, the history and development of this recreational angler initiative, and show that it can be considered a valuable and valid resource for the study of shark species.

Methodology

Aims of the programme

The aims of the programme are primarily to study eight elasmobranch species targeted by anglers and increase understanding of these creatures among recreational anglers, the scientific community and the public at large. The programme currently concentrates its efforts on collecting morphometric data, developing an understanding of seasonal distributions and pinpointing areas that are likely to be important to shark populations at key stages in their life histories.

Development of the programme

The 2000+ UK Shark Tagging programme uses recreational anglers around the whole of the UK as the primary tagging resource. A preliminary study of angling behaviour with regard to sharks fishing was carried out prior to the development of the main tagging programme. This showed a catch and release rate of almost 99.9% for some species such as Tope *(Galeorhinus galeus)* and lower percentage for others such as Smooth Hounds *(Mustelus sp.)*. This supported the anecdotal concept of some species being regarded as 'sport-only'. It was this 'sport-only' attitude already prevalent among many recreational sea anglers targeting big-game fish that was viewed as the foundation stone within angling for the establishment of a tagging programme.

A pilot study was carried out in 1998-99, to establish the practicalities and acceptability of tags, the concept of tagging and willingness to tag. This study was carried out using a sample group from one harbour association of angling charter boats (8 of the fleet of 18 boats assisted with the study). This study demonstrated a reluctance to use 'M' type tags (similar to those used in the NMFS programme), as they were found to be too large for the species being encountered most frequently, namely Tope and Smooth Hounds. However, acceptance of Floy dart tags FT-1 was universal. These tags were reported to be more 'user-friendly' and 'less damaging to our fish', as reported by the charter boat captains. This aspect of 'their' fish will be discussed later.

Having developed field protocols, tags types and a willingness to tag sharks, the programme developed a full working programme outline, and sought funding from organisations that would be acceptable to anglers. This came in the form of funding from the World Wildlife Fund for Nature (UK), and the Angling Trades Association spread over 3 years. Anglers interested in participating in the programme complete an application form detailing the areas fished, species likely to be encountered and style of angler (whether charter boat, private small boat owner or beach angler). Kits in the form of Tags, Canula, Report cards and comprehensive instructions for tagging are issued free. Participating anglers can request further supplies of tags and card upon return of completed report cards.

Recruitment of anglers to the tagging programme was initially undertaken by a very widespread advertising campaign run in conjunction with the main sea angling publications within the UK (Sea Angler, Total Sea Fishing, Boat Fishing Monthly, Angling Times). This took place towards the end of 1999 and it was soon apparent that interest of individual anglers and charter skippers was far greater than had been anticipated. Before the programme

was publicised recruitment of around 70 taggers in 2000 had been anticipated. However, interest in the programme was such that in the first year 140 had been enrolled, and the numbers of participating taggers in 2000 and 2001 was around 220. Further publicity of the programme through word of mouth, magazine, radio and television coverage maintains a steady trickle of enquiries. The programmes' own web site (http://www. ukshark. co.uk) also maintains recruitment and general interest in the programme and UK sharks. Taggers have been recruited from around the coast of England and especially on the south coast (Fig. 1). Although most anglers involved in the programme are coastal anglers, some target pelagic species such as Blue and Porbeagle sharks.

Once taggers have joined the programme they are provided with newsletters on a bi-annual basis. The winter edition deals primarily with events that have taken place over the previous 6 months and the summer edition provides a brief outline and breakdown of the data gained over the preceding 12 months. By providing taggers with this information, it keeps them appraised of the tagging effort of the whole programme and shows them a basic outline of distribution (see comments later on) over a year of the targeted species, together with recaptures that have occurred. These newsletters are posted on the web site and the information is therefore available to a far greater, varied and interested audience.

Tagging methodology

Tagging is carried out using Floy FT-1 tags and canula system, with the barbed tags being anchored in the dorsal musculature (Fig. 2). The tagging instructions include a recommendation that the canula be mounted on a pole that makes insertion of the tag easier and prevents damage to the fish through over insertion. Advice was sought from different programmes around the world tagging smaller species of sharks, that were utilising similar tags (New Zealand and Australia) (John Stevens, pers. comm.), and tagging trials were conducted in the 1999 'pilot' study.

Although the original M-tags utilised in the pilot study were found to be too large for the most common caught sharks, we have since had to re-introduce these in the form of Floy FT-69 tags for some of the taggers that are specifically targeting larger shark species, such as Porbeagles and Blues. The thicker skin is thought to be the cause of the barbs on the FT-1 tags shearing, and the FT-69 were more suited to the larger beasts.

Handling protocols of the captured sharks were in part already in place, due to the sport fishing ethic that was applied especially to Tope. The development of this to other species led to larger landing nets being used for species up to 1.8 m long and the use of weighing slings specifically designed for sharks. Refinements such as hoods, which placed the fish in partial dark, affect a calming behaviour on the sharks. As with other programmes (M. Pawson, pers. comm.) these developments and refinements have come about from the taggers' initiatives, and their wish to cause little of no harm to 'their' fish.

Data recording systems were examined during the 'pilot' study, and developed with the sample group of charter skippers. The development of the card (Fig. 3) came about through ease of use for the 'end-user', and with consideration for their working environment, as did the colour of the cards. The use of tick-boxes is a concession towards the speed at which tagging may need to take place, especially on a sports charter boat with up to 12 anglers all fishing. Here ease of use and minimum of writing proves to be essential, as at times it appears that a 'pack' or 'school' of sharks will move through and nearly all the anglers (up to 12) will catch sharks.

Generally species identification has not been a problem, as most of the species are quite distinct from one another and anglers are enthusiastic about their target species group. However, the programme web site provides pictorial and 'lay' descriptions of each species, with diagnostic features and possibilities for mis-identification. An example being the white or light patch on the rear of the first dorsal of a Porbeagle, against the lack of the patch on a Mako.

Practised charter skippers have developed small scale working procedures unique to their boats, and in such cases the shark is only aboard for between 2 and 3 minutes, from netting to release, tagged and measured. Larger sharks are tagged at alongside, to avoid potential damage to the fish from unsupported removal from the water. These fish are usually measured against pre-measured lines along the boat hull, usually starting at the transom.

An overriding factor in all the tagging operations is that of care for the fish, with an element in the tagging instructions to abort tagging should the situation become unsafe for the angler or the shark. To date this has been reported only on a few occasions where anglers have been fishing alone and caught large specimens. One aspect of

the tagging data record, is the status of the fish upon return to the water, and a request for pictures of unusual markings, damage or other features. The growing spread of computers and digital cameras are proving to be valuable in this respect, with pictures being transmitted back to the organisers by email, just hours after the tagging event.

The programme has encouraged the use of circle hooks in an effort to avoid deep hooking thus reducing the potential for internal damage to the fish. This concept of circle hooks as a potential conservation tool has been adopted by the angling press and promoted widely. A code of best shark angling practice is also sent out with each tagging kit which promotes both the use of circle hooks or plain painted hooks.

Administration of the programme

Completed tagging cards are requested from the taggers on a six monthly basis, or whenever they start to run short of their allocated kits. This allows data recording to be carried out over a short period of time. Particular pressure on available time comes from the fact that the programme administrators are volunteers. Other times during the year are spent on administrative tasks, such as dealing with recaptures, website updates, press releases, 'mild' data analysis and production of the annual newsletter.

The development of the 'Shark Working Group' is a unique feature of this programme, which had been established before the introduction of marine biologists. The 'recruitment' of a science team from institutions that would not be disapproved of by anglers to evaluate and develop the data gathered did not pose a particular problem.

The current science team, which includes a sponsored MSc student, have expertise in fisheries management, microbiology, population dynamics and field research. The team have provided advice on standard sampling methodology and initial treatment of data. In addition they have developed new sampling strategies for the more active taggers that take full advantage of their enthusiasm and expertise. These include DNA sampling and external parasite collection.

Recaptures come for a number of sources, mainly due to an ongoing poster campaign, where posters are distributed to commercial ports in UK and Europe, and repeat press releases to appropriate publications. Recaptures come in a variety of formats, email, letters and phone calls, and all basically quote the same data: Date, species, location and weigh (dressed - always?). Information on distance travelled, confirmation of species identification, time elapsed since tagging and growth changes are forwarded to the reporter, along with a five Euro reward. In addition the original tagger is informed of the recapture, and awarded a unique 'tagging cap'.

Results

To date the programme has 220 taggers, that over two years have tagged 2374 sharks across five of the eight target species (Table 1). Tagging efforts were initially based on traditional fishing areas and seasons. In some areas this has changed, with anglers extending their fishing season, in a wish to investigate further the boundaries of their shark season. This has also led to the anglers initiating their own investigations into potential areas and times for shark angling, where there were formerly none thought to exist.

Distribution and movement

The most commonly targeted and tagged species is Tope (Table 1). The tagging data returned for this species have generated a picture of the changes in distribution of this species over the year (Fig. 4). The angler understanding of seasonal movements is restricted to periods when certain species arrive, and then depart, with local variations for the size and sex of the species. A specific area might see large male Tope arrive in late April, followed by medium and large females until the middle of June, followed by small mixed male and female groups, right through to September or October. Other areas might have a brief 'season' of large mixed fish mainly during August. The general feeling of the anglers is that tope are first encountered in the southern UK waters, followed by a spread northwards towards the Scottish waters through spring and summer, with a return migration leading the last Tope being captured off the south English coast during October.

Recaptures

Of the 2374 sharks tagged to date, 20 have been recaptured (14 Tope, 5 Blues, 1 Smooth hound). These preliminary data suggest that Blue sharks generally move around 8.77 miles per day compared to 1.85 miles per day for Tope (Fig. 5). These indications fit in well with the known migrational movements of these species (Wheeler, 1969)

The length-weight-girth chart

An inherent feature of angling culture is the need to know the weight of a captured fish. In order to claim a record or to compete in many competitions anglers are required to bring their fish back to the quay for weighing. Anglers that tag fish obviously wish to return them alive to the sea in as good a condition as possible. However they retain the desire to know the weight of their catch. In order to encourage the return of fish, tagged or not, the tagging programme (in consultation with taggers) has developed a length-girth-weight chart for Tope (Fig. 6**)**. This was calculated through a combination of least squares multiple regression and iterative techniques. A simple length-weight plot demonstrates that the lengths and weights taken by anglers are of an excellent standard (Fig. 7). It should be noted that as the majority of British sea anglers remain stubbornly attached to imperial measures, fish dimensions are in inches and the weights are in pounds. It is hoped that as the database develops it will be possible to refine the current version of the chart and produce similar charts for other species.

Tide v catch rate chart: and example of anecdote meets statistic

The feeding behaviour of their target species is of particular interest to anglers. Although they generally do not think in terms of catch per unit effort, they have long recognised that tope are more likely to be caught at specific states of the tide.

Using a tidal prediction programme (NavTides (v2.0) by PC Maritime Ltd, London.) that provides data on tidal cycles for any given station in UK coastal waters, it was possible to estimate the current state of the tide at the time each shark was captured over two years. Figure 8 demonstrates that in the main tagging season of year 2000, the predominance of tope captures were during the periods of slower water movements, of the 3 hr prior to low water, and 1.5 hr before high water.

Discussion

There are many examples of successful teleost and elasmobranch tagging programmes to which anglers collaborate around the world (Lucy *et al*., 1991; Lucy and Davy, 2000). However, and contrary to many others, this programme differs in that it has been established and is being run by recreational anglers who have invited scientists to contribute and work within the programme parameters.

The drawback of using volunteer taggers, is two-fold; firstly we have no control over where and when they fish, and this can leave some areas thinly sampled, and secondly tagging effort is only when the anglers are fishing for sharks.

The tagging programme's use of recreational anglers as the only tagging resource has had a number of effects on those carrying out the tagging. They have an even greater regard for 'their' fish, and it has awakened a questioning attitude in their approach to the life cycle of each species, a further desire to improve their handling procedures, and a desire to assist further.

The scientists were encouraged to participate in some angling trips when it became clear from some of the suggestions and criticisms they were making that they often lacked an appreciation of the difficult working conditions on a <10 m charter vessel. Two-way discussions between taggers and the science team resulted in the development of effective 'angler-friendly' protocols for the collection of copepod and DNA samples.

The analyses are specifically related to recreational anglers, by way of return for their tagging efforts, and are very much part of the developing working relationship between the science team and the taggers. The use of a six monthly newsletter has provided a platform to invite further collection efforts, and to refine existing efforts. The collection of copepods was first addressed through a newsletter, and the response soon followed with collection kits being dispatched weekly after the initial mention of this further opportunity to assist.

One factor evident very early on in the life of the programme is a very strong need from the anglers to have a greater understanding of 'their' sharks, with regard to numbers, distribution and predation. In the absence of feedback, taggers feel isolated and no longer part the team. In return for feedback the science team and administrators are rewarded with a rich tapestry of anecdotal field observations. At times these can be of immense use in developing further focussed research aspects. One of the major tasks of the science team is to follow up anecdotal data and look for ways to turn angler's tales into hard data that will be accepted by conservationists, scientists and managers. One such 'collection' of observations resulted in an investigation (in progress) of a pupping and a separate nursery area used by both Starry and Common Smooth Hounds in the East Solent.

An aspect that has been found throughout the development of the programme to date is the concept of the anglers and charter skippers considering the fish - once tagged as 'their' fish. They assume a responsibility for the fish and have a vested interest in its welfare. The charter skippers participating in the programme have noted an increase in bookings for 'tagging' trips rather than 'shark' trips, and skippers that have not volunteered for the programme have subsequently volunteered because potential customers have been seeking opportunities to tag. The charter skippers and anglers alike all have an interest in the developing results of the programme, as greater knowledge of their target species will improve catches, but they are now equally mindful of the need for more catch and release effort.

Conclusions

The programme is demonstrating that non-academic stakeholders can take the initiative to investigate and research marine species in a structured manner. It is also demonstrating that data collected by anglers can be viable and when considered alongside anecdotes may prove to be extremely useful in developing research opportunities and sensible management strategies.

In this case the collaboration of researchers and amateurs in the investigation of elasmobranches is proving to be extremely fruitful. As well as fulfilling some of the original investigative and conservation objectives, the programme is proving to be a powerful tool in changing the attitudes of anglers and fisheries scientists towards each other. Despite the common perception of each group as occupying polarised positions, as Connelly *et al.* (2000) suggest, the overall objectives of both may actually be very similar.

With the growing realisation that anglers, commercial fishers, academics and fisheries managers all have something valuable to contribute to the management and conservation of marine resources, access to funding for stakeholder organisations needs to be facilitated. The main weakness of the UK Shark-Tagging programme is that it depends very much on the good will of the administrators and academics involved. Without sensible and accessible funding, initiatives such as this programme are unlikely to survive in the medium to long term. They not only promote collaboration between formerly alienated bodies and institutions but provide an extremely economic means of gathering data on a wide range of fish species. Conservation minded anglers are the true 'Monitors of the Marine Environment' and as such they deserve recognition for their interest and expertise.

Acknowledgements

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Table 1. The eight shark species targeted by the 2000+ UK Shark Tagging Programme along with the numbers that have been tagged since 2000 and their perceived distribution.

Species	**Number**	**Distribution**
Tope (*Galeorhinus galeus*)	1661	ICES Areas Vlla, Vllf, Vlle,Vlld, IVc, Ivb
Common Smooth Hound (*Mustelus mustelus*)	170	ICES Areas Vlle, Vlld, Vllf
Starry Smooth Hound (*Mustelus asterias*)	412	ICES Areas Vllf, Vlle, Vlld, IVc
Blue Shark (*Prionace glauca*)	97	ICES Areas Vllg, Vllf, Vlle
Porbeagle Shark *(Lamna nasus*)	17	ICES Areas Vllf, Vlld
Shortfin Mako *(Isurus oxyrinchus)*	0	
Thresher *(Alopias vulpinus)*	0	
Angel shark *(Squatina squatina)*	0	

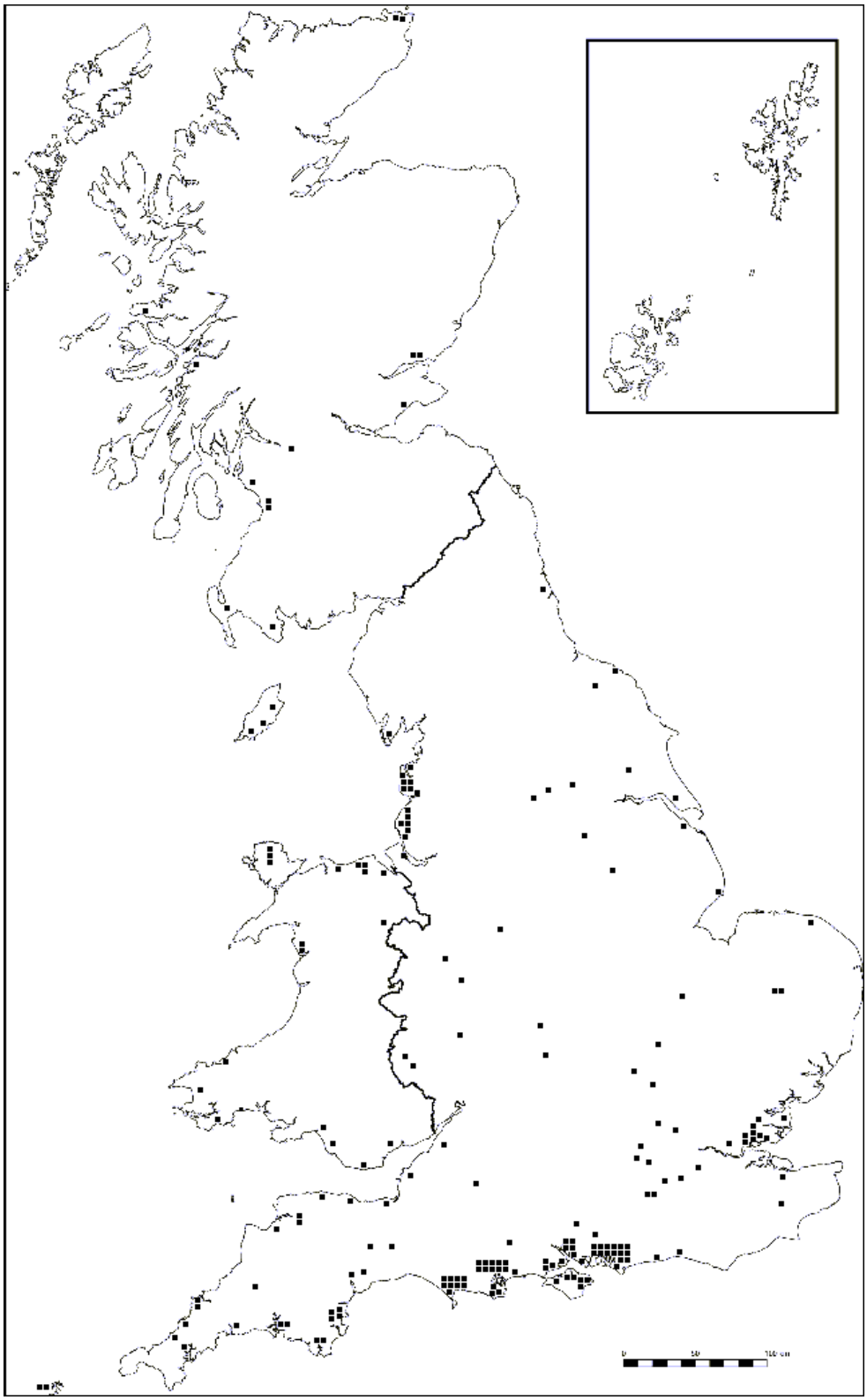

Fig. 1. The distribution of participating anglers in the UK shark tagging programme.

Fig. 2. A tagged Tope (*Galeorhinus galeus*) showing the placement of the tag in the musculature near the dorsal fin.

2000+ UK SHARK TAGGING PROGRAMME	**TAG NUMBER:**	Completed forms to go to Sue and Jeri Drake 48 Woodbridge Avenue Leatherhead Surrey KT22 7QN – 01372 386276 tag@ukshark.co.uk
SPECIES:- **Tope** **Starry Smooth Hound** **Common Smooth Hound** **Thresher Shark** **Porbeagle Shark** **Short Fin Mako Shark** **Angel Shark (Monkfish)** **Smooth Hammerhead** **Blue Shark**	**Sex:** **Male** **Female** **Unknown**	**Comments:**
Condition of Fish: Good Fair Poor Gravid Non Gravid **Total Length: Fork Length: Girth: Weight: lbs**		
Locality in Words: **Lat/Long:**	**Weather:** **Tide:**	
Bottom Structure **Sandy Rough Reef Other**	**Depth:** **Ft/Mtrs:**	
Date: **Time:**		
Parasites: **Bait Used:**		
Tagger/ Anglers Name and Address:		
Charter Boat Name		

Fig. 3. The record card used by the 2000+ UK Shark tagging programme. Note that figures are in imperial (pounds and inches) rather than metric.

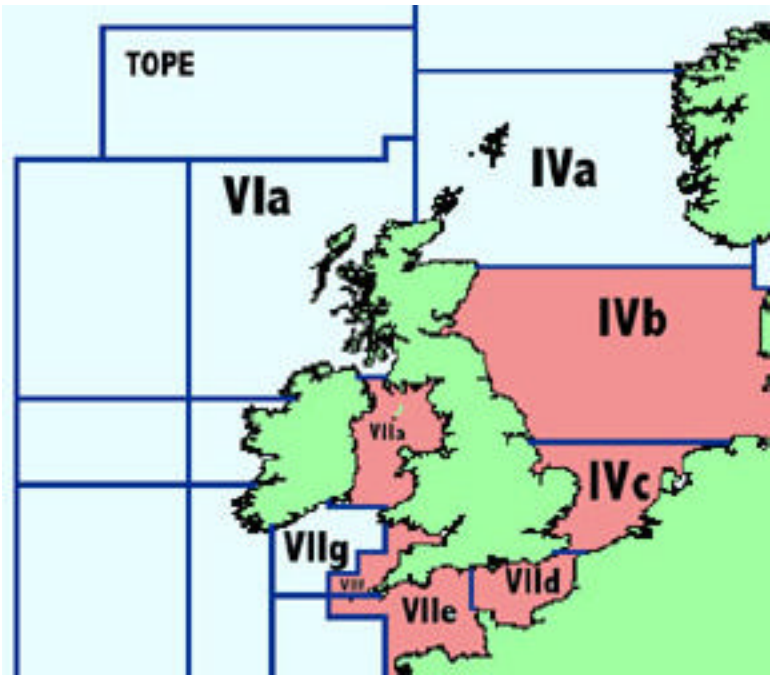

Fig. 4. Seasonal distributions of Tope (*Galeorhinus galeus*) around the UK from anglers tagging records. In order to respect the desire that anglers and charter boat skippers have to keep prime locations confidential, all published distributions are given by ICES box. However, for a coastal species such as Tope it can generally be assumed that most fish were captured within 12 miles of the coast.

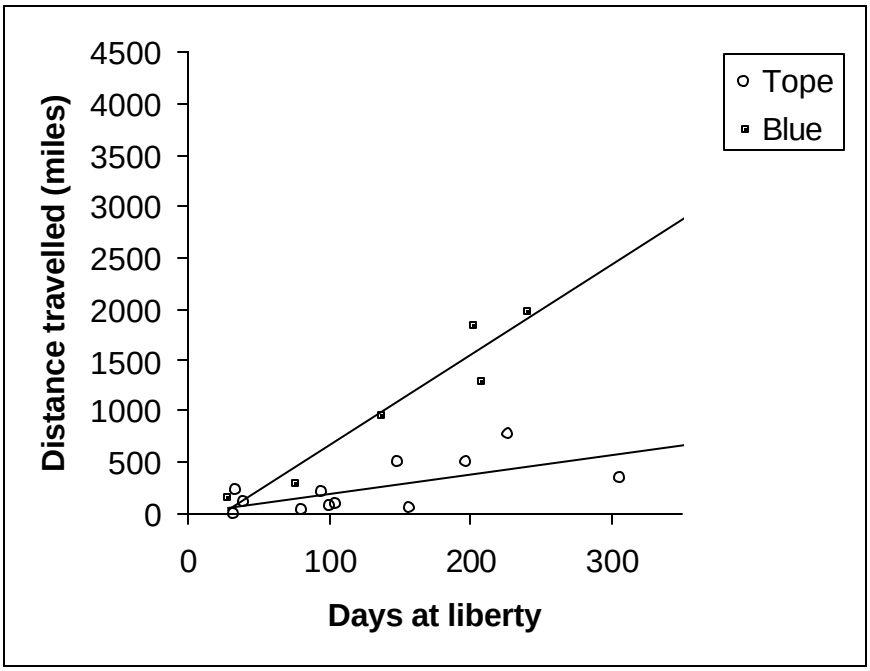

Fig. 5. The relationship between days at liberty and distance moved from the release point for Tope and Blue sharks. For Tope, distance travelled = 13 + 1.85 x Days ($r = 0.66$, $p<0.02$) and for Blue sharks, distance travelled = 8.77 x Days at liberty – 204 ($r = 0.96$, $p<0.002$)

First Appraisal of Tope Length/Girth : Weight Chart

Length \ Girth	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
20	4.6	4.9	5.2	5.6	6.0	6.4																					
22	4.9	5.2	5.6	5.9	6.3	6.7	7.2																				
24	5.2	5.5	5.9	6.3	6.7	7.2	7.6	8.2																			
26	5.5	5.9	6.3	6.7	7.1	7.6	8.1	8.7	9.2																		
28	5.9	6.2	6.7	7.1	7.6	8.1	8.6	9.2	9.8	10.5																	
30	6.2	6.6	7.1	7.5	8.0	8.6	9.2	9.8	10.4	11.1	11.9																
32	6.6	7.0	7.5	8.0	8.5	9.1	9.7	10.4	11.1	11.8	12.6	13.4															
34		7.5	8.0	8.5	9.1	9.7	10.3	11.0	11.8	12.5	13.4	14.3	15.2														
36			8.5	9.0	9.6	10.3	11.0	11.7	12.5	13.3	14.2	15.2	16.2	17.2													
38				9.6	10.2	10.9	11.6	12.4	13.3	14.1	15.1	16.1	17.2	18.3	19.5												
40					10.9	11.6	12.4	13.2	14.1	15.0	16.0	17.1	18.2	19.4	20.7	22.1											
42					11.5	12.3	13.1	14.0	14.9	15.9	17.0	18.1	19.4	20.7	22.0	23.5	25.1										
44					12.3	13.1	14.0	14.9	15.9	16.9	18.1	19.3	20.6	21.9	23.4	25.0	26.6	28.4									
46						13.9	14.8	15.8	16.9	18.0	19.2	20.5	21.8	23.3	24.8	26.5	28.3	30.2	32.2								
48						14.7	15.7	16.8	17.9	19.1	20.4	21.7	23.2	24.7	26.4	28.2	30.0	32.0	34.2	36.5							
50							16.7	17.8	19.0	20.3	21.6	23.1	24.6	26.3	28.0	29.9	31.9	34.0	36.3	38.7	41.3						
52							17.7	18.9	20.2	21.5	23.0	24.5	26.2	27.9	29.8	31.7	33.9	36.1	38.5	41.1	43.9	46.8					
54								20.1	21.4	22.9	24.4	26.0	27.8	29.6	31.6	33.7	36.0	38.4	40.9	43.7	46.6	49.7	53.0				
56								21.3	22.8	24.3	25.9	27.6	29.5	31.5	33.6	35.8	38.2	40.7	43.5	46.4	49.5	52.8	56.3	60.1			
58									24.2	25.8	27.5	29.4	31.3	33.4	35.6	38.0	40.6	43.3	46.2	49.2	52.5	56.0	59.8	63.8	68.0		
60									25.7	27.4	29.2	31.2	33.3	35.5	37.9	40.4	43.1	46.0	49.0	52.3	55.8	59.5	63.5	67.7	72.3	77.1	
62										29.1	31.0	33.1	35.3	37.7	40.2	42.9	45.7	48.8	52.1	55.5	59.2	63.2	67.4	71.9	76.7	81.9	87.3
64										30.9	33.0	35.2	37.5	40.0	42.7	45.5	48.6	51.8	55.3	59.0	62.9	67.1	71.6	76.4	81.5	86.9	92.7
66											35.0	37.3	39.8	42.5	45.3	48.4	51.6	55.0	58.7	62.6	66.8	71.3	76.0	81.1	86.5	92.3	98.5
68												39.7	42.3	45.1	48.1	51.4	54.8	58.4	62.4	66.5	71.0	75.7	80.8	86.1	91.9	98.0	104.6
70													44.9	47.9	51.1	54.5	58.2	62.1	66.2	70.6	75.4	80.4	85.8	91.5	97.6	104.1	111.1
72														50.9	54.3	57.9	61.8	65.9	70.3	75.0	80.0	85.4	91.1	97.2	103.6	110.6	118.0

2000+ UK SHARK TAGGING PROGRAMME

THE UNIVERSITY OF HULL Scarborough Campus

The table makes no allowance for gravid (pregnant) females.

This Chart an approximation of weight(lbs) to length(inches) and girth(inches), and will be subject to annual review, by the Shark Working Group.

Fig. 6. The tope Length-Girth-Weight chart produced by the programme in consultation with taggers. The chart was produced from two years sampling (1111 fish from 40 locations), and in consultation with taggers. By measuring the length and girth of a particular fish the chart can be used to estimate the weight of a fish.

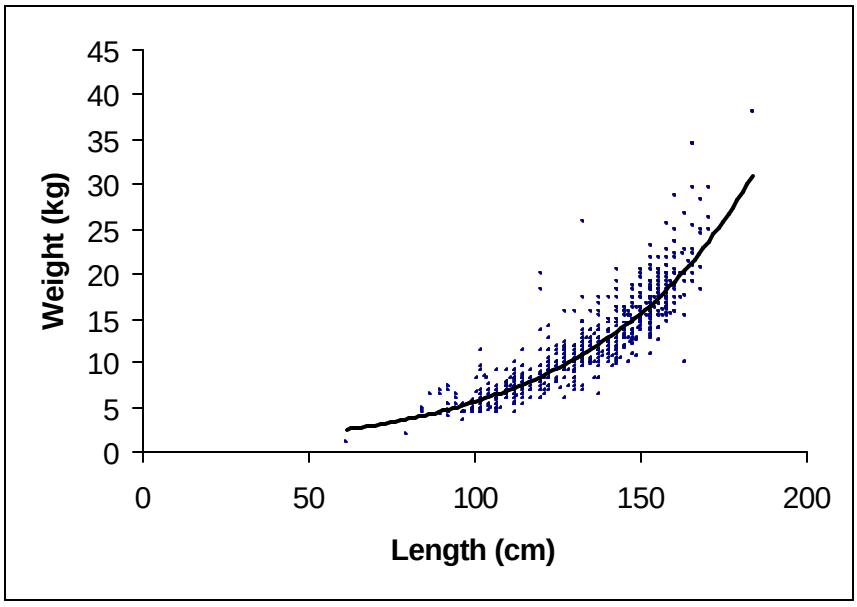

Fig. 7. Length-Weight relationship for Tope (*Galeus galeorhinus*). The exponential relationship is Weight = $0.715e^{0.0205\ \text{Length}}$ ($r=0.91$, $p<0.001$). These are the raw data and take no account of whether the fish was gravid or not.

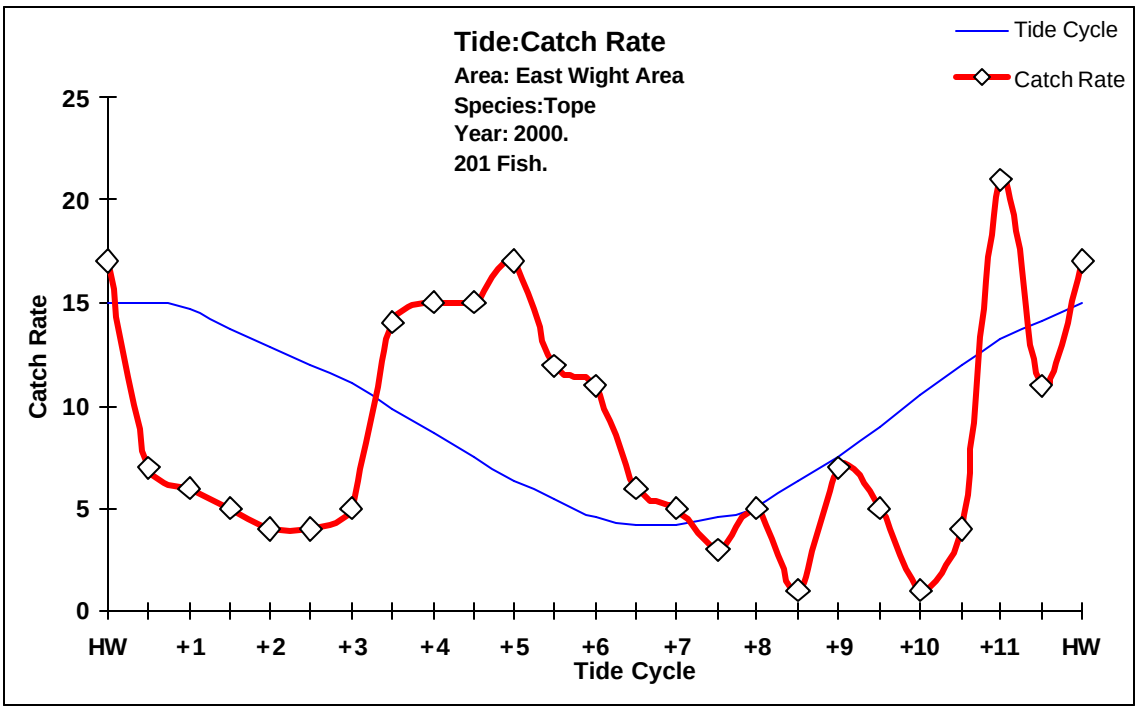

Fig. 8. The relationship between frequency of capture and tidal movement for tope tagged by 2000+ UK Shark tagging issues. N = 201, fish captured in the East Wight area. . The average height range for the area across summer spring and neap tides is in the order of 4.50 metres.