Invest in Fish South West Report

The Motivation, Demographics and Views of South West Recreational Sea Anglers and their Socio-economic Impact on the Region

Contents

INTRODUCTION

Invest in Fish South West is a stakeholder-led project that seeks to develop a regional strategy for managing fisheries in the Celtic Sea, English Channel and Western Approaches to improve fish stocks in a way that will benefit the marine environment, regional economy and local communities. The project was launched on 28 April 2004 by HRH the Prince of Wales and, to celebrate progress made within its first year, Invest in Fish South West will be releasing four reports over the next month. Each report will discuss important findings from different research projects conducted within the context of the project to date.

Although these reports do not convey the collective views of Invest in Fish South West, they do provide a basis for discussion that will aid stakeholders in defining a fisheries management strategy. Relevant biological, economic and social data collected from these reports will also be input into the Invest in Fish South West's bio-economic model.[1]

The reports and dates for release are as follows:

- *Imagining Change: A Survey of South West Fishermen* by Invest in Fish South West – released 9 May 2005

- *The Motivation, Demographics and Views of South West Recreational Sea Anglers and their Socio-economic Impact on the Region* by Nautilus Consultants – to be released 16 May 2005

- *Analysis of the Interactions between Fishing and Marine Mammals* by the Sea Mammal Research Unit, SMRU – to be released 23 May 2005

- *Analysis of the Legal and Institutional Policies Relating to South West Fisheries* by The Institute of European Environmental Policy (IEEP) – to be released 30 May 2005

Editor's note

1. The Centre for the Economics and Management of Aquatic Resources at the University of Portsmouth, Cemare, and The Centre for Environment, Fisheries and Aquaculture Science, CEFAS are currently developing a bio-economic model to test the social, economic and environmental implications of different management options on behalf of Invest in Fish South West.

CONTEXT

Invest in Fish South West aims to define a fisheries management strategy that improves fish stocks while balancing the needs of the marine environment, regional economy and local communities.

Recreational sea anglers are directly affected and sometimes restricted by fisheries management policies. *The Motivation, Demographics and Views of South West Recreational Sea Anglers and their Socio-economic Impact on the Region* provides insight into anglers' views of current fisheries management policies and their suggestions for future management options. The report, as its title suggests, also looks at recreational sea anglers' potential economic contribution to the region and investigates the drivers and the interdependencies between recreational sea angling, commercial fishing and the environment.

Recreational sea angling contributes significantly to the South West economy, but the extent of its input has never been properly quantified. This work, by Nautilus Consultants, attempts to establish the value of sea angling to this region by assessing resident anglers' direct expenditure as well as the "knock on" benefits of angling to other regional businesses (hotels, fuel, food and drink).

Data gathered from this report will be incorporated into the Invest in Fish South West bio-economic model, creating real life scenarios in which different fisheries management options will be tested. This information has been presented to the Invest in Fish South West Steering Group and will play an important role in its fisheries management debate.

STEERING GROUP COMMENTS

The steering group is intrinsically involved in the project. Together with stakeholder dialogue, they will determine the final Invest in Fish South West strategy. Each member represents a stakeholder group that has an ultimate interest in the management and use of fish stocks.

All the research conducted and reports issued within the Invest in Fish South West project are a basis for discussion between stakeholder groups. Naturally, each steering group member will have a different opinion on the relevance and details of the reports and it is important that these thoughts are made known.

The steering group members' comments on *The Motivation, Demographics and Views of South West Recreational Sea Anglers and their Socio-economic Impact on the Region* are as follows:

Mike Barry, representative of retailers in the South West and sustainable development manager for Marks & Spencer comments: "This is really good report on a difficult area. It provides a good analysis of benefits of sea fishing. However, we will have to make sure that commercial fishing is treated in the same way - i.e. a full capture of benefits."

Caroline Bennett, representative of South West restaurateurs and managing director of the London-based sushi restaurants Moshi Moshi, which sources some species of fish from the South West, comments: "It is fascinating to learn the importance of the angling sector to the South West."

Joan Edwards, representative of environment NGO's and conservation organisations for Invest in Fish South West and head of the Marine Conservation Programme for The Wildlife Trusts, comments: "This is an interesting report which provides further evidence of how important the sea angling industry is to the South West economy and, therefore, proves the case that sea anglers and their own particular needs must be accounted for when looking at the overall management of the Channel."

Malcolm Gilbert, representative of South West recreational sea anglers, fisheries representative for the National Federation of Sea Anglers and European liaison officer for the Bass Anglers Sportfishing Society, comments: "Recreational sea angling in the South West is clearly important, socially and economically. It is also biologically significant in that the activity is responsible for measurable amounts of fishing mortality. The highest catch is for mackerel and at over 1000 tonnes this represents about 15% of commercially caught mackerel (7000 tonnes landed at South West ports 2001 – according to the Baseline study). For other species the volumes are closer to commercial landings – Pollack and bass. For some species however, the recreational catch represents a very low proportion of commercial catches – 5% for plaice. Whilst there are areas of conflict between the commercial and recreational industries,

there are a considerable number of species that are very important to commercial fishing that are of little if any direct interest to recreationals – lobsters, crabs, soles, scallops, monk, cuttle and hake. By the same token, there are a few species that are critically important to anglers that are of limited or negligible value to commercials – mullet, flounder, wrasse and conger."

Gilbert continues, "The £165 million of sea angling expenditure supports 3000 jobs across the South West and such figures justify serious consideration of how our fish stock resources should be managed and for what overarching purpose. It is clear that for some species, the "best return" for the South West economy is from recreational exploitation. For other species, ensuring that a higher proportion of the stock is allowed to grow older & bigger may generate significant recreational angling benefits. Catch and return rates are already significant but in other areas of the globe where certain species are subject to specific management measures, implemented for the development of recreational sea angling, a rapid increase in catch and release with restrictive bag limits and minimum landing sizes have served to reduce fishing mortality so that the stock improves, which in turn increases the future prospects for sea anglers. The socio-economic benefits thus increase simultaneously with improving fish stocks, which is very much a win–win situation."

Paul Trebilcock, representative of the commercial fishermen and chief executive of Cornish Fish Producer's Organisation (CFPO) comments: "This is a useful study in its own right. However, based on this report alone, it's difficult to compare the economic impact of angling to that of the fishing-catching sector. At this point, similar research has not been conducted on the fish catching sector and to compare the information from this report with the data we have for the commercial sector, like the cost of landings in the South West, wouldn't be comparing like for like. I, therefore, caution those who attempt to use this report in a comparative fashion."

Acknowledgement

This study is primarily the work of Rod Cappell and Keith Lawrence of Nautilus Consultants. Abi Reader, six interviewers from the University of Plymouth, and Fiona Nimmo and Myriam Baete of Nautilus Consultants carried out additional work.

The consultants would like to thank all of the sea anglers who contributed their time to participate in the study; the level of support received was invaluable in drafting this report. Particular thanks go to Malcolm Gilbert for his time and unerring commitment to the project, and to Andy Rye and Mike Barker for invaluable contributions to the survey design. Dr Bob Crabtree of CJC Consulting and Professor Kenneth Willis of the University of Newcastle provided helpful guidance on their previous study. Dr Riccardo Scarpa of the University of York also commented on the choice experiments.

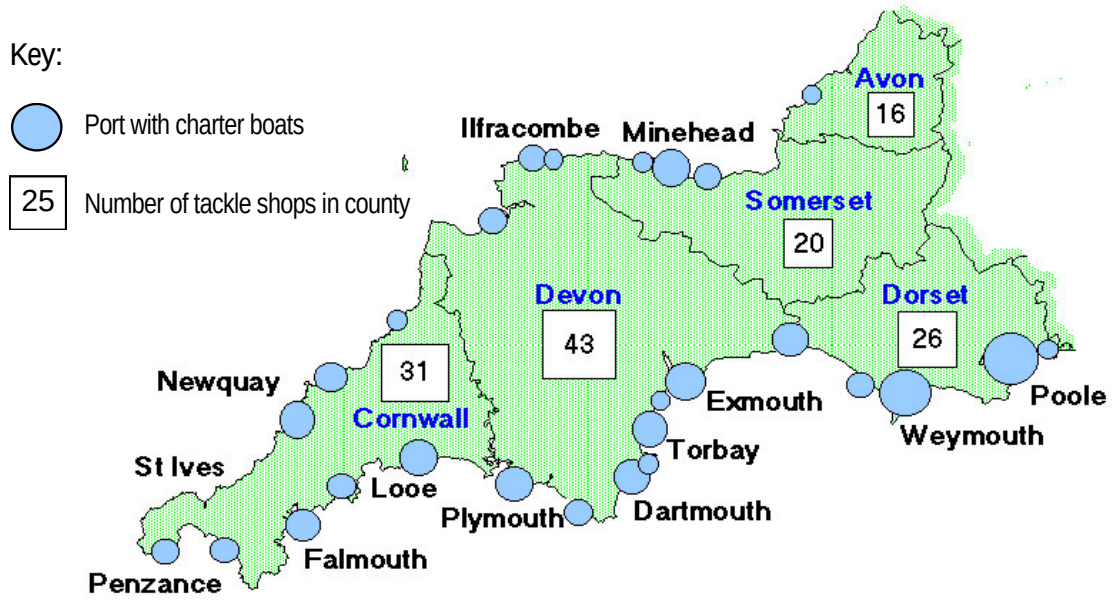
This report has been amended following an external review by Dr Meg Huby of the University of York in February 2005.

Executive summary

The South West offers some of **the finest and most diverse sea angling opportunities in the UK**. "Sea angling" here ranges from families angling at holiday resorts to boat trips visiting wrecks far out in the English Channel; from low-cost trips targeting easily caught shoals of mackerel to private boat owners spending large sums in pursuit of an elusive record-sized bass; and from kids exploring their coastline to experienced anglers enjoying the social side of angling. Furthermore, the species caught in the region are more diverse than in any other part of the country. All of this diversity means that there is no such thing as a "typical" sea angler.

Sea angling takes place all around the coastline of the region (see Figure 1). The South coast has the largest concentrations of angling in the region, including the largest charter boat ports in the UK, at Weymouth and Poole, plus significant fleets at Falmouth, Looe, Plymouth, Dartmouth, Torbay, Exmouth, Lyme Regis and numerous smaller ports. The North coast offers fishing in the Bristol Channel, and also has charter boats, private boat owners and shore angling marks. Fewer large fish are found here, but this is perhaps compensated for by the shorter distances required to reach a fishing site, and the different composition of species on offer.

Figure 1. Distribution of sea angling around the South West



This study is largely based upon the results of four data-gathering exercises:

- **A socio-economic study** of the businesses that derive income from sea angling, and the economic linkages between these.
- **Sea angler surveys**, providing information on anglers' expenditure, demographics, and the species caught.
- **A choice experiment**, which investigates and quantifies anglers' preferences for different site attributes (the number of fish caught; the size of fish; environmental quality; the presence of a bag limit; and cost).
- **Fieldwork** in the South West, talking to anglers, charter boat skippers, tackle shop owners, angling clubs and others.

The scale of sea angling in the South West is extensive and is widespread. 240,900 residents of the South West go sea angling and visitors spend 750,000 days sea angling in the region. Sea angling in the South West generates **£165 million of expenditure** within the region each year – £110 million of this is from resident anglers and £55 million is from visiting anglers. These estimates of expenditure per household are higher than some previously published estimates. This expenditure generates a substantial contribution to the region's economy – this contribution will be quantified further in the Invest in Fish South West bio-economic model.

We estimate that **over 3000 jobs** are linked to sea angling in the South West. **Charter boats, mackerel trips and tackle shops** are directly dependent upon sea angling. Charter boats and mackerel trips have a combined turnover of £7.7 million, resulting in 231 jobs. Tackle shops have a turnover of £15.6 million, supporting 245 jobs. Expenditure on bait is difficult to quantify but is estimated to be in excess of £10 million per annum. Hotels, food and drink, fuel and transport, and boat manufacture and maintenance also derive benefit from sea angling, but are less dependent upon it.

The majority of resident anglers' expenditure goes on **gear and boats**. Private boat owners spend a disproportionately large amount, making up 64% of the total spend by resident anglers. Visiting anglers spend substantial amounts on transport and parking, accommodation, charter boat fees and food, as well as their spend on gear and boats.

In addition to this expenditure, recreational sea angling generates a **consumer surplus**, which makes up a substantial portion of the value of angling. Although quantifying this is difficult, it is important and should be taken into account by decision-makers. Our best estimate of consumer surplus for South West resident anglers is £77 million.

It is natural to want to compare the value of recreational sea angling with the value of commercial fishing. However, care is required here, as we discuss in Section 1.4.2.

The **most popular species** to target is bass, with nearly half of all sea anglers choosing it as their favourite. Cod is also popular, as are mackerel, rays and sharks, conger eels and Pollack (Section 4). Mackerel has the highest **angling mortality** (1,238 tonnes per annum), followed by Pollack (964 tonnes). 207 tonnes of bass, 202 tonnes of cod and 140 tonnes of plaice are killed by sea anglers each year. Catch and release is widespread, with over two-thirds of all fish being returned.

The report assesses **how the value of the angling experience would change** as the characteristics of the angling experience change. We find that the catch of the angler's favourite species is an extremely important attribute, until catch levels reach around six fish per day, at which point anglers become satiated. Current catch levels are 2.5 per day for trips targeting bass and 2.9 per day for cod. Anglers are discerning about the species they catch – they would pay only one third as much to catch more fish of non-target species.

Management policies should aim to increase the **size of fish** as well as the **number of fish caught**. Overall, increasing the size of fish will have a larger impact than increasing the catch per day, although this varies by species. In contrast, the presence or absence of rod or bag limits, and the environmental quality of a site are only minor factors in anglers' decisions on where to fish.

It is clear that the **interaction between commercial and recreational interests** does not have to be based on conflict, as only a few species are of interest to both sectors – and both sectors want the same thing: more and bigger fish.

Another key output is the **identification of management options** proposed by sea anglers. There was a strong demand for restrictions on commercial fishing (marine protected areas, gear restrictions, minimum landing sizes, seasonal closures and protection for specific species) and improved enforcement of current legislation. Other suggestions included artificial reefs, maximum landing sizes and increased take-up of catch and release. Anglers also pointed to examples of successful management elsewhere, such as the bass fishery in the Republic of Ireland, the striped bass fishery in the US and commercial fishing restrictions in Australia.

We also present an investigation into which management options anglers rate most highly – all management measures that would restrict commercial fishing were popular. Out of the management measures that would directly impact recreational angling, the most popular were closing areas to all fishing, and increased minimum landing sizes. Sea angling licences (with ring-fencing of revenue) were the least popular option, although opinions were highly diverse on this issue.

Much of the information in this report is designed to provide input into the Invest in Fish South West bio-economic model. To this end we investigate how the level of participation in sea angling might change as the characteristics of the angling experience change, although further work is recommended in this area.

We also investigate the alternative activities for anglers to switch to if sea angling were deemed unacceptable; the most popular alternatives are to continue to go sea angling elsewhere in the UK, to switch to coarse angling, or to take up another outdoor activity.

Participation levels appear to be stable at present. There is potential for growth if the sport improves (including improved fish resources) and through the emergence of saltwater fly-fishing. Threats to the sector include the likelihood of participation levels falling if stocks continue to decline; a possible lack of recruitment and retention of young anglers; and the possibility (considered remote at present) of animal welfare interests threatening angling as an activity.

The Invest in Fish South West project proposes management options that balance economic, social and environmental benefits. The findings from this report contribute to this process and give a clear message that anglers want and merit a say in wider fisheries management, particularly as management becomes more regionalised and ecosystem-based. The report shows that the socio-economic contribution of angling to the South West justifies these demands.

1 Background

1.1 How this report can be used

This report will be of interest to a number of different audiences, each of whom will view the results from a different perspective and with different uses in mind. These audiences include the Invest in Fish South West Steering Group; sea anglers in the South West and elsewhere; Cemare and CEFAS; government agencies; other stakeholders in the fish stocks of the region; and the general public. This report can be used to:

- determine the number and typology of sea anglers in the region;
- ascertain the contribution made by sea angling to the South West's economy, including consumer surplus;
- identify how the value of the angling experience changes as factors such as the size of fish change;
- provide inputs into the Invest in Fish South West bio-economic model;
- identify management options that are proposed by sea anglers;
- help decision-makers to identify which management objectives will match anglers' needs;
- generate a better awareness of sea anglers' opinions and a high level of knowledge.

1.2 The value of sea angling

Until recently, the economic importance of recreational sea angling in the UK has been underestimated or ignored, but this is now changing. There is increasing recognition that angling can benefit society in a number of ways, and that its contribution is substantial. Sea angling's contribution can be categorised as:

- **Direct expenditure by sea anglers**
  Anglers spend large amounts of money on their sport. This feeds into the economy (both locally and on a wider scale), creating jobs, income and economic output. Expenditure itself is not a particularly useful measure of economic impact, but it can be fed into the Invest in Fish South West bio-economic model to generate the true economic impacts. In this report we largely restrict ourselves to quantifying expenditure (Section 3).

- **Businesses that are directly dependent upon sea angling**
  Businesses such as charter boats, tackle shops and angling journalism rely upon sea angling for their survival (Section 3.4).

- **Knock-on benefits to other businesses**
  A number of other industries also derive income from sea angling, but are not wholly or largely dependent upon it for their survival. These include hotels, food and drink, fuel and transport, boat manufacture and maintenance (Section 3.4.3).

- **Induced effects**
  The jobs created by sea angling result in employees with extra wages, much of which will be spent within the region, generating additional benefit to the South West. Again, the Invest in Fish South West bio-economic model will cover this.

- **Consumer surplus**
  This is the additional value generated from anglers' enjoyment, above and beyond their actual expenditure. Consumer surplus can be conceptually challenging for those not used to considering it, but it is an important part of the value of recreational activities and should not be ignored. We explain this further below (see also Section 5).

For decision-makers, the most important factor is the **marginal** value of sea angling – how much its contribution would change if the quantity or quality of sea angling changed – rather than the absolute value. This is discussed in Section 5.3. We should also consider the likely **substitution effects** – as with any activity, if people were to stop sea angling then they would do something else instead, which would probably also generate economic value (Section 7.2). Note that some of sea angling's value takes place within the South West region, but the rest leaks out of the region, through imports, taxation and so on (see Section 3.2).

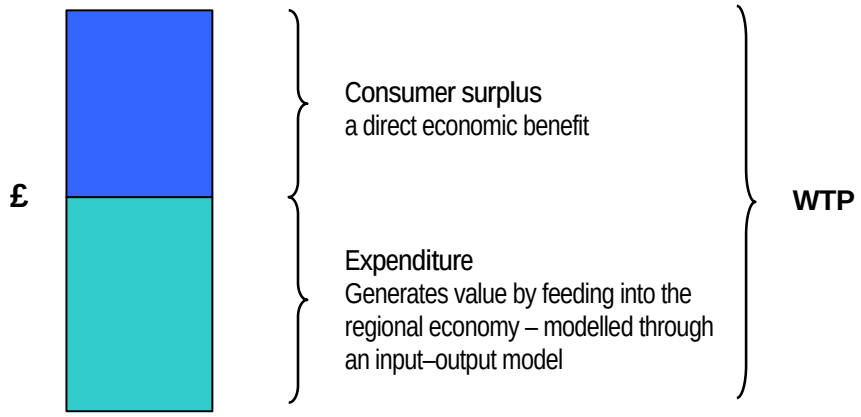
1.2.1 Consumer surplus

Consumer surplus is unrealised in monetary terms (no money changes hands), but nevertheless forms an important part of the economic contribution of sea angling. In economic terms it can be thought of as analogous to the profits generated by a business activity, as it represents the "surplus" benefits that are generated above and beyond the expenditure associated with the activity.

Another important concept here is **Willingness to Pay** (WTP). WTP is the maximum amount an angler would be prepared to pay to go angling, and is equal to the sum of actual expenditure and consumer surplus. Consumer surplus is therefore the difference between the maximum that anglers would be willing to pay, and the amount they actually do pay. Anglers benefit from the fact that their angling experience costs less than their maximum WTP; in effect they are saving this much money. This is a tangible economic benefit, as they can use the money saved to purchase other goods and services. Consuming any good or service will generate consumer surplus, from buying a tube of

toothpaste to hiring an emergency plumber. It appears to be particularly important here.

Figure 1.1. Relationship between expenditure, consumer surplus and WTP



1.2.2 Comparisons with commercial fishing

It is natural to want to compare the value of recreational sea angling with the value of commercial fishing – indeed, it is essential that decision-makers in Invest in Fish South West are given information on this comparison, so that they can make management decisions that fully allow for the contributions of both sectors.

However, care is required here. In particular, it is not valid to directly compare the "headline figures" which are often quoted for the two sectors – expenditure on sea angling and the value of landings for the commercial fleet, for a number of reasons:

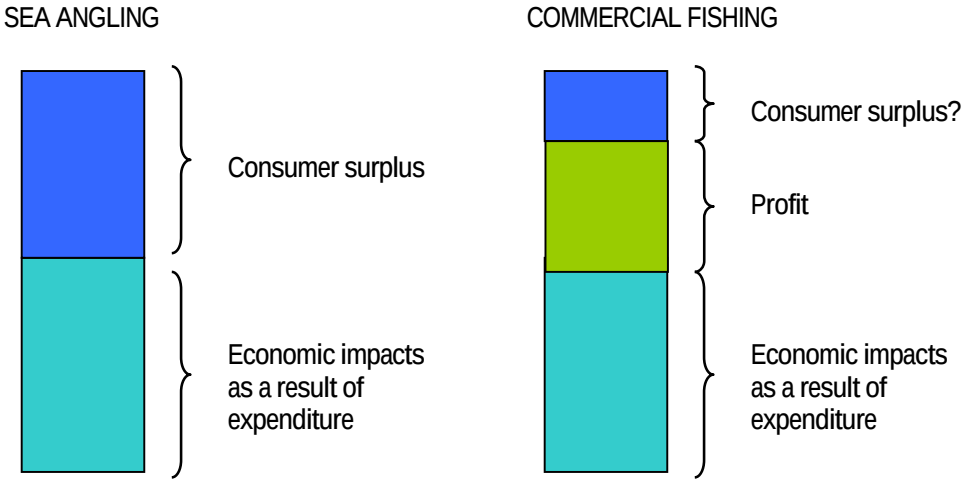
- Expenditure by sea anglers can be considered to be analogous to the expenditure made by commercial fisherman (on their boats, fuel, wages and so on). However, as detailed above, expenditure is not a particularly useful measure of economic impact; we should instead be considering the impact on economic income and output, and on employment.
- Similarly, consumer surplus may be compared to the profits generated by commercial fishing. But might commercial fishing also generate consumer surplus? If it is true that commercial fishermen prefer to continue to be fishermen (rather than taking alternative employment) above and beyond the profits they generate, then this could equate to consumer surplus. Further studies are required to investigate this. Our opinion is that this consumer surplus probably does exist, but is probably significantly smaller than the consumer surplus for recreational angling.
- The two sectors do not always target the same species, so are not always in conflict with each other. It is probably most appropriate to single out those species where conflict for stocks does occur, and make a

comparison for each species separately. Key species in this regard include mackerel, cod, bass and plaice (see Section 6.1).

- For decision-makers, the key variable is the *marginal* impact of a management policy (taking into account substitution effects), rather than the absolute value of the sector.
- The comparison ignores the social and environmental impacts of the two sectors.

The components of value for sea angling and commercial fishing are summarised in Figure 1.2. Further studies are required to allow us to make a more reliable comparison between the two sectors, and to encourage a wider understanding of the issues involved in making such a comparison.

Figure 1.2. The components of value for sea angling and commercial fishing



1.3 Existing studies

Although the literature on the value of sea angling is rather sparse, a variety of reports and information sources have been of use in informing our work. Generally speaking, more studies exist on the value of freshwater angling than of sea angling. Much of the relevant work comes from the US, where the economic impact of recreational fishing is readily acknowledged, and incorporated into management decisions.

Of particular relevance to the present study is "Research into the Economic Contribution of Sea Angling" commissioned in 2004 by Defra and authored by Drew Associates. This is discussed in more detail in Section 1.5.1, and is hereafter referred to as **the Defra report**. Other sources include:

1. **The Economic Impact of Game & Coarse Angling in Scotland**
   Scottish Executive

A database of angling effort and expenditure. Estimates the expenditure lost if angling ceased, knock-on impacts on output (£100 million), income (£50 million) and employment (2800 jobs), using a regional input–output model.

2. **The Economic Importance of Marine Angler Expenditures in the United States**
   NOAA Professional Paper NMFS 2 by S. Steinback, B. Gentner, J. Castle, 2004
   A detailed economic model of the impacts of sea angling in the USA. Nationwide, recreational saltwater fishing generated over $30.5 billion in sales in 2000, nearly $12.0 billion in income, and supported nearly 350,000 jobs – a *huge* economic impact. The largest components of expenditure were on boats, boat maintenance and rods and reels.

3. **A Database of Sport Fishing Values**
   Economics Division, Fish and Wildlife Service, US Department of the Interior, http://www.indecon.com/fish/default.asp
   An extensive review of the available literature on the economic valuation of sport fishing resources across the US. Included in the database is welfare estimate information from 109 travel cost and contingent valuation studies.

4. **A Bio Economic Review of Recreational Angling for Bass (Dicentrarchus labrax)**
   B. Dillon, Scarborough Centre for Coastal Studies, for East riding of Yorkshire council
   Summarises the literature relating to recreational sea angling, and examines the fishery for bass.

5. **NFSA Conservation Group's mid-long term plans**
   NFSA, 2003
   Indicates the scale and typology of sea angling, and the political and institutional framework etc.

6. **Wales Fisheries Strategy**
   Nautilus Consultants, for National Assembly for Wales, 2000
   A report spanning marine, coastal, estuarine, river and lake fisheries, dealing with commercial fishing, recreational angling and aquaculture, to help develop integrated development measures. The value of recreational sea angling in Wales is estimated to be £28 million.

7. **Social & Economic Value of Recreational Fishing**
   EAA, 2002
   Reports on surveys in nine countries (Nordic countries and central European countries). Most of these studies estimate numbers of anglers, and some look at spend and demographics. The Austrian study considers motivations for fishing.

8. **Public Attitudes towards Angling; Environmental Valuation Studies & Guidance**
   Environment Agency
   A variety of reports and guidance.

9. The National Recreational and Indigenous Fishing Survey (Australia)
Tasmania University
"Nationally consistent & comparable" fishery statistics for the non-commercial components of Australian fisheries. Estimates catch, effort, expenditure and attitudes to management.

10. Other academic papers
Numerous papers exist on recreational fishing. Some use environmental valuation techniques to estimate willingness to pay (WTP) for the angling experience. Others present case studies, and some focus on the process for engaging recreational fishermen. Examples include:

- "Angling management organizations: integrating the recreational sector into fishery management" *J. G. Sutinen and R. J. Johnston, 2003*
  Ways to reduce conflicts. Suggests forming "angling management organizations".
- "Economic Evaluation of Recreational Fishery Policies" *Rudd et al, 2002*
  Techniques for valuing the non-market benefits of recreational fishing.
- "The LEM fishery simulation model" *L.G. Anderson, E. Maruyama and M. Middelkoop, 2002. In: L.G. Anderson (Ed), Report on the bio-economic modelling workshop, 23–25 July 2002, Washington DC, ASMFC Committee on Economics and Social Sciences*
  Estimates Willingness To Pay and cost per trip from a survey of recreational fishers. Derives a supply curve of recreational fishing effort as a function of catch.

There is increasingly a desire to incorporate recreational fishing into management decisions. The **Prime Minister's Strategy Unit** report "Net benefits: A sustainable and profitable future for UK fishing" (March 2004) states that:

- *The recreational fishing sector is a potentially high contributor to local economies in coastal areas.*
- *There is a need for better data on the value and contribution of this sector.*
- *Fisheries management policy should recognise that sea angling may, in some circumstances; provide a better return on the use of some resources than commercial exploitation.*

Liz Richardson, at the School of Ocean Sciences, University of Wales, Bangor, is currently undertaking a survey of sea anglers in Wales. This includes consideration of sea anglers' expenditure.

We also note the proposed **RECFISH** research programme (*EAA & EFTTA*), which is seeking funding for an investigation into the numbers and socio-

demographics of anglers across Europe, as well as their spend and potential for growth.

1.3.1 The Defra report[1]

The report was commissioned by Defra and undertaken by Drew Associates Ltd in April–October 2003. Its aims overlap with the aims of the present study to a certain extent, as it provides economic information on sea angling; identifies the important local centres for sea angling in England and Wales; assesses the economic impact of sea angling; and quantifies the value of the experience to anglers.

It differs from the present study in that it is national rather than regional in scope, and so does not provide detailed information on the South West. In addition, it does not focus on management options, on interactions with the commercial fishing industry or on environmental impacts. The present study adds to our knowledge in all of these ways, provides a second set of data against which the Defra report's results can be compared, and is in general more tightly focused on providing information that will be of specific use to the Invest in Fish South West project.

Information sources included:

- A household Omnibus survey, in order to estimate the number of people engaged in sea angling in England and Wales (10,200 households interviewed);
- An angler survey, in order to understand better their activities; the utility associated with the activity and their expenditure patterns (900 anglers surveyed, partly face-to-face, and partly by postal survey of members of angling clubs); and
- A business survey of suppliers to sea anglers in order to estimate the impacts on employment and incomes from anglers' expenditure (130 businesses surveyed).

Rather than duplicating their work, we use results from the Defra report wherever this is appropriate; in particular, we use the results of the household Omnibus survey extensively, as this is the most reliable unbiased representation of angling activity that is available. For some other variables we compare our results against the Defra report to check for consistency (for example, see Section 3.2.4). The report's results include:

- Numbers of sea anglers in the UK (1.45 million anglers, in 1.1 million households), split between shore anglers (54%), private boats (23%) and charter boats (22%);
- The mean number of days angling per household per year (11.3 days; but 14.0 days for residents of the South West);

[1] "Research into the Economic Contribution of Sea Angling", Drew Associates for Defra, 2004.

- Average catch per trip (around 10 per trip) and the proportion retained (32–39%);
- Trends in the number of fish caught and their size (both have decreased);
- Numbers of charter boats and species targeted by port, as well as shore angling locations;
- Discussion of four case studies: Weymouth, Whitby, Hastings and Anglesey.

The report estimates that expenditure on sea angling in England and Wales is **£538 million** per annum. The study also presents a range of possible values for consumer surplus; it is an additional **£111–753 million** per annum. Clearly there remains substantial uncertainty over the size of the consumer surplus, but we can say for certain that there is a substantial economic value here. Angling expenditure by visitors (travelling more than 50 miles from home) makes up 36% of the national total.

First round impacts on spending, jobs and suppliers' income are estimated; sea anglers' support around **19,000 jobs** in the supply sector, and the estimated benefit to suppliers is around £71 million. Boat anglers have the largest impact.

Finally, a choice experiment was used to estimate the values associated with changes in the diversity and quality of the angling experience. Results included:

- Were anglers willing to pay more for larger fish? *Yes*
- … and for species different to those caught close to home? *Yes*
- Were anglers willing to pay for more fish? *Maybe – only true for shore anglers*

2 Methodology

The information in this report is derived from four main sources:

- A socio-economic study of the businesses that derive income from sea angling, and the economic linkages between these.
- Sea angler surveys, which provide information on anglers' expenditure, demographics, and the species caught.
- A choice experiment that investigates and quantifies anglers' preferences for different site attributes (the number of fish caught; the size of fish; environmental quality; the presence of a bag limit; and cost).
- Fieldwork in the South West, talking to anglers, charter boat skippers, tackle shop owners, angling clubs and others.

Section 3 and Annex A present results for anglers' expenditure levels, along with the outcomes of the socio-economic study, to build up a picture of the economic impact of sea angling in the region.

Section 4 and Annex B contain the remaining results from our survey of sea anglers. They discuss the demographics of our sample and the results for the species caught, and discuss some potential sources of bias in these results.

Section 5 and Annex C introduce and discuss the choice experiment results.

Sections 6 to 8 provide a discursive look at the issues involved, pulling together some of the implications of the earlier sections, and incorporating information obtained from our more informal conversations during our fieldwork. Finally, Section 9 draws together our results and reaches conclusions as to the uses to which they can be put.

2.1 The socio-economic impact of sea angling

This study quantifies the scale and typology of sea angling in the South West. As well as using key results from the Defra report's household survey, we also had access to a database of charter boats and tackle shops, which was supplied by Malcolm Gilbert; a number of sea angling websites, including the NFSA and Professional Boatman's Association sites, plus www.yell.co.uk and directories of charter boats (www.deepsea.co.uk, www.bristolchannelangling.co.uk, www.charter-skippers.co.uk, www.charterboats-uk.co.uk) and tackle shops (www.eftta.com/english); listings in magazines (including Sea Angler magazine); and, most importantly, fieldwork and interviews in the region (see Section 2.4). South West tourist board data are used to help quantify expenditure by visiting anglers.

We also assess the socio-economic impacts of sea angling. We combine our survey results on anglers' expenditure, with the results of the above study of the

scale of sea angling and its associated businesses, to piece together as reliable a portrayal as possible of how sea angling impacts on the regional economy.

Further information on the methodology employed is given as the results are presented in Section 3.

2.2 Sea angler surveys

Face-to-face and telephone surveys were carried out with over 500 anglers, with questions asking about anglers' demographics, expenditure (split between a number of categories), species targeted and caught (catch levels, return rates and trends) and their opinions on various potential management strategies.

Six interviewers from the University of Plymouth plus Keith Lawrence and Fiona Nimmo of Nautilus Consultants carried out the face-to-face interviews. Interviewers travelled widely to ensure that all parts of the region were sampled. Interviews took place at shore angling marks, angling competitions and in tackle shops. For the questionnaires undertaken in tackle shops, we used a cut-down version of the questionnaire, which was more practical for this purpose. The choice experiment was included as the final section of the questionnaire in all cases. The full questionnaire is presented as Annex D.

Abi Reader, Fiona Nimmo and Myriam Baete undertook the telephone surveys. Respondents were asked the same questions as for the face-to-face survey, but without the choice experiment section. Respondents were selected at random from the list of NFSA members. Malcolm Gilbert contacted these members in advance of our call, to ensure they were happy for us to call them.

Table 2.1. Numbers of interviews completed[2]

	Expenditure, species caught, management opinions	Choice experiment	TOTAL
Face-to-face: full	138	136	**138**
Face-to-face: cut-down	0	220	**220**
Telephone	176	0	**176**
Total	**314**	**356**	**534**

[2] Note that whilst every attempt was made to sample a broad range of sea anglers, these samples are not necessarily representative of the sea angling population as a whole. The impacts of this are discussed where relevant throughout this document – for example, see Section 4.3.

2.3 Choice experiment

An important output of our work is to provide an indication of how anglers will be affected by changes in the quality of sea angling in the South West. We therefore need a way to quantify anglers' preferences for various different attributes of the sea angling experience – for example, is it most important that catches increase? Or that sizes of individual fish increase? Or is the general environmental quality of greater interest?

These preferences were elicited through a choice experiment, a branch of environmental valuation that gives an empirically sound method to quantify respondents' trade-offs between these different attributes.

We also wanted to find out more about anglers' opinions on various management options. The choice experiment allows us to do this indirectly, through asking questions on anglers' preferences regarding the **outcomes** of these options. By choosing our attributes carefully, we gain insights into which management options will be most favourable for anglers.

We had an ideal situation for carrying out the experiment, in that our audience was knowledgeable about their activity, they understand the issues reasonably well; and we were speaking to them face-to-face. 358 anglers were presented with the choice experiment, and all but two provided usable responses.

2.3.1 Attributes chosen and their levels

It was critical to design the experiment carefully, to ensure we gathered the right information, and produced results that will represent the factors that actually underpin anglers' decision-making process. The process works by creating hypothetical angling sites with different **levels** of various site **attributes**, and asking anglers to choose between them.

We gave our choice of attributes very careful consideration, based on an initial scoping meeting with several sea angling representatives. We also consulted with the designer of the choice experiment in the Defra report, Professor Ken Willis of Newcastle University. Perhaps the most important consideration when choosing the site attributes to include is that all of the most important attributes influencing anglers' choice should be included. A maximum of around five or six attributes can be included in order for the experiment to be workable. The attributes chosen are summarised in Table 2.2.

It was explained to anglers that cost per day referred to the "usual" costs of visiting an angling site, such as travel cost, parking, and bait and so on – and that it does *not* refer to a policy measure, such as an entrance fee or a licence. It is essential to include cost as an attribute, so that results for the other attributes can be compared to this, and hence converted into monetary equivalents. The process produces estimates of anglers' Willingness to Pay for a change in each attribute (see Section 1.2.1).

We started by asking the question: "*What is your most favoured species to target when sea angling in the South West*?", so that we would be able to segment anglers in this way. Average catch per day is split between the angler's "favourite species" and "other species"; to investigate how discerning anglers are about the species they catch. The presence or absence of a bag/rod limit was tested, to give an indication of whether the presence of a management measure was important to anglers – are they only interested in the *results* of management options, or is the *method* of getting there important as well? Environmental quality was left broad in definition – we explained that this could include anything from water quality to aesthetic appeal and the quality of facilities available. The full explanatory text is included in Annex D.

Each attribute is systematically varied between a number of different levels, so we can investigate the impact of changing between these levels. These are also summarised in Table 2.2.

Table 2.2. Attributes used in the choice experiment, and their levels

Attribute	Levels
Average catch per day: Favourite Species	"Less than 1" / 4 / 8 / 12 / 16
Average catch per day: Other species	"Less than 1" / 4 / 8 / 12 / 16
Size of fish	"No change" / "50% increase"
Bag/Rod Limit	"Yes" / "No"
Quality of the surrounding environment	"Satisfactory" / "Excellent"
Cost per day	£10 / £20 / £40 / £60 / £80

These levels were combined in 60 different ways to produce 60 hypothetical angling sites. These were paired up and then combined into three sets of 10 pairs. Each angler was presented with one of these three sets, chosen at random.

2.3.2 Process

Respondents were presented with a choice card containing three options, and were asked to choose one of them. An example is shown in Figure 2.1.

The three options consisted of two hypothetical angling sites and a "do something else" option. Anglers were asked to choose which site they would choose to visit on their next trip. The two sites differ in terms of the levels of each attribute included. The anglers were told that these are the only two sites

available to them. If neither site was attractive to them, they could instead decide to do some other activity instead of going sea angling (Option C).

This process was repeated 10 times for each respondent. We also provided initial text to help interviewers explain the experiment to respondents; this is a critical part of the process, as it is essential that respondents fully understand the task they are being asked to perform, and the issues they are assessing (see Annex D).

The method relies upon respondents understanding the task and answering rationally – and they must interpret the task in the way that we intended them to. In particular, there is a question mark over whether all respondents fully considered Option C (do something other than sea angling) in their decisions (see Section 5.4).

2.4 Fieldwork

We visited the South West four times to gather anglers' opinions, and to learn from those who really know what's going on in the region. These conversations were undertaken with a loose structure in order to generate as wide a range of information and opinions as possible. Conversations covered interviewees' opinions on management strategies, interactions with the commercial fishing industry, environmental impacts, trends for fish stocks and angler numbers, and the economic impacts of sea angling.

Specific questions were asked about the finances of charter boats and tackle shops, and the number of such businesses in the local area, which fed into the socio-economic study we undertook. As is common with such studies, the contribution made by local knowledge was invaluable, and was far superior to most published lists. We travelled widely throughout the region, speaking to:

- Charter boat skippers
- Tackle shop owners
- Sea angling clubs
- A variety of individual anglers, both in person and by telephone
- Angling journalists and photographers
- Ships' chandlers
- Hotels specialising in the sea angling trade

The results of the fieldwork influence all of the sections of this report. They have a particularly important role in shaping the discussions in Sections 3, 6, 7 and 8. We also carried out a small amount of additional fieldwork towards the end of the study, to ground-truth our quantitative results with angling clubs and tackle shops.

Figure 2.1. An example of a choice card

Site A	
Average catch per day: Favourite Species	4
Average catch per day: Other species	8
Size of fish	50% larger
Bag/Rod Limit	No
Quality of the surrounding environment	Excellent
Cost per day	£20

Site B	
Average catch per day: Favourite Species	12
Average catch per day: Other species	8
Size of fish	No change
Bag/Rod Limit	No
Quality of the surrounding environment	Excellent
Cost per day	£60

Option C
Do something other than sea angling

3 The socio-economic impact of sea angling

The socio-economic component of this report combines qualitative and quantitative information on anglers' expenditure, and discusses the industries that benefit from sea angling in the South West. The expenditure information contained here will feed into the Invest in Fish South West bio-economic model, to derive the value added and jobs generated from sea angling. Annex A contains further details and technical information on these issues. Consumer surplus is ignored in this section as is it dealt with in Section 5.

3.1 Scale and typology of the sector

3.1.1 Participation levels

The Defra report found that there are **184,400 households** in the South West that participate in sea angling. As there is an average of around 1.3 anglers in each participating household, this equates to an estimate of **240,900 individual sea anglers** who live in the South West. In addition, visiting anglers make a significant contribution to the region's economy; we estimate that **750,000 days** are spent sea angling by **visitors** to the South West (see Section 3.2.3).

Only a small proportion of these anglers are members of clubs: Saunders *et al*. (1998) indicate that only 10–25% of all sea anglers are members of the National Federation of Sea Anglers (NFSA) or National Federation of Anglers and their member organisations.

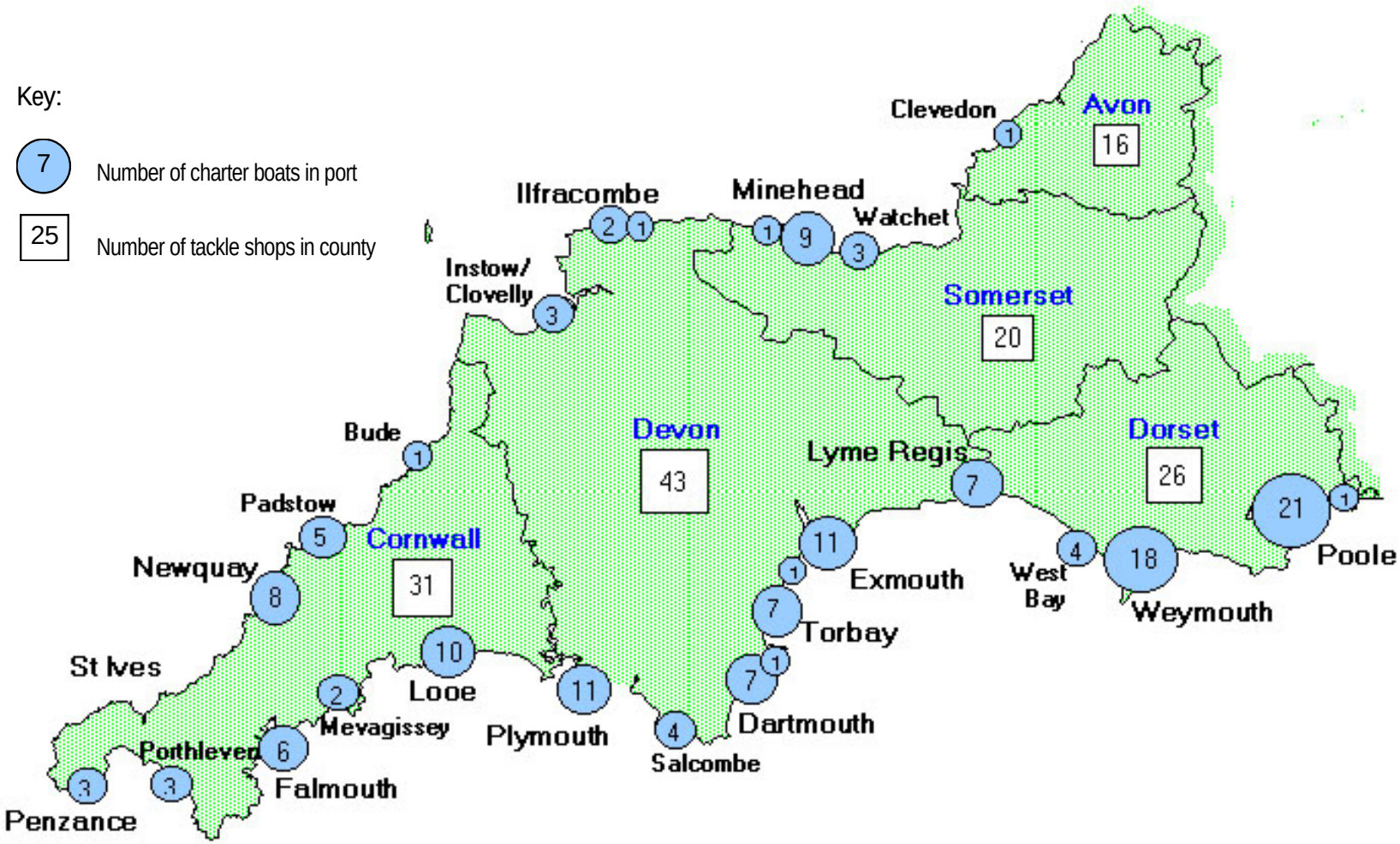
3.1.2 Geographic distribution of sea angling in the South West

Sea angling takes place all around the coastline of the region (see Figure 3.1). The **South coast** provides a diverse range of angling opportunities, which are amongst the very best on offer in the United Kingdom. This includes:

- the largest charter boat ports in the UK, Weymouth and Poole;
- significant fleets at Falmouth, Looe, Plymouth, Dartmouth, Torbay, Exmouth and Lyme Regis, as well as numerous smaller ports;
- charter boat trips to the Channel Isles and the Scilly Isles;
- boats making mackerel trips from a number of ports, especially in tourist resorts such as Torquay;

- large numbers of private boat owners, moored in many harbours and marinas including those listed above, plus Mevagissey, Salcombe, Christchurch and others;
- a vast array of shore fishing marks all along the coastline.

Figure 3.1. Distribution of charter boats and tackle shops around the South West



The **North coast** also offers charter boats, albeit in smaller numbers, and fishing in the Bristol Channel. Fewer large fish are found here, but this is perhaps compensated for by the shorter distances required to reach a fishing site, and the different composition of species on offer. There are:

- significant fleets at Newquay and Minehead, as well as numerous smaller ports,
- boats making mackerel trips from a number of ports, especially in tourist resorts such as Newquay,
- large numbers of private boat owners, moored in many harbours and marinas including those listed above, plus Padstow, Ilfracombe, Clevedon, Portishead and others,
- a wide range of shore fishing marks all along the coastline.

3.2 Expenditure

This section explores the expenditure feeding into the South West economy as a result of sea angling in the region. As Invest in Fish South West focuses on sea angling within the region, we do not include any expenditure made within the South West that results from sea angling carried out outside the region (for example, if a South West based tackle manufacturer sells to anglers in Wales, this would not be included here). Equally, we do not include any expenditure that results from sea angling in the South West, but which is spent in other regions of the UK.

The total expenditure feeding into the South West economy as a result of sea angling in the region is **£165 million**. This is split between resident anglers and visiting anglers.

3.2.1 Expenditure by residents of the South West

By multiplying the numbers of households from the Defra report by average annual expenditures derived from our survey results, we find that the total spend on sea angling by anglers resident in the South West is **£190 million** per annum. 184,400 households in the South West contain at least one person who participates in sea angling, so the mean spend per *participating household* is **£1028** per annum. 64% of this comes from private boat anglers, much of it the fixed cost of buying their boat. Shore anglers contribute 25% of total expenditure, whilst charter boat anglers contribute only 11% – in part because of the relatively low number of trips they make each year. Table 3.1 shows these splits, and Annex A explains the methodology used to derive these results.

Table 3.1. Expenditure by residents of the South West, by angling type

	Number of households[3]	No. days angling p.a. per h/hold[2]	Annual spend		% of spend
			Per participating household	Total (£m)	
Shore	101,337	16.6	£469	48	25%
Charter	39,870	6.1	£517	21	11%
Private boat	43,193	15.1	£2813	122	64%
Total	**184,400**	**14.0**	**£1028**	**190**	**100%**

To find the total expenditure *in the South West region* by resident anglers, we need to subtract the spend made outside of the region by anglers resident in the South West.

3.2.2 Proportion of resident anglers' expenditure that is outside the South West

The proportion of resident anglers' expenditure that takes place outside the South West region is estimated from our fieldwork and discussions with individual anglers. We do not use the results derived from our survey for expenditure outside the region, as we believe these to be significant underestimates.

Our survey tells us that resident anglers make 88.6% of their trips, and 88.4% of their expenditure, within the South West. This close match supports the hypothesis that many respondents interpreted the question as "expenditure relating to South West trips" rather than "expenditure made in the South West". We believe that this resulted in respondents understating the expenditure made outside the region, especially on large capital items such as boats.

Our two most important assumptions are:

- 50% of expenditure on boats is within the South West
  Many anglers buy their boats from a national dealer, and may travel large distances to get a good deal; spend within the region is often limited to fuel, maintenance and items of equipment, sometimes including the boat's engine.
- 60% of expenditure on gear is within the South West
  Large items may be bought though mail order, or again by travelling to get a better deal. Smaller items, most notably bait, are usually bought locally.

The full set of assumptions is detailed in Annex A4. We allow for charter boat anglers making a higher proportion of their expenditure outside the region, as

[3] Source: The Defra report. Variances and confidence intervals are not supplied for these data in the Defra report.

they are more likely than private boat or shore anglers to travel outside the region.

We calculate that resident sea anglers spend **£110 million** in the South West, which equates to **58%** of their total spend.

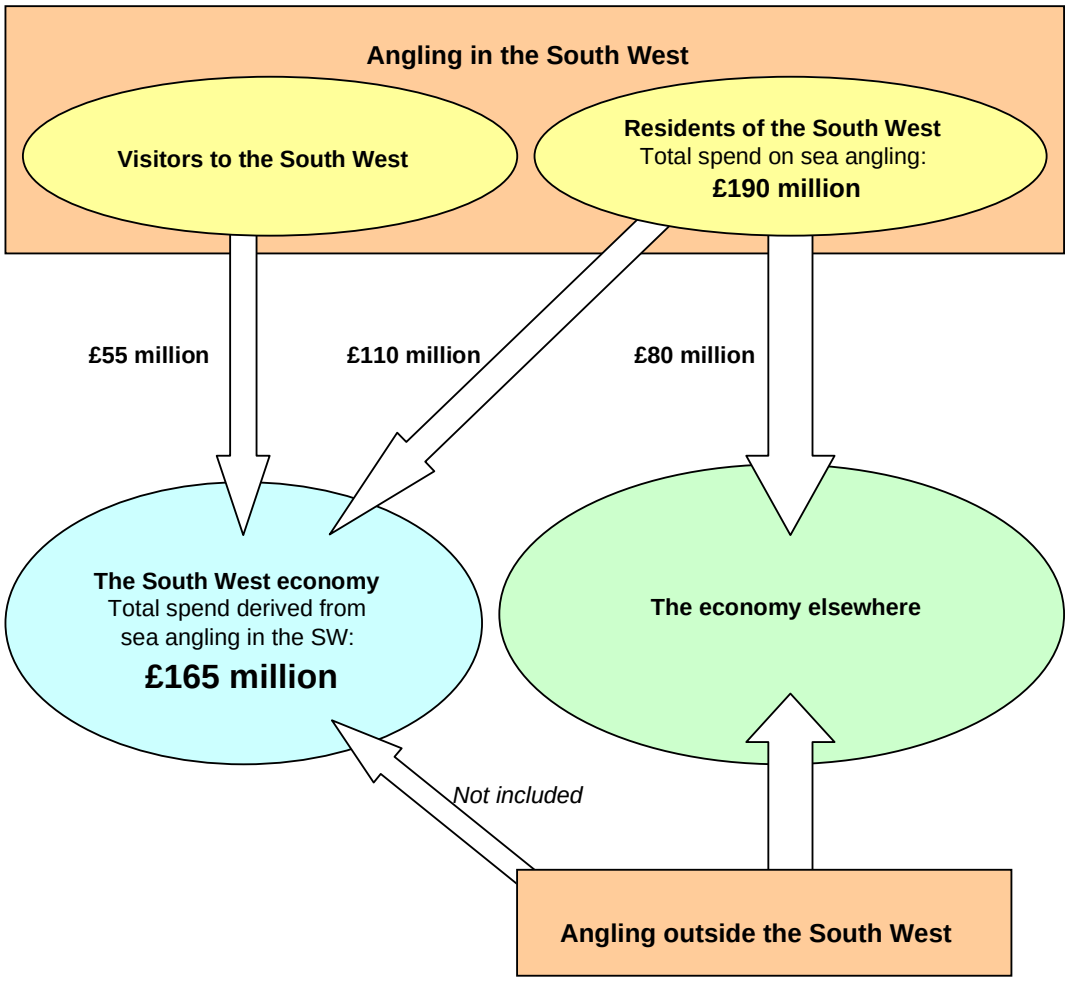
3.2.3 Expenditure by visitors

Tourist board data[4] indicates that 600,000 visitors to the South West participate in sea angling. We assume that this translates to 750,000 days' sea angling (assuming that each visitor spends an average of 1.25 days' sea angling), and that the average spend per day in the South West is the same as for our sample (£73.51). Again, these are strong assumptions, and should be treated with caution. The latter assumption is supported by the finding, in the Defra report, that visiting anglers spend similar amounts per day to resident anglers.

We calculate that visiting sea anglers spend **£55 million** in the South West. Figure 3.2 summarises the total expenditure feeding into the South West economy as a result of sea angling in the region, and where it comes from.

[4] South West Tourist Board visitor information as part of United Kingdom Tourism Survey 2003.

Figure 3.2. Expenditure in the South West that is derived from sea angling in the region (£ million)



3.2.4 Comparison with previously published estimate of sea anglers' expenditure

This study concerns itself only with expenditure in the South West that is derived from sea angling in this region and hence does not capture the linkages with other regions. Care is therefore required when comparing our headline results with estimates of expenditure derived from a wider region (for example, the Defra report assesses all expenditure by sea anglers resident in England and Wales). However, it *is* interesting to compare our results for expenditure per participating household in the South West with the Defra report's estimates of expenditure per participating household in England and Wales.

The Defra report found that the total expenditure by sea anglers in England and Wales was £538 million per annum, with a total of 1.1 million households

containing at least one person who participates in sea angling. This translates to an average spend of **£489** per participating household p.a. In contrast, our study derived an average spend of **£1028** per participating household p.a. – more than double the previous estimate. We suggest three possible reasons for this difference:

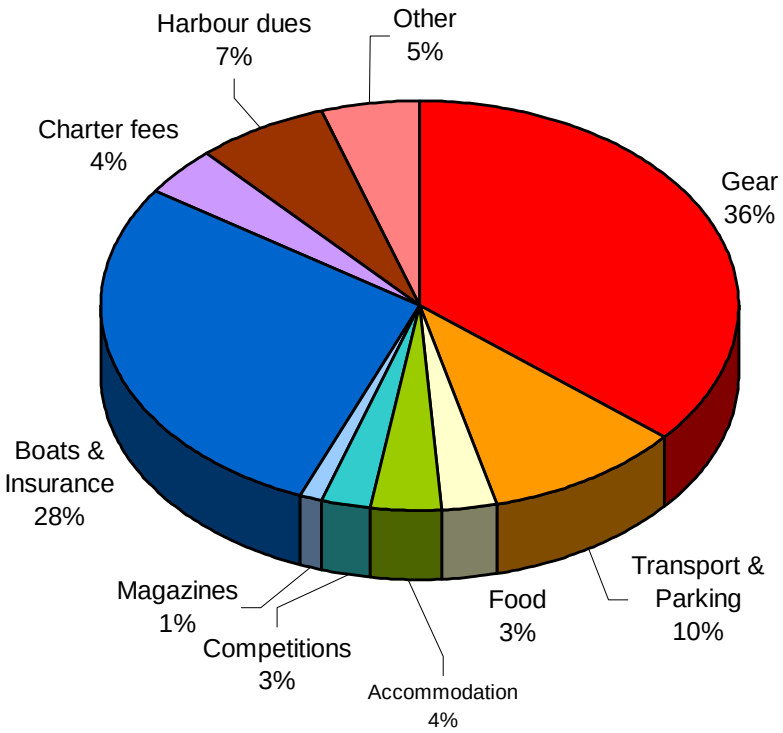
1. Anglers resident in the South West go angling 24% more often than anglers elsewhere;
2. We believe that the Defra report underestimates expenditure due to a methodological difference in how to account for bias in the sample;
3. The Defra report may slightly underestimate expenditure because fewer prompts were given for the different categories of expenditure than in the present study.

Annex A5 explains these reasons in more detail. The second reason above is believed to be the major source of the difference.

3.3 Breakdown of expenditure by category

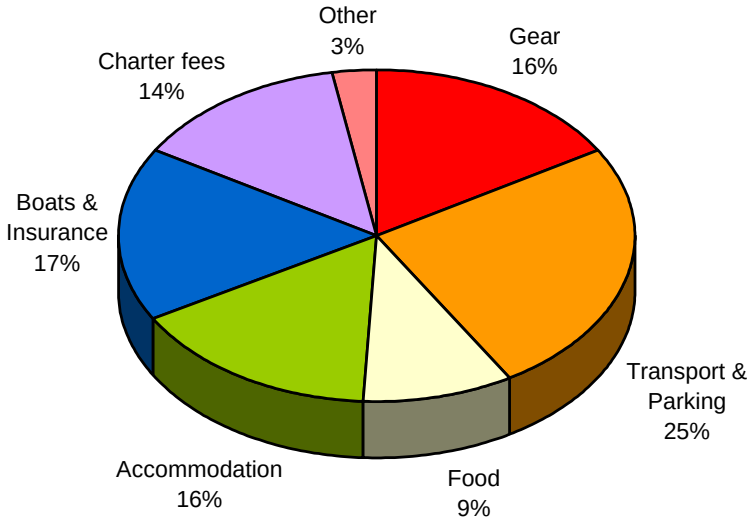
Figures 3.3 and 3.4 show how expenditure in the South West on sea angling is splits between different categories, for resident and visiting anglers respectively. For resident anglers, the largest contributor is gear purchase and rental (including rods, reels, clothing, bait etc.) which is 36% of the total. Expenditure on boats (including insurance, maintenance & fuel) accounts for 28%. Transport and parking makes up a further 10%. These splits vary considerably between shore, charter boat and private boat anglers. Annex A6 presents this data in more detail.

Figure 3.3: Expenditure in the SW by category



The breakdown of spend by visiting anglers is sourced from the Defra report. As might be expected, visiting anglers spend substantial amounts on transport and parking (25%), accommodation (16%), charter boat fees (14%) and food (9%), as well as their spend on gear and boats.

Figure 3.4. Expenditure in the South West by category visiting anglers (total £55 million)



3.4 Associated industries

This section starts by describing and quantifying the two main industries that depend wholly or largely upon sea angling in the South West – **charter boats** and **tackle shops**. We then summarise the other industries that also derive income from sea angling in the South West, but which are less dependent upon it.

3.4.1 Charter boats and mackerel trips

146 charter boats operate within the South West region, offering trips targeting a variety of species on reefs, wrecks and other fishing grounds. Much of this activity takes place in inshore areas, but some boats go further afield to fish specific wrecks, and to offer trips to the Channel Isles and the Scilly Isles. 96 of these boats are full-time operators, who offer trips throughout the year (although in winter trips are heavily dependent on the weather, and may be restricted to weekends). The remaining 50 boats are part-time, concentrating on the high-season in summer, and whose skippers have a second job to supplement their income.

Charter boat customers tend to be committed anglers who want to experience high quality angling, and to benefit from the skipper's experience. This includes a high proportion of visitors to the South West, often through angling clubs. Trips are commonly for a full day, although half-day and evening trips are sometimes available. Some boats offer multiple-day trips with overnight stays, for example in the Channel Isles. They are priced in two different ways:

- hiring the entire boat for a party of anglers, or on occasion for a wealthy individual angler, for between £220 to £400 per day, depending on the type and location of fishing undertaken
- a charge per customer of around £30–40 per day – skippers will usually require a minimum number of anglers on the boat before they are prepared to go out

In addition there are **51** boats which concentrate on mackerel fishing. We distinguish these from the "charter boats" by calling them "mackerel trips". Most of their custom comes from holidaymakers and casual anglers, who are attracted by the low prices and high likelihood of catching a fish easily. Trips tend to be between 1.5 and 3 hours long, and stay close to shore. Prices vary between £5 to £15 per customer, depending on the length of the trip and the port operated from.

Annex A7 describes how we estimate the turnover associated with each of these types of trip, as well as the profit generated and the level of employment supported, expressed in full-time equivalents (FTE). Table 3.2 presents our results. Our results for turnover and employment are closely consistent with that in the Defra report.

Charter boats and mackerel trips have a combined turnover of £7.7 million. This activity supports 232 FTE jobs. The bulk of this is generated by the charter boats, with mackerel boats contributing less than a quarter of the turnover.

Table 3.2. Turnover, profit and employment from charter boats & mackerel trips

		Per boat		Total	
	Number	Turnover (£)	FTE	Turnover (£m)	FTE
F/T charter boats	96	45,000	1.3	4.3	125
P/T charter boats	50	31,500	0.9	1.6	46
Mackerel boats	51	36,000	1.2	1.8	61
Total	**197**			**7.7**	**232**

The above estimate of turnover (£7.7 million) is lower than the £11.8 million expenditure on charter boats in the South West, as derived from responses to our angler survey (Section 3.3 and Annex A6). This could be because

respondents were including items other than charter boat fees in their responses to this category; or it could suggest that the expenditure figure is an overestimate.

3.4.2 Tackle shops

There are 136 tackle shops in the South West that deal in the sea angling trade. Some are primarily aimed at sea anglers (particularly those in coastal areas), whereas others generate most of their business from freshwater angling.

Annex A8 describes how we estimate the turnover per shop, as well as the level of employment supported. Our result for turnover appears to be consistent with that in the Defra report. We find a slightly more conservative estimate of employment levels than in the Defra report.

Table 3.3 presents our results. Tackle shops in the region have a turnover of £15.6 million. This activity supports 245 FTE jobs.

Table 3.3. Turnover, profit and employment from tackle shops

		Per shop		Total	
	Number	Turnover (£)	FTE	Turnover (£m)	FTE
Tackle shops	136	114,770	1.8	15.6	245

The above estimate of turnover (£15.6 million) is lower than the £48.8 million expenditure on gear in the South West, as derived from responses to our angler survey (Section 3.3 and Annex A6). Part of this difference is because respondents do not spend all of their "gear" expenditure in tackle shops.

A substantial proportion of this expenditure is on bait. Although bait is usually (but not always) bought through tackle shops, we believe that very little of this is included in the above estimate of turnover, as bait is usually either recorded as a separate business, or not recorded at all (see Section 3.4.3). This alone explains a substantial portion of the difference between the figures. The expenditure estimate will also include items such as clothing, footwear, photographic equipment and other items that would not necessarily be bought in a tackle shop. Some respondents may also have included expenditure on expensive boat equipment such as GPS, fish finders, radios, safety equipment and so on.

A second possibility is that resident anglers make a lower proportion of their total spend within the South West, lower than the 60% we assume in Section 3.2.2. However, as the estimate above may include exports to anglers outside the South West, this in part counteracts this argument.

If these explanations are insufficient to explain all of the difference then this suggests that our expenditure figure is an overestimate.

3.4.3 Other industries

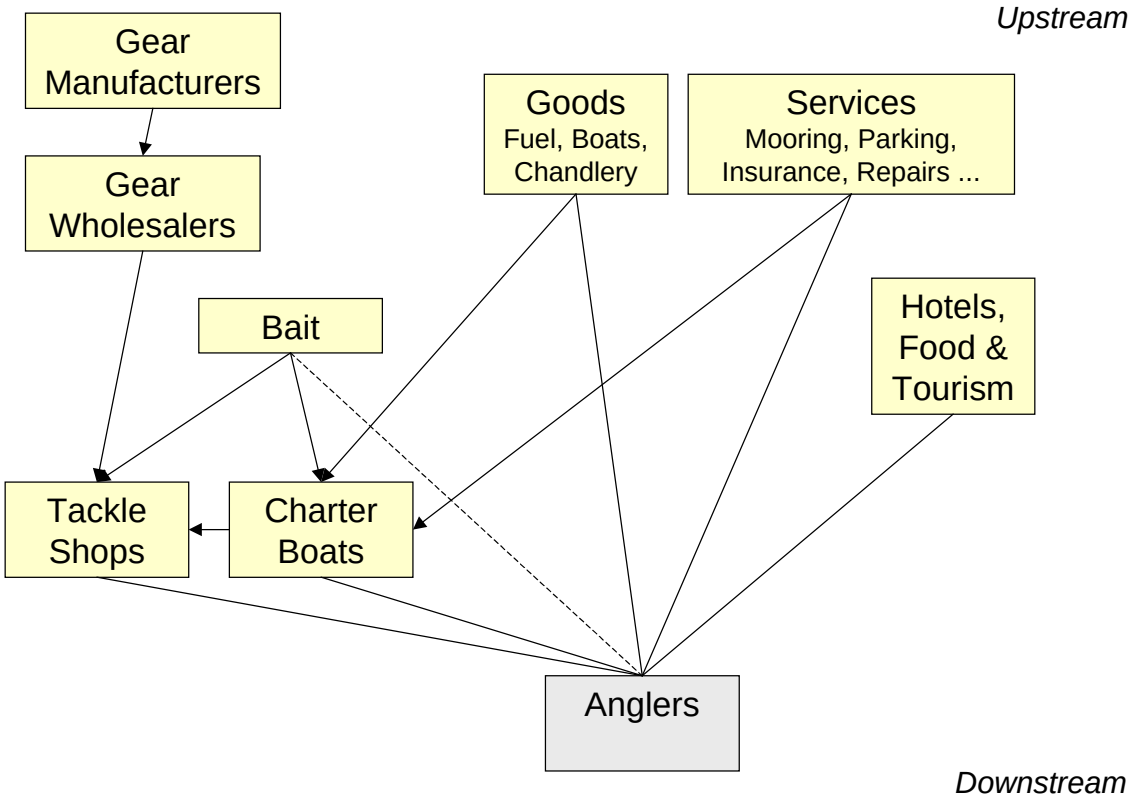
As can be seen from Figures 3.3 and 3.4 above, a number of other industries also derive income from sea anglers. We do not attempt to quantify these industries in any more detail; their contribution will be measured through the Invest in Fish South West bio-economic model. The linkages between these industries are summarised in Figure 3.5.

- **Hotels and guesthouses, food and drink**
  Visiting anglers will spend substantial amounts on accommodation, food and drink. Many keen anglers stay for one of two nights, with some groups staying for a whole week (and angling every day). Not all spend on accommodation can be attributed to the impact of sea angling, as the angler may well have visited the region in any case. The estimate given in Section 3.3 is an attempt to separate out only that accommodation spend that was due to trips made primarily for the purposes of sea angling.

  Many hotels and guesthouses across the region benefit from sea angling. A small number of these specialise in catering to anglers. We spoke to two hotels in Weymouth who generate nearly all of their business in this way, providing specialist services such as early morning breakfasts and storage for the fish caught. This results in business even in the winter months, when other hotels are often empty. One downside is that business can be weather dependent, with last minute cancellations being common.

  There may be additional knock-on benefits if an angler brings his/her family with them, or if they return for a family holiday at a later date. We do not attempt to quantify these benefits here.

Figure 3.5. Socio-economic linkages with sea angling in the South West



- **Bait suppliers**
  Bait is an important component of all anglers' expenditure. It is often supplied and bought locally, and is likely to make a significant contribution to the region's economy. Unfortunately it is extremely difficult to quantify this trade, because much of it is not recorded or declared. The exception to this is the small number of larger, reputable bait suppliers. Most bait is sold through tackle shops, with the remainder being bought directly from suppliers. In addition, many anglers dig bait for their personal use, or catch species such as mackerel to use as bait when targeting larger species.

  – **Live bait** dominates the bait industry, particularly ragworm, lugworm and peeler crabs from wild-dug and farmed sources in the UK and elsewhere in Europe.

  – **Frozen bait** is also significant in size, with the UK market being worth around £10 million. The South West obtains at least 30% of this total.

  – **Preserved bait** is aimed at the tourist market, and is smaller in scale.

  Estimates of the value of the UK bait market vary considerably – we have been given estimates ranging from £25 to £90 million per annum. Conversations with key players in this market indicate that the South

West certainly obtains it fair share (perhaps around 20%) of the UK's bait market. This suggests that turnover in the South West is between £5 and £18 million per annum, and is probably at the higher end of this range, **in excess of £10 million**. Much of this total is in addition to the turnover attributed to tackle shops in Section 3.4.2.

- **Other retailers**
  As discussed in Section 3.4.2, sea anglers also buy equipment such as clothing, footwear and photographic equipment in a range of retailers other than tackle shops.

- **Fuel and transport**
  Anglers spend large amounts on their travel costs; although a relatively small proportion of this spend will stay within the region. Boat anglers also spend a lot on petrol and diesel for their boats. Section 8.1.4 discusses issues around the use of red diesel by anglers.

- **Boat manufacture and maintenance**
  Expenditure on boats is one of the largest categories of anglers' spend. Much of this spend takes place outside the region; however, there are local manufacturers and ship's chandlers who will also benefit. Spend on boats also includes the purchase of engines, electronic equipment and safety equipment, as well as maintenance costs on all of the above.

- **Tackle manufacturers and wholesalers**
  Tackle manufacturers and wholesalers tend to be national in scale. Several companies are based in the South West, including three companies with turnovers well in excess of £1 million. There are also smaller concerns, such as custom rod builders and reel repair services.

- **Angling magazines, journalists and photographers**
  Sea angling supports a number of national magazines and publications, as well as freelance photographers and journalists.

In addition, the **public purse** benefits through taxation, parking fees and harbour dues.

We can estimate the turnover attributable to all "other industries" as £141 million, by subtracting the turnover of charter boats, mackerel trips and tackle shops from our estimate of total expenditure. We convert this into an estimate of employment attributable to sea angling by dividing it by an estimate of turnover per FTE job for the South West region. Turnover per FTE job is £52,844, obtained by dividing turnover for the entire South West region

(£129,784 million) by employment in the region (2.456 million FTE).[5] This approach is more conservative than the approach used in the Defra report; using their ratio of 0.25 FTE per £10,000 turnover would increase our estimate of employment by 32%.

This approach suggests that a total of 3153 FTE jobs in the South West are linked to sea angling in the region. Note that these jobs are not necessarily reliant upon sea angling; if sea angling were to stop then some of the jobs could be retained by redirecting effort towards different customers or markets (this would also be true for any similarly derived estimates of the jobs relying on any sector, including the commercial fishing sector). The Invest in Fish South West bio-economic model should provide a more detailed assessment of sea angling's impacts on employment in due course.

Table 3.4. Total turnover and jobs in the South West from sea angling in the region

	Number	Turnover (£m)	FTE
Charter boats	146	5.9	170
Mackerel trips	51	1.8	61
Tackle shops	136	15.6	245
Other industries		141.4	2676
Total		**164.8**	**3153**

3.5. Summary

240,900 residents of the South West go sea angling. In addition, visitors spend 750,000 days sea angling in the region.

Sea angling in the South West region generates £165 million of expenditure within the region each year – £110 million of this is from resident anglers, and £55 million from visiting anglers. This expenditure feeds into the regional economy and will generate economic income and output in a number of sectors – we do not quantify this process here, as it will be carried out as part of the Invest in Fish South West bio-economic model. We estimate that over 3000 jobs are linked to sea angling in the South West. Employment impacts will also be considered in the bio-economic model.

For resident anglers, the largest element of expenditure is gear purchase and rental, which is 35% of the total. Expenditure on boats accounts for 28%, whilst transport and parking makes up a further 10%. These splits vary considerably between shore, charter boat and private boat anglers. Private boat owners spend a disproportionately large amount, and make up 64% of the total spend by resident anglers. Visiting anglers spend substantial amounts on transport and

[5] Source: Annual Business Inquiry, as explained in Socio-Economic Baseline Study of the SOUTH WEST Fishing Industry, EKOS Consulting & Nautilus Consultants for SOUTH WEST regional development agency, 2002.

parking, accommodation, charter boat fees and food, as well as their spend on gear and boats.

Charter boats, mackerel trips and tackle shops are directly dependent upon sea angling. Charter boats and mackerel trips have a combined turnover of £7.7 million, resulting in 231 jobs. Tackle shops have a turnover of £15.6 million, supporting 245 jobs. This excludes much of the expenditure on bait, which is difficult to quantify but is estimated to be in excess of £10 million per annum. Angling journalism is also dependent upon sea angling.

Many other sectors also derive benefit from sea angling, but are less dependent on it. These sectors include hotels, food and drink, fuel and transport, boat manufacture and boat maintenance.

4 Sea angler survey results

This section presents some of the key results from our face-to-face and telephone surveys with sea anglers (see Section 2.2). We first describe the characteristics of our samples, in terms of their demographics and the types of angling they undertake. We then detail the results obtained by species, including listing the most popular, and the most commonly caught species, and the corresponding catch rates and return rates. These results are combined to provide an estimate of the total angling mortality for each species. Further details can be found in Annex B.

4.1 Characteristics of our sample

4.1.1 Demographics

314 sea anglers participated in a full interview either by telephone or face to face, answering all sections of the questionnaire as presented in Annex D. A number of personal details were recorded to aid later comparison and potential differentiation. The great majority of respondents were male and resident in the South West (4% of respondents are female and 8% live outside the region).

4.1.2 Club Membership

Question 3 asked about club membership; these results are summarised in Table 4.1.

Table 4.1. Club membership

	Face-to-face		Phone		Total	
	Number	%	Number	%	Number	%
Club member	55	39.9	167	94.9	222	70.7
Non member	83	60.1	9	5.1	92	29.3
Total	**138**	**100.0**	**176**	**100.0**	**314**	**100.0**

4.1.3 Level of participation

Respondents had been going angling for an average of 28 years – this varied from those on their first trip, to anglers with as much as 70 years' experience.

The age of anglers is similarly varied in our sample with an average age of 45 (see Annex B1 for a full breakdown of the sample by age profile).

Table 4.2 is based upon the definitions of angling type from the cluster analysis discussed in Section 4.1.5 below. These results suggest a very high level of angling activity. In reality, the average angler makes rather fewer trips than is indicated here; both our phone and face-to-face samples produce an overestimate of angling activity levels:

- The phone sample interviewed members of angling clubs, who are likely to be more active than the "average" angler.
- The face-to-face sample suffers from on-site sampling bias – we were much more likely to interview anglers who go more often than those who go infrequently (see Section 4.3.2 below).

Table 4.2. Number of days angling p.a. split by angling type

Angling type	Days fished p.a.	
	Mean	Standard Deviation
Shore	41.6	29.1
Charter	27.0	26.7
Mixed	54.5	29.9
Private boat	50.8	25.5

No clear trend emerged when recent angler activity (rather than overall participation levels) was considered. 37% of respondents stated that their level of angling activity had declined over the previous five years; 33% stated there had been no change; 29% had increased their level of angling activity in that period. This indicates a very minor overall decline in the activity of our sample.

4.1.4 Regions fished in

Overall, anglers who live in the South West fished a total of 46.1 days a year, split between 40.9 days in the region (88.6%), 3.0 days in the UK outside the South West (6.5%) and 2.3 days overseas (4.9%). Of their angling within the region, Table 4.3 shows the regions they fished in. The pattern shown is influenced by the locations we interviewed in, so this is *not* an unbiased representation of where sea angling takes place. The table does show that we succeeded in interviewing significant numbers of anglers who fish in each region.

Table 4.3. Regions that our respondents fished in

Region	Respondents*
Dorset	47
Somerset	25
N. Devon	21
S. Devon	134
S. Cornwall	63
N. Cornwall	24

** Where respondents stated a split between multiple regions, this was treated as a fraction – an even split between Dorset and Somerset would contribute 0.5 "respondents" to each region.*

4.1.5 Angling types

Table 4.4 shows that 70% of our face-to-face respondents were shore anglers. This is thought to be an overestimate because the face-to-face surveys were largely carried out at shore angling locations. Efforts were made to ensure that we had sufficient numbers of own-boat anglers and charter-boat anglers to carry out analysis on these groups, but it was not possible to obtain a representative sample in this respect. The phone sample *is* expected to be a reasonable representation of the population of club members.

For our expenditure estimates (Section 3.2.1 and Annex A), we adjust our results to fit the split between angling type provided in the Defra report, as these were obtained from a general household survey – making them representative of the general population. The question asked was "which of the following was the main method used by members of your household" … making the splits quoted a split of *households* rather than of *anglers* or of *trips*. Also, the splits refer to the UK as a whole, and it may be that the splits in the South West are rather different. For example, we might expect a higher proportion of own-boat and shore anglers in the South West than in inland regions, due to their proximity to the coast.

The Defra report also estimates the average *number of trips* made each year by each angling type. By combining this information with the split of households by angling type, we can estimate the split of *trips* by angling types; as charter boat anglers go angling less often than shore or private boat anglers, the relative importance of charter boat angling decreases here.

Table 4.4. Split of angling types

	shore	charter boat	private boat
Face-to-face respondents	70%	16%	14%
Phone respondents	63%	13%	24%
Defra report (households)	55%	22%	23%
Defra report (trips)	65%	9%	25%

4.1.6 Cluster analysis

In Section 7 (Management options), we classify each individual in our sample as either a "shore", "charter boat", "private boat" or "mixed" angler, using K-means clustering based on their answers to Q10 of our questionnaire. The "mixed" category contains anglers who undertake a genuine mixture of types of angling – the other categories contains anglers who predominantly (although not necessarily exclusively) choose one type of angling. The phone and face-to-face surveys are treated as a single population. The process reached convergence after three iterations. Annex B shows the centres of each of these four clusters. The numbers of each type are shown in Table 4.5.

Table 4.5. Number of cases in each cluster

Cluster	Number	%
1. Shore anglers	187	59.6%
2. Charter boat anglers	30	9.6%
3. Mixed anglers	52	16.6%
4. Private boat anglers	45	14.3%
Total	**314**	

4.2 Results by species

4.2.1 Species caught and species targeted

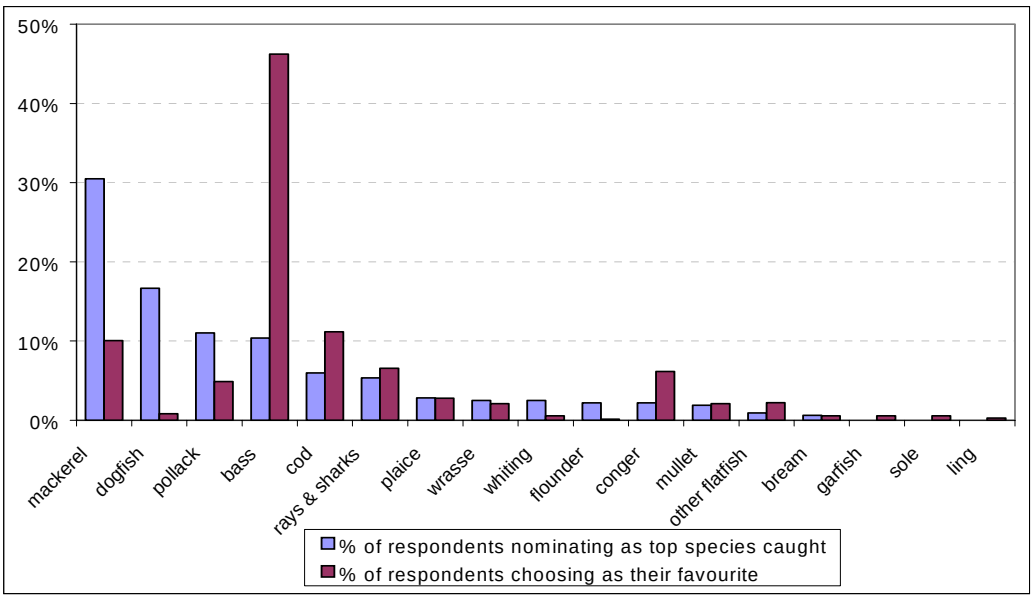
Table 4.6 and Figures 4.1 and 4.2 summarise the results for the catch and mortality of each species by **residents of the South West**. Respondents were asked to nominate their top species (up to five species) by the number currently caught. The first column in Table 4.6 shows the percentage of respondents who nominated each species as being in their top five species. The most commonly nominated species was mackerel (59%), followed by Pollack (although relatively few anglers suggested this was their number one species, 36% had it in their top five), bass (35%) and dogfish (35%).

Figure 4.1 shows the percentage of respondents who nominated each species as being their *most commonly caught* species. It also shows the percentage choosing each species as their *favourite to target* (Question 22 in our survey, see Annex D). The differences between these two criteria show an interesting (although perhaps unsurprising) pattern: those species that are most favoured by anglers are not necessarily the same species that are most commonly caught. This is in part due to the relative abundance of each species; dogfish are very common, so are caught often, but are not highly sought after – whereas cod is often targeted for food, but catch levels are low due to the decline in cod stocks in the region.

The favourite species to target is bass, by a large margin, but this is ranked only fourth by the number caught. Bass is favoured because it provides good sport, and also good eating. In descending order, the other favoured species are cod, mackerel, rays and sharks (note that this excludes dogfish, which are listed separately), conger eels and Pollack.

Feedback from anglers suggests that flounder and ling may be understated in these results.

Figure 4.1. Species most commonly caught and most favoured species



4.2.2 Catch levels

The catch per day of mackerel was much higher than any other species, whilst the catches per day of cod and bass were relatively low. The average across all species is 6.0 fish per day. We believe that these figures may be overestimates because of overoptimistic responses; anglers tend to think about a "good" day when answering this question, rather than a "typical" day. Figure 4.2 shows the catch per day by species. The number above each bar indicates the sample size for each species (the number of respondents choosing the species as one of their top three by the number caught).

Figure 4.2. Catch per day by species

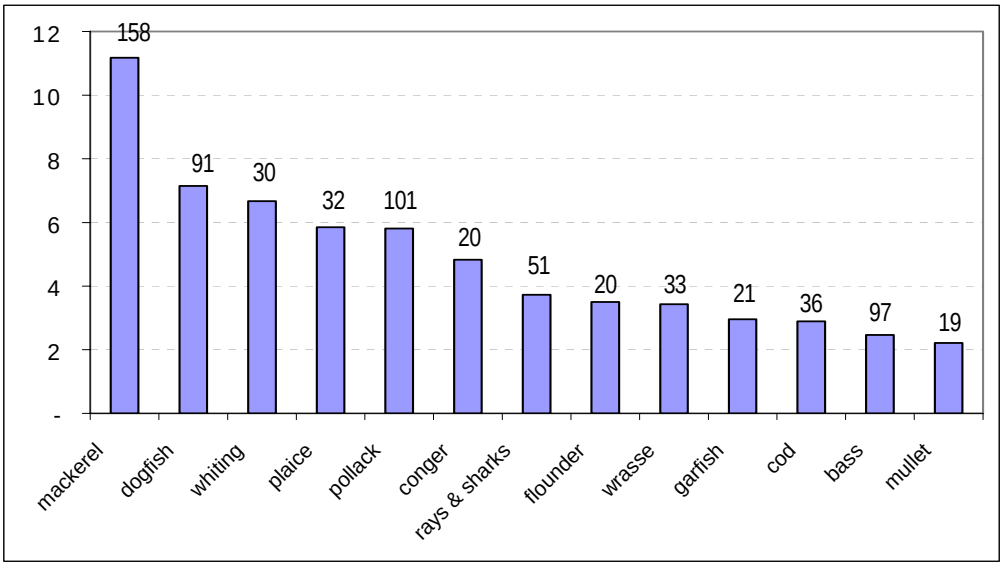


Table 4.6 also considers the proportion of catch that respondents return alive. The average across all species is 67.8%. Catch and release has been increasing in recent years, and many individual anglers, charter boat skippers and tackle shop owners are very proud of this culture. The highest return rates are for species that are not normally eaten (dogfish, wrasse, conger eel, rays and sharks). For species such as cod and bass, anglers tend to take home the amount that they wish to eat, and return the remainder. Return rates tended to be around 55–75% for such "food fish". The lowest return rate (38%) is for mackerel, which are often taken as bait as well as for food. Sample sizes for these calculations are the same as those indicated in Figure 4.2 above.

The survival rate of these returned fish is also allowed for. Anecdotal evidence suggests that survival rates are good in many cases, although they will vary by species, depth caught (likely to be from deeper water when boat angling compared to shore angling) and several other variables. We have assumed a 90% survival rate for all species. A sensitivity analysis shows that changing this assumption to 80% survival would increase overall mortality rates by 21%, and changing to 100% survival would decrease overall mortality rates by 21%. This is a source of uncertainty in our results. However, as the overall picture would not change dramatically if we altered this assumption; we believe that this is a less serious source of uncertainty than the ambiguities described in Section 4.2.3.

By combining our data on the catch per trip and the return rate with our assumptions on survival rates, we can find the mortality per trip for each species (Table 4.6).

4.2.3 The total catch of each species in the South West each year

For this we also need to know the number of trips taken that target each species. Here there is some ambiguity, as anglers could have interpreted the question in two different ways:

1. Each species nominated by an angler could represent a different trip which specifically targets that species.
2. The suite of species nominated could represent the typical breakdown of catches on an "average" trip.

We assume that anglers interpreted the question in the former manner (each species represents a different trip), as the latter interpretation is more conceptually difficult. We therefore divide the total number of trips made per angler (13.99) between the different species nominated, to find the number of trips made which target each species. We assume that 50% of trips target the first species nominated; 35% target the second species; 25% the third species; 10% the fourth and 9% the fifth (this sums to more than 100% because many respondents nominated fewer than five species – it averages to 100% across all respondents).

Of the 3.0 million angling trips made within the South West each year, 2.3 million are made by residents of the region and 750,000 by visiting anglers. Table 4.6 shows how the trips made by **South West residents** are split between trips targeting each of the key species. Multiplying this figure by the average mortality per trip gives us the total mortality from angling in the region, in numbers of individual fish removed. This can be converted to biomass by multiplying it by the average mass of a fish of each species. Average mass is estimated through ground-truthing with anglers. It could be argued that undersized fish are likely to be returned and therefore a higher than average weight could be used. But there is also an increasing trend for the larger "specimen" fish to be handled carefully while being recorded before return, which may balance this effect.

Mackerel has the highest angling mortality (in tonnes) as it is targeted the most, has the highest catch rates per day and the lowest proportion returned. Pollack is second as it is also targeted frequently, has a fairly high catch rate per day, a fairly low return rate, and each fish is relatively large. Conger eels are next; although they are targeted much less often, and are usually returned, each fish is large, so the mortality in tonnes is high. Dogfish is fourth (despite near universal catch and return being practised), as it is so widespread in the region.

Table 4.6. Catch levels by species

	% of respondents with spp. in top 5	Average catch per day*	% returned	Average mass of a caught fish (kg)	Mortality per trip (kg)	No. targeted trips ('000s)	Residential anglers total mortality pa (tonnes)	Residential and visiting anglers total mortality pa (tonnes)	Trend
mackerel	59%	11.2	38%	0.25	1.8	509	932	1,238	-2
pollack	36%	5.8	57%	0.90	2.5	285	726	964	-3
conger	8%	4.8	88%	5.00	4.9	56	277	368	-1
dogfish	35%	7.1	97%	0.70	0.6	289	178	236	2
rays & sharks	23%	3.7	92%	2.00	1.3	153	194	258	-1
bass	35%	2.5	71%	0.65	0.6	273	156	207	-2
cod	15%	2.9	60%	1.00	1.3	115	152	202	-3
plaice	12%	5.8	54%	0.40	1.2	88	106	140	-3
whiting	12%	6.7	73%	0.25	0.6	86	49	66	-1
wrasse	14%	3.4	97%	0.75	0.3	96	32	42	-1
garfish	9%	3.0	77%	0.50	0.5	55	25	33	-1
flounder	9%	3.5	91%	0.50	0.3	62	19	26	-2
mullet	8%	2.2	86%	0.60	0.3	54	16	22	-2
others	8%	5.9	57%	0.50	1.4	164	236	314	
Total		**6.0**	**69%**		**1.3**	**2,286**	**3,099**	**4,115**	**-2**

Estimated average catch weight from angling literature and discussion with experts ** Based on 90% survival rate for returned fish * Assumes that visiting anglers catch the same species as resident anglers, catch the same amount each day, and return the same proportions*

Sufficient evidence does not exist to assess accurately whether these patterns would differ for **visiting anglers**. Table 4.6 shows the total mortality of each species from **all** angling in the South West (residents and visitors), if we assume that visiting anglers catch the same species as resident anglers, catch the same amount each day, and return the same proportions. These are strong assumptions. However, as visiting anglers make only 25% of all angling trips in the region, these assumptions may not affect the overall results too seriously. Section 6.1.2 goes on to discuss the four species where there is believed to be significant competition for stocks between anglers and commercial fishermen (mackerel, bass, cod and plaice).

Finally, we asked for an indication of what the respondent thought the trend in stocks of each species had been over the last five years. Anglers think that stocks of all species have declined, with the exception of dogfish. The strongest opinions were of a decrease in stocks of cod, plaice and pollack, with bass not far behind. Less dramatic declines (but nevertheless still declines) were suggested for conger eels, wrasse and rays and sharks. We convert this into an index, and use arrows to indicate the overall trend in Table 4.6. Annex B2 shows this data in more detail.

4.3 Potential sources of bias

4.3.1 Differences between the phone and face-to-face samples

We carried out a statistical test (Mann–Whitney U-test) to compare the phone responses with the responses from club members interviewed face-to-face, and found very few significant differences. The only noticeable differences related to anglers' opinions: those from the telephone interviews seemed to be more conservation minded in general, and also returned a higher proportion of their catch. This could perhaps be connected to their membership of the NFSA.

Average expenditure was higher for face-to-face club members than for phone respondents. This was heavily influenced by a small number of individuals who spent very large amounts (mostly on boat purchases), and the difference was not significant. This gives us confidence to group together the phone and face-to-face respondents as a homogeneous sample.

4.3.2 On-site sampling bias

A simple examination of the number of days respondents go angling each year would suggest that the face-to-face sample went 35 times a year and the phone sample 49 times a year. This high number is plausible for the phone sample, as these are club members who are assumed to be keen on their sport. However, the face-to-face result is an overestimate of the true number of trips, as we used

on-site sampling. This means that we were much more likely to interview anglers who go more often than those who go infrequently.

This is potentially quite a serious issue. However, we have adjusted for on-site sampling bias to remove its influence, by giving more weight to those respondents who fish less frequently. Annex B3 explains the weighting system that was employed, and presents an example showing results for one variable before and after we adjust for this bias. In the example shown, our estimate of the number of years angling is substantially reduced by compensating for on-site sampling bias. Some care is required here, as the resulting outputs are very sensitive to the data from a small number of respondents.

4.3.3 Seasonality

The survey was carried out entirely during summer months, suggesting that the face-to-face sample could be biased towards anglers who fish in the summer. This might include more holidaymakers and fewer dedicated anglers, for example. Annex B3 shows that 88 out of 141 face-to-face respondents fished all year round, with only 21 fishing solely in the summer months, suggesting that this is not likely to result in significant bias. This bias should not be present in the phone sample. Only seven of 166 phone respondents said they did not fish in summer, suggesting that we did not miss out a large number of people by only sampling in the summer. Nevertheless, the face-to-face sample is more heavily slanted towards summer-only anglers than the phone sample, so some bias is indeed present – this was unavoidable given the timescales of the work package.

4.4 Summary

314 respondents completed our full angler survey, with a large majority of them being male and residents of the South West. Anglers covered a wide age range, and fished in all areas of the region. Our phone sample covered club members only; 63% of these were shore anglers, 24% private boat and only 13% were charter boat anglers.

The most popular species to target is bass, with nearly half of all sea anglers choosing it as their favourite. Cod is also popular, as are mackerel, rays and sharks, conger eels and pollack. The picture for the species most commonly caught was rather different, with mackerel well in the lead, followed by dogfish and pollack. Bass and cod were fourth and fifth respectively.

These results are combined with data on average catches per day and average return rates, together with estimates of the survival rates of those returned and average mass data for each species, to calculate the angling mortality of each species. Mackerel has the highest mortality from angling (1238 tonnes per annum), followed by pollack (964 tonnes) and conger eels (368 tonnes). 207

tonnes of bass, 202 tonnes of cod and 140 tonnes of plaice are killed by sea anglers each year.

Catch and release is widespread, with over two-thirds of all fish being returned. This varies by species, with “food fish” such as bass and cod, and “bait fish” such as mackerel having lower proportions returned.

Anglers have observed a decline in catches of all species, with the exception of dogfish (which has increased). The strongest opinions were for cod, plaice and pollack, where decreases in stocks were strongly noted.

Our samples are subject to a number of biases, including on-site sampling bias and seasonal bias. However, we have captured as much as possible of the variability contained within the diverse range of anglers found in the South West. We can make adjustments to remove most of the biases, including removing on-site sampling bias and adjusting to the split of anglers of each type (shore/charter boat/private boat) in the general sea angling population.

5 Choice experiment results

This section presents the results of the choice experiment presented to 356 anglers in our face-to-face surveys. The focus here is to assess the relative importance of different site attributes, through quantifying the effect that changing these attributes has on anglers' Willingness to Pay (WTP). We discuss how the results vary by different types of sea anglers: the species targeted; the method of angling (shore/charter/private boat); club membership; frequency of angling activity; whether resident in the South West; and age. Detailed results are presented in Annex C.

Finally, we use the results to derive a crude estimate of consumer surplus for sea angling by South West anglers. This estimate is subject to considerable uncertainty and should be treated with caution. We do not extend this analysis to assess what proportion of the consumer surplus from resident anglers is attributable to angling in the South West; nor do we add on the consumer surplus for visiting anglers.

The choice experiment allows us to calculate how much anglers would be willing to pay to visit a given angling site. When making their choice, anglers should ignore any *fixed costs* (such as buying a boat or a rod), and instead concentrate on the *variable costs* (the costs of visiting the site – travel, parking, charter boat fees, bait and so on). The fixed costs have already been spent, and do not come into the decision of whether to go to the site in question or not. The WTP derived from the choice experiment should therefore be interpreted as WTP *on top of* the fixed costs incurred. We call this the "**variable WTP**".

5.1 How WTP varies by angler type

Sea angling is a highly diverse activity, and significant variations exist in both the total amount that anglers are prepared to pay, and in their preferences for different site attributes. Results suggest that:

- Boat anglers are willing to pay more for their experience than are shore anglers. There was no significant difference between the amount that charter boat and private boat anglers will pay.
- Club members place a higher value on their angling than non-members.
- Those who fish more often will pay more to visit an angling site.
- Residents of the South West would pay more to visit a site than visiting anglers – this is perhaps because many visitors are holidaymakers, who are only casual sea anglers (although other visitors are enthusiastic anglers who come primarily for this purpose and spend substantial amounts whilst doing so).

- Age plays a minor role in determining WTP.
- Sufficient data were available to split anglers between four different "favourite species": bass, cod, mackerel and "others". Of these, cod anglers would generally pay the most, followed by "others". Mackerel anglers would pay the least for their experience. This result varies depending on the characteristics of the angling site, as anglers favouring different species had differing preferences for site characteristics (see below).

The results shown in Annex C allow us to quantify each of these differences. In particular, they can be used to find the WTP for any given angler to visit any specified angling site. We now examine the importance of each site attribute in turn.

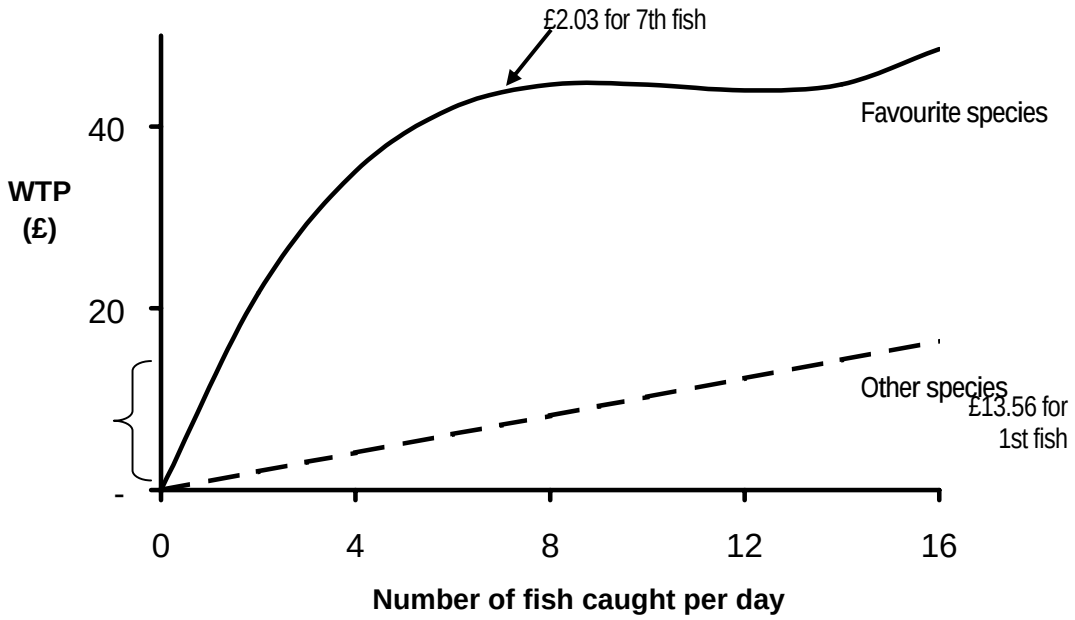
5.2 Results by site attribute

5.2.1 Catch of favourite species

We examine anglers' WTP to catch one additional fish of their favourite species. The relationship between WTP and the catch of the favourite species is not linear, as illustrated in Figure 5.1. Anglers have a high WTP of £13.56 (s.e.[6] 1.61) to increase their catch from 0 fish per day to 1 per day. The WTP for additional fish on top of this decreases as they catch more, and becomes negligible at higher catch levels; for example, anglers will pay only £2.03 (s.e. 0.48) to increase their catch from six fish per day to seven per day.

[6] s.e. = standard error – an estimate of the standard deviation of the sample mean. A measure of how much fluctuation the statistic will show around this mean estimate as a result of the sampling process.

Figure 5.1. Relationship between WTP and number of fish caught



Anglers targeting cod and mackerel are less concerned about this attribute than are other sea anglers. Anecdotal evidence supports the view that anglers targeting cod are less discriminating about their catch, as cod is perhaps viewed as a "food fish" rather than a "sport fish". Anglers targeting mackerel are more likely to be casual anglers, including holidaymakers.

Older anglers are also less concerned with catch of favourite species. This may be because younger anglers can be more focused on catching a particular species, whereas older anglers have "already been there and done it", and are now more interested in the social side of the sport (or just the general pleasure of going fishing), rather than on chasing after a specific species.

The catch of the angler's favourite species is an extremely important attribute … until catch levels reach around 6–7 fish per day, at which point anglers become satiated.

5.2.2 Catch of other species

Anglers will pay an average of an extra **£1.02** (s.e. 0.16) to catch one additional fish of any species other than their favourite. This is just over a third of what they would pay for their favourite species. This indicates that anglers generally are discerning about which fish they catch – they have a strong preference for catching their target species. This suggests that the angling experience would substantially worsen if stocks of a key target species were to fall, as anglers would not be as satisfied by switching to an alternative species.

No evidence was found to support a non-linear relationship in this case. This relationship is shown as the dashed line in Figure 5.1.

Club members place a lower value on this attribute than non-members do, which supports the notion that club members are even more discriminating about the species they target.

Anglers are discerning about the species they catch – whilst they would pay a significant amount extra to catch more fish of non-target species, the amount they would pay is much lower than for catching their favourite species.

5.2.3 Size of fish

Anglers will pay **£13.27** (s.e. 1.96) for a 50% increase in the size of individual fish, making this a very important attribute.

Club members are more concerned than non-members are about this attribute, again pointing to them being more discerning. Similarly, older anglers were less interested in the size of the fish they compared with younger anglers, which supports our contention that older anglers are less particular about their experience. Anglers targeting cod also found this attribute of less importance, supporting the idea that cod anglers are less discriminating than other sea anglers are.

Management policies should aim to increase the size of fish as well as the number of fish caught, as this has a major impact on the angling experience.

5.2.4 Rod/bag limits

Overall, anglers have a marginal preference for sites without rod/bag limits – but this result is statistically insignificant (they will pay an extra £3.27, s.e. 2.65). Anglers' attitudes to this attribute are highly variable, with some anglers preferring sites *with* restrictions – perhaps because they believe in the long-term benefits of such policies.

The presence or absence of rod/bag limits is only a minor factor in anglers' decisions on where to fish.

5.2.5 Environmental quality

Anglers will pay only a small amount for an improvement in environmental quality from "Satisfactory" to "Excellent" – and this result is also statistically insignificant (they will pay an extra £2.50, s.e. 2.41). Our definition of environmental quality was left very broad and vague, out of necessity – it

includes everything from water and air quality to the aesthetic appeal of a site and the facilities available. We did not test the reaction of anglers to a decline in environmental quality from "Satisfactory" to "Poor".

Environmental quality appears to be a minor factor in anglers' decisions on where to fish.

5.3 Marginal effects

The above discussion focuses on absolute levels of change in WTP. However, decision-makers should really be more interested in *marginal* effects – the impact of site attributes changing from their *current* levels. Table 5.1 compares the marginal effects of increasing the catch of favourite species by 50% from current levels, and the marginal effects of increasing the size of favourite species by 50% from current levels.

These results vary by species for two reasons. First, anglers targeting different species exhibit different preferences, as described above. Second, the status quo varies by species – for example, the catch per day of mackerel is substantially higher than that of bass or cod.

For bass and "others", both values are positive, but increasing the size of fish has the larger impact. As cod anglers exhibit different preferences towards the size of fish, these results indicate that increasing the size of fish actually *decreases* their WTP. This is an anomalous result, and may be due to the relatively small number of anglers surveyed putting cod as their "favourite species". Anglers targeting mackerel have a positive preference for catching larger fish, but a slightly negative value for catching more fish. This is because current catch levels for mackerel are already high relative to the other species, placing mackerel anglers in that portion of the relationship between WTP and number of fish caught (Figure 5.1) where anglers are already satiated. In reality, this value is probably not negative, but is close to zero – increasing the catch of mackerel will not have a significant impact on the welfare of anglers.

When all of the species are combined together, we find that increasing either the number caught or the size of fish would increase anglers' welfare. Increasing the size of fish would have the larger impact.

Table 5.1. Marginal effects of increasing the number and size of fish, by species

Species	Catch of favourite species increases by 50 %	Size of fish increases by 50 %
Bass	£8.46	£12.45
Cod	£6.35	-£4.74
Mackerel	-£0.61	£9.29
Others	£5.60	£12.45
All species	**£6.38**	**£10.24**

Decision-makers should base decisions on marginal effects rather than absolute values. Increasing either the number caught or the size of fish would increase anglers' welfare. Overall, increasing the size of fish will have a larger impact, although this varies by species.

5.4 Total consumer surplus

The choice experiment presented here is not designed with finding the total consumer surplus in mind. Nevertheless, we can use the results to infer some information about the likely scale of consumer surplus for anglers resident in the South West. We do not extend this analysis to assess what proportion of the consumer surplus from resident anglers is attributable to angling in the South West; nor do we add on the consumer surplus for visiting anglers.

We obtain a crude estimate of "variable WTP" by finding the WTP for a trip to a "typical" sea angling site by a "typical" South West resident, and multiplying by the total number of sea angling trips made in the South West. Annex C4 shows the characteristics of these, which are generated from our survey results.

One difficulty here is the presence of ambiguity over how to interpret the constant term in the utility equation; results indicate that anglers would still prefer to go sea angling rather than doing a different activity, even if the angling experience was poor. Anglers were still willing to pay around £30 per trip even if there were no fish to catch. Three explanations are possible; these are detailed in Annex C5. We believe that there is some truth in all three explanations, but that the most convincing explanations indicate that much of the constant term is spurious. We therefore produce "best-guess" estimates of WTP, which include only 25% of the constant term.

5.4.1 Results for consumer surplus

Using our "best guess" estimates, our typical angler would be willing to pay £49.72 to visit the typical angling site. As they make 10.86 trips p.a. and there

are 240,900 sea anglers living in the South West, this corresponds to a total **variable WTP** for South West sea anglers of **£128 million**. This is *in addition to* fixed costs of £139 million (derived from the split of expenditure described in Annex A3).

This compares to total variable expenditure by South West anglers of £51 million. In other words, the **consumer surplus** for South West resident anglers is **£77 million** (£128 million less £51 million). These figures are summarised in Table 5.2 below.

The range of estimates produced for variable WTP due to the ambiguity described in Annex C5 is from £111 million to £179 million.

In addition to the uncertainty described and covered by the range of values presented above, there is a large degree of additional uncertainty; no estimate of consumer surplus is 100% robust. Nevertheless, we can say with confidence that consumer surplus is substantial, and should not be ignored.

Note that all of these results relate to anglers who reside in the South West, rather than to angling trips that take place within the region. We would expect that the consumer surplus for angling trips that take place within the South West would be somewhat higher than the results presented here.

Table 5.2. Expenditure, consumer surplus and WTP of sea anglers living in the South West (£ million)

	Fixed costs	Variable costs	Total
Actual expenditure	139	51	190
Consumer Surplus	**N/A**	**77**	**77**
WTP	139	128	267

As our estimate of consumer surplus is rather crude, it may be more appropriate to use the estimates in the Defra report: consumer surplus for sea anglers in England and Wales is in the range of £111 million to £753 million, with a central estimate of £594 million. This central estimate equates to £410 per individual angler – so the 240,900 resident anglers of the South West would have a consumer surplus of £99 million, which is not too far from our estimate of £77million.

Consumer surplus is large, and forms a substantial portion of the value of angling. This value should be taken into account by decision-makers.

5.5 Summary

This section has investigated how the value of the angling experience changes as site attributes such as the size of fish change. This information will be of use to modellers, and to help decision-makers to choose management objectives that match anglers' needs.

The catch of anglers' favourite species is an extremely important attribute, until catch levels reach around six fish per day, at which point anglers become satiated. Anglers are discerning about the species they catch – whilst they would pay a significant amount extra to catch more fish of non-target species, the amount they would pay is only a third of that for catching their favourite species.

Management policies should aim to increase the size of fish as well as the number of fish caught, as this has a major impact on the angling experience. In contrast, the presence or absence of rod or bag limits, and the environmental quality of a site are only minor factors in anglers' decisions on where to fish.

Angling is a diverse activity; significant variations exist by angler type, both in the total amount they are prepared to pay, and in their preferences for site attributes.

Decision-makers should base decisions on *marginal effects* rather than absolute values. Increasing either the number of fish caught or the size of fish would increase anglers' welfare. Overall, increasing the size of fish will have a larger impact, although this varies by species.

Consumer surplus forms a substantial portion of the value of angling, and should be taken into account by decision-makers. Our best estimate of consumer surplus for South West resident anglers is £77 million – although this is crude, and subject to a number of uncertainties.

6 Sea angler interactions

The following discusses the current and potential interactions between recreational sea angling and commercial fishing in the South West, along with the environmental impacts associated with recreational fishing. Interactions with commercial fishing are presented as spatial interactions (areas of sea) and species (common target species).

6.1 Interactions with commercial fishing

Many anglers have strong feelings about the commercial fishing industry, and feel that they get a raw deal out of fisheries management. However, this is not inevitable – relations are quite good in some ports. In addition, angling and commercial fishing often target different species, meaning that conflict over stocks is limited to a relatively small number of species.

6.1.1 Spatial

As both sectors fish in the sea, it is inevitable that some interaction occurs at particular "hotspots". These may include some quaysides where anglers fish and commercial boats tie-up – but conflicts in these situations are very isolated, as such locations are rarely seen as good marks for dedicated anglers. Shore anglers elsewhere often cite the disruption caused by trawlers fishing close to shore, who may catch the fish anglers are targeting, scare fish away, or cause damage to the seabed.

Of greater significance is the spatial competition between charter boats and commercial fishing boats at particular wreck or reef locations. These interactions relate to both static gear and mobile gear operators, as modern fishing technology permits trawls to get much closer to seabed obstructions than was previously possible. The static gear such as gill nets and pots set over and around such obstructions can result in the snagging of angling gear. With different vessels targeting the same area at the same time, intimidation can occur from either side. A number of anglers suggested to us that commercial fishermen believe that they have more of a "right to fish" a particular area than recreational fishermen, and that this can lead to harassment of anglers. One angler we spoke to alleged that a foreign trawler had shot at him.

6.1.2 By species

As our survey findings illustrate, only a small number of species are of value to both recreational and commercial fishermen. While many fish species have some market value, only four of the 13 species nominated by anglers are of such

value to commercial fishermen that a targeted fishery exists: mackerel, bass, cod and plaice. Other species on the list considered saleable, but of more limited commercial value are: pollack, rays and sharks, dogfish, whiting and conger. This is particularly the case in the South West where commercial fishermen are mainly targeting high value prime fish and shellfish; there are only a few species where both sectors are targeting the same resource. These are discussed individually below.

Mackerel – As it is caught for food, sport and bait there appears to be the potential for conflict between groups. There is already a strong distinction in the commercial sector between the offshore pelagic mackerel fishery, which is not permitted to fish in the South West mackerel box and the inshore hand-line fishery, which is of such a limited scale and impact as to be exempt from these restrictions. By the same token, the impact on stocks by the recreational sector is estimated to result in fishing mortality (1310 tonnes) of a similar scale to the hand-line fishery (1750 tonnes). South West mackerel hand-liners operate in a fishery that is managed sustainably, as certified by the Marine Stewardship Council, suggesting sufficient management is or will be in place to deal with conflicts should they arise in the future.

Cod – Commercial catches of cod in the South West have reduced significantly in recent years as a result of emergency measures to conserve stocks in the North Sea and Irish Sea. Much of the cod caught in the South West comes from inshore fisheries targeted by gillnetting vessels rather than the large offshore demersal trawlers fishing elsewhere around the UK. There is potential conflict between the inshore commercial and recreational cod fishers, but both groups place the blame for declining stocks on the offshore sector and on climate change, rather than each other.

Bass – There is a great deal of controversy surrounding the South West bass fishery as, offshore, it is targeted by pair trawlers that are thought to be responsible for cetacean deaths and strandings in the South West. The pair teams also account for the large proportion of bass caught in region waters and consequently many commercial fishermen have joined calls from environmentalists and recreational fishermen to ban pair trawling. Many would like to go further and ban the commercial bass fishery altogether, as the Irish did many years ago. This was also suggested in the recent Government Strategy Unit report, *Net Benefits*. Commercial bass fishermen have concerns for their future livelihood, but this is as much to do with greater market competition from bass farmed in the Mediterranean as the recreational fishing lobby. Many expect the bass trawl fishery to be phased out in the near future, but it remains to be seen whether inshore commercial fisheries landing line-caught bass (an established niche in the top end of the European bass market) will be allowed to continue. As bass is the species that anglers like to target the most, there is a large value derived from bass angling in the region. This value could be increased substantially by increasing the stocks and individual sizes of bass (see Section 5.3).

Plaice – Plaice came out relatively low down on our list of species targeted by anglers. However this varies by area and our results may understate the importance of plaice angling in ports such as Poole and Dartmouth.

6.2 Interactions with the environment

6.2.1 Stocks

As mentioned above, recreational impacts on fish stocks are thought to be limited and only significant compared with the commercial fisheries for a small number of species. Concern exists amongst environmentalists over the targeting of rays and sharks as these are low-fecundity species and therefore more prone to over fishing. Anglers in the survey only suggested a slight decrease in the numbers of most rays and sharks – and there has been a strong increase in the numbers of dogfish.

6.2.2 Bait collection[7]

The most common species targeted for bait in sea angling are oily pelagic fish such as mackerel (*scomber scombrus*), lesser sandeel (*ammodytes tobianus*) and greater sandeel (*Hyperoplus lanceolatus)* or shoreline species such as worms, crabs and molluscs. A more detailed description of shoreline species targeted is presented in Annex E.

The collection of fish for bait is not seen as having a significant impact on stocks when compared with commercial collection for food or feed. As discussed above, there are closer interactions between mackerel hand-liners in the South West and recreational anglers than there are between the large pelagic vessels targeting mackerel offshore. Moreover, the commercial bait trade targeting sandeel is extremely small in scale compared with the commercial fishmeal trade (dominated by the Danes) also targeting sandeel.

Environmental concerns have so far concentrated on the disturbance of shoreline ecosystems by bait collection. Collection may be by hand picking, digging, pumping or raking, depending on the target species. In many cases, shoreline species collection activity is not thought to be incompatible with nature conservation objectives in marine sites. Some scientific and site management case studies, however, demonstrate that habitat damage and alteration, damage to non-target species, and bird disturbance and prey depletion may arise from this activity, particularly if carried out on a large scale.

In the South West, soft-shelled crab is popular bait, which was originally collected by overturning rocks on rocky shores where the crabs sheltered while moulting. This practice, viewed as damaging to rocky shore habitats, has to a

[7] Further detail can be found in Fowler, S.L.. (1999) Guidelines for managing the collection of bait and other shoreline animals within UK European marine sites. English Nature (UK Marine SACs Project). 132 pages.

great extent been replaced by anglers setting artificial shelters for easier collection. These artificial shelters are made of waste objects such as tyres, pipes, bricks or tiles and are therefore strictly viewed as illegal dumping. There is also a potential danger to boat users in creating subsea obstructions in shallow waters, but most shelters are modest in scale. A recent investigation in the South West suggested a reduction in crab numbers was not obvious as a result of this activity and that these structures were colonised by other floral and fauna relatively quickly. Crab shelters are therefore not viewed as a major negative environmental impact and have some benefits if reducing rocky shore disturbance.

Although bait digging in soft sediment is more prevalent in other UK regions (Northumberland, Cumbria and East Anglia) some areas within the South West (Bristol Channel, estuaries and beaches) are dug for bait worms. Concerns exist over the impact on these communities and the disturbance to important bird populations associated with these areas. Where mud flats are extensive, zonation is one potential management option, but this is unlikely to be workable for the region where bait-digging areas are very localised. The NFSA has developed a bait-digging code to encourage anglers to dig for bait responsibly.

A number of non-native polychaete species could be imported into the bait market in Britain and the resulting probability of introductions to the wild would be high. Such introductions would be in breach of the Wildlife and Countryside Act (1981) (without a licence). Developments in the culture of non-native species should be monitored very carefully, and actively discouraged. Potential impacts include competitive displacement or predation of native species, alteration of natural habitats, and damage to fisheries.

National and regional sea angling bodies and most, if not all, local clubs strongly promote a sea anglers' code that includes guidelines for protecting the marine environment and mitigating harmful impacts. These codes include measures as simple and effective as avoiding moorings and other intertidal structures while digging bait and back-filling the holes and trenches produced, returning rocks and weed to their original positions when collecting crabs and shellfish, and only taking the minimum bait required for planned fishing trips. Unfortunately, as the majority of anglers are not members of angling clubs, they may be unaware of the codes or may not experience the peer pressure to adhere to them. As a consequence, voluntary codes may not be sufficiently effective to avoid the damage created by bait collection – particularly where this occurs on a commercial scale.

6.2.3 Lost gear and litter

There are negative environmental impacts resulting from lost gear and litter affecting marine organisms, birds, mammals and the visual amenity of sea angling sites. An area of concern feeding into the wider issue of marine litter is the entanglement of marine species in lost fishing gear. Anglers do not

deliberately lose gear; our results indicate "gear" is the largest overall expenditure category for fishermen. Some aspects can and are being addressed, however, including material's persistence in the environment and the safe collection and disposal of damaged gear by anglers. The Countryside Council for Wales (CCW) conservation code has practical advice to minimise gear loss and reduce its potential impact on the environment.

Tackle manufacturers are increasingly considering environmental matters when designing and producing fishing gear, both in response to customer demands and legislative change. The use of lead in fishing gear is likely to be banned in the near future in recognition of the harmful and persistent effects of lead at popular angling locations.

Recreational users are responsible for about 1/3 of litter found on UK beaches. Marine litter is an important issue for anglers as they are frequent coastal users. Many remove their own and others' litter, but some anglers do not dispose of the litter they generate appropriately and therefore contribute to marine litter themselves. Litter is therefore one of the most serious environmental issues associated with angling.

6.2.4 Recreational boating

Boat anglers are a significant part of recreational boating traffic. As such they present the same potential environmental impacts as leisure boat traffic, although their boat usage may differ in terms of time, location and activity. The British Marine Federation is developing an environmental code of practice for recreational boat users. Potential issues to be addressed include waste disposal, damage to marine habitats with anchors and anchor chains, disturbance of marine organisms by boat traffic and oil/fuel spill risk.

6.2.5 Positive impacts

Anglers have a vested interest in the protection of the resources they target and consequently many are committed conservationists. In many situations the presence of anglers helps to maintain environmental quality through their own stewardship and self-policing. There are also occasions where sea anglers have taken positive steps towards improving their sport through tagging schemes or campaigning to reduce marine pollution. A number of sea angling organisations have environmental sections or working groups to address the issues mentioned above.

The Countryside Council for Wales' conservation code for sea anglers recognises that sea anglers are natural conservationists. Many elements of the CCW code are similar to the Australian national code of practice for recreational and sport fishing presented in Annex F. The Australian code is voluntary amongst member organisations. As with bait collection codes, the impact of a similar voluntary

agreement in the UK has to overcome the fact that only a small proportion of boat anglers are within associations.

6.3 Summary

Conflict exists between anglers and commercial fishermen in inshore areas – and, more intensely, on wrecks and reefs. This includes problems with snagging gear, and with anglers perceiving they are being intimidated by commercial fishermen. The two groups fish for a different set of species, but do compete for some stocks, most notably mackerel, cod, bass and plaice. It is more common for anglers to blame commercial fishermen for the poor state of some stocks than the reverse situation. However, conflict is not inevitable, and relations are good in some areas.

Sea anglers' impact on the environment is, for the most part, low impact. Certain practices, such as bait digging, may have significant localised impacts at the few locations available in the South West. Certain target species such as rays and sharks are prone to over fishing, but there is a positive trend favouring catch and release. Marine litter is an important issue for many anglers, and is a problem to which some anglers contribute. Positive environmental initiatives would have greater impact if they were able to reach beyond club members to the whole sea angling sector.

7 Management options

7.1 Survey responses

In our angler survey, respondents were asked to consider a variety of issues and indicate how important these issues were to them. They were then asked to consider a variety of management options and indicate their level of support for these options. The management options were grouped into those targeting commercial fisheries and those targeting recreational fisheries. Unsurprisingly, overall anglers gave stronger support to options targeting commercial fisheries than management measures directed at the recreational sector.

The average response for each option ranges from “no opinion/neutral” through to “very important” or “strong support”. This overall positive response may, to some extent, be explained by the fact that this is one of the first exercises where UK anglers have been consulted on fisheries management options and so are keen to see developments beyond the current status quo. Anglers feel that “any management” is better than “no management”.

There are limitations to this form of questioning as respondents will inevitably consider the likely impact upon themselves rather than on all users of the shared resource. As a result, some of the responses are “obvious” – such as anglers’ support for measures that restrict commercial fishing. Nevertheless, in a suitably large sample size the average ratings do give an indication of comparative importance of issues or level of support for the options proposed.

In the tables below, anglers are differentiated by how they predominantly fish. This was determined using K-means cluster analysis (see Section 4.1.6 and Annex B1). The process resulted in four types: shore anglers, charter boat anglers, private boat anglers and “mixed” anglers (who fish from the shore an average of 44% of the time, private boats 36% and charter boats 20%).

Table 7.1 presents responses to the question, “how important are these angling issues to you?” A score of 5 = very important, 4 = important, 3 = neutral, 2 = not important and 1 = irrelevant. It is evident that environmental issues, fisheries management and wider recognition of sea angling are seen as more important to anglers than “access & facilities” or “events and competitions”.

Table 7.1. Level of importance of angling issues by angler type

Issues	Angling type				Total
	Shore	Charter	Mixed	Private boat	
Environmental issues	4.8	4.6	4.8	4.5	**4.7**
Fisheries management	4.6	4.4	4.7	4.8	**4.6**
Wider recognition of sea angling	4.2	4.2	4.7	4.6	**4.3**
Accessibility & facilities	3.7	4.0	4.2	4.2	**3.9**
Social events & competitions	2.8	3.1	3.3	3.0	**3.0**

At first glance, it is surprising that "environmental issues" scores highest as "environmental quality" is deemed an insignificant attribute in angler choices through the CE results. To some extent this may be due to yea-saying (a desire to please the surveyor). This question does also mention litter (something many anglers feel strongly about) and water quality as specific issues rather than the choice experiment considering a "satisfactory" or "excellent" environment. This distinction is borne out by the greater importance shore-based anglers place on environmental issues compared to boat anglers: anglers fishing on the shoreline are likely to be exposed to litter or evidence of point source water pollution for longer periods of time.

"Social events and competitions" are considered the least important of the issues presented to anglers in the survey. It is understandable that an overall neutral score is chosen, as not all anglers choose to participate in group events – and some enjoy angling partly for the opportunity to spend time alone. The social aspects of angling are very important to many anglers whether they enter competitions or not, but it is clearly not a major issue of concern for the management of sea angling.

Table 7.2 presents angler responses to the statement, "Please tell me your level of support for these *potential* management options for commercial fisheries". Scoring 5 relates to "strongly support" while 1 relates to "oppose strongly". All options receive support from anglers with "stronger enforcement" coming out on top. This may be due to this option not introducing new regulations, but simply ensuring more efficient management – something most feel able to support.

Table 7.2. Level of support for commercial fisheries management options by angler type

Management options	Angling type				Total
	Shore	Charter	Mixed	Private boat	
Stronger enforcement	4.7	4.6	4.9	4.9	**4.8**
Restricting methods conflicting with angling	4.5	4.5	4.8	4.7	**4.6**
Increased minimum landing sizes	4.5	4.2	4.6	4.5	**4.5**
Exclusive sea angling areas	4.3	4.5	4.6	4.7	**4.4**
Designating 'Recreational species'	4.1	3.7	4.4	4.2	**4.1**

Designating "recreational species" is supported, but not as strongly as other options, perhaps because some respondents saw this as being unnecessary and/or unworkable for the species of most interest to them – or did not understand what the policy would involve. It may also create additional friction between commercial and recreational fishers, which may be why the lowest support rating is from charter boat anglers who may experience more interactions with commercial fishing interests.

Table 7.3 presents angler responses to the statement, "Please tell me your level of support for these *potential* management options for recreational fisheries" with the same scoring system as the table above. Strong support exists for areas closed to all types of fishing and for increased minimum landing sizes.

Although an average score of 3 was given for sea angling licences, anglers all had an opinion on licences, and each is far from "neutral". Attitudes towards licences are very mixed and thus a highly emotive issue for sea anglers with the Review of Marine Fisheries Enforcement showing that licensing sea anglers is currently being considered by Defra. Overall, there is not a great deal of angler support for sea angling licences, despite the statement that revenue would be ring-fenced, as this is perceived as an additional cost to the angler without any guarantee of benefits.

Seasonal closures for both commercial and recreational fishers are also not well supported. This is understandable given that 77% of survey respondents fish all year and would therefore expect to find their pastime curtailed in some way. Bag or rod limits are given some support, but noticeably less amongst own-boat anglers.

Table 7.3. Level of support for recreational fisheries management options by angler type

Management Options	Angler type				Total
	Shore	Charter	Mixed	Private boat	
Closed areas to all fishing	3.9	4.2	3.8	4.3	**4.0**
Increased minimum landing sizes for all	4.0	4.0	4.3	3.9	**4.0**
Bag/rod limits	3.8	3.7	3.9	3.2	**3.7**
Seasonal closures for all	3.5	3.7	3.4	3.2	**3.4**
Licences with ring-fencing of revenue	3.0	2.9	3.3	3.3	**3.1**

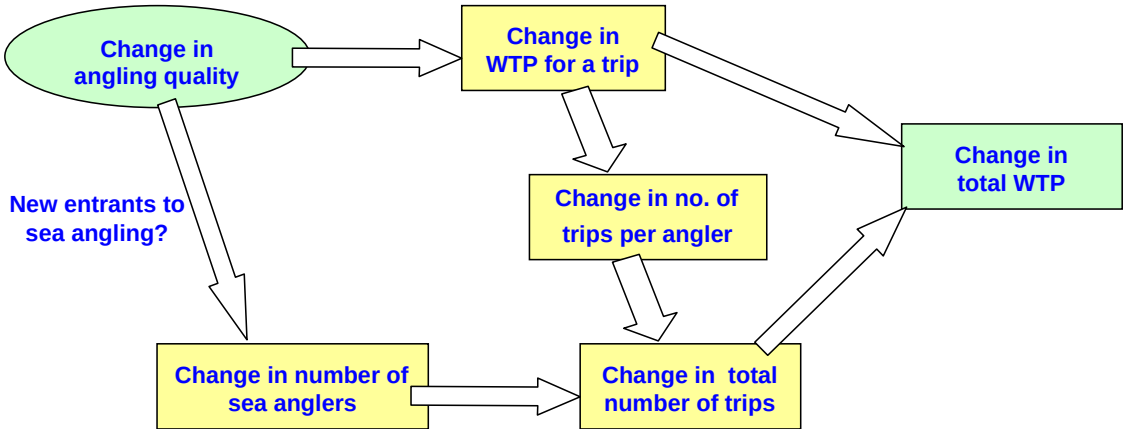
Immediately after the questions on issues and options, anglers were asked which phrase best explains their reasoning behind the answers given. Over half the respondents selected "measures are needed to ensure good fishing for future generations" while 22% selected "commercial fishing needs to be restricted" and 15% chose "measures need to be taken to preserve the environment". Reassuringly, only 1% suggested they were "just guessing" when responding to the questions.

The choice experiment (CE) results (Section 5) quantify the "importance" of different attributes of a particular site to anglers in monetary value. This has the benefit of the respondent weighing up attributes together rather than considering each individually. In this way trade-offs between different attributes can be measured, which is beyond the scope of simple questioning through survey. It is suggested therefore that the findings from the choice experiment have greater rigour than the results below, but the following results do contribute to our understanding of angler perceptions and management options they currently favour.

7.2 Angler responses and alternative activities

A change in the quality of sea angling can affect the value of sea angling through a number of mechanisms: it can attract new entrants to the sport; it can change the activity level of existing anglers; and it can change the value that sea anglers gain from their sport. Figure 7.1 shows how these mechanisms interact with each other.

Figure 7.1. Responses to a change in angling quality



Sections 5.2 and 5.3 investigate how WTP changes as the quality of the angling experience changes. Importantly, these results tell us about the relative importance of each site attribute, so that we know what is important in determining anglers' responses. Section 8.1.1 discusses the evidence on potential numbers of new entrants. In this section we assess the remaining mechanism – the change expected in the number of trips made by existing anglers.

We present two pieces of evidence: a qualitative investigation from our angler survey, and results derived from the choice experiment. In an ideal world we would want to collect time series data on how participation levels link to angling quality, but that was not possible in this study. Anecdotal evidence and the results in 4.1.3 suggest that there has been little change in participation levels, despite anglers believing that stocks have declined substantially (Section 4.2.3). However, there is likely to be a lag between stocks falling and any corresponding fall in sea angling participation – so the level of sea angling activity may currently be vulnerable to a further decline in stocks.

There is some evidence from elsewhere in the world that initiatives which succeed in increasing the size of a fish stock can lead to corresponding increases in the number of angling trips taken. In the US, for example, Essig and Beal (2000)[8] show that the number of recreational fishing trips targeting Atlantic coast striped bass increased by over 500% between 1982 and 1998, following on from management measures which led to a similarly impressive increase in the stock of striped bass. Expenditure on striped bass fishing trips increased by an even larger amount.

[8] Essig R. J. & Beal R. E. (2000) Atlantic coast striped bass recovery: federal aid in sport fish restoration in support of interstate fishery management. In "Celebrating 50 years of the sport fish restoration program", supplement to *Fisheries*, magazine of the American Fisheries Society.

7.2.1 Qualitative indication of likely changes in participation levels

The main piece of evidence we have on potential changes in activity levels is the results of a qualitative question in our angling study. Respondents were asked, "If there were substantially more or bigger fish, would you … go sea angling much more often; somewhat more often; or would there be no change?" They were similarly asked about their level of future activity if they caught fewer or smaller fish. Table 7.4 presents the results.

Around half would increase their angling activity if they experienced more or bigger fish. By the same token around half would decrease activity if the angling product worsened. It is interesting to note that this means around half the anglers surveyed would not alter their activity in response to significant changes in fish size or numbers. The response to an improved angling experience is marginally more elastic than the response to a worsened experience. The choice experiment results indicate that anglers want more and/or bigger fish – but Table 7.4 indicates that there would be some inertia from existing anglers towards changing their level of activity.

Table 7.4. Change in activity due to change in the sea angling product

Proportion of anglers that would…	If more or bigger fish	If fewer or smaller fish
Go much more often	27%	
Somewhat more often	26%	
No change	47%	52%
Somewhat less often		26%
Much less often		21%

7.2.2 Response functions derived from choice experiment results

We can also derive response functions from our choice experiment, as we always set the utility of option C, "do some other than sea angling", to zero. Thus, if the utility of either (or both) of sites A and B is greater than zero then the respondent will choose to go sea angling; if the utility of both is less than zero then (s)he will choose to do something other than sea angling. As we know how utility varies as site attributes change (from the results in Section 5), we can calculate how the proportion of anglers who choose to go sea angling will vary as site attributes change. This assumes that anglers' behaviour would be directly linked to their current preferences.

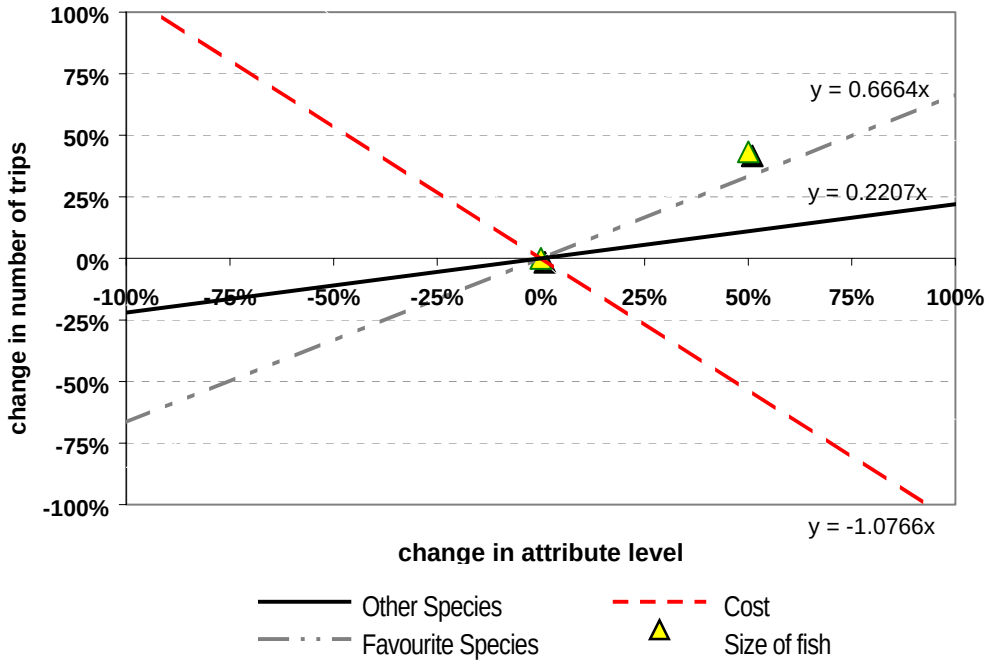
However, this process is rather complex. As quantifying anglers' responses was not part of the original brief for this work package, it was not appropriate for us to spend large amounts of time here. Nevertheless, we have carried out this process in a simplified form, producing the results shown in Figure 7.2. The

results should be treated with caution, as they may not accurately reflect how anglers would behave in practice. In particular, the results at the extreme ends of the graph are likely to be least reliable.

For example, the results show that a 50% increase in the size of fish would result in existing anglers making 43% more trips; a 50% increase in the catch of the angler's favourite species would result in 33% more trips; a 50% increase in the catch of other species would result in 11% more trips. A 50% increase in the cost of going angling would result in 54% *fewer* trips.

If further information is required on anglers' responses then we suggest that an additional piece of work be commissioned to investigate this further.

Figure 7.2. Changes in the number of trips made by existing anglers, as attribute levels change



7.2.3 Alternative activities

To help determine the potential substitution impacts of anglers no longer choosing to go sea angling, interviewees were asked which one of a list of activities would they do instead. Table 7.5 presents a breakdown of responses, which indicates that if sea angling were deemed unacceptable around two thirds would continue to go fishing either elsewhere in the UK, overseas or at coarse angling locations. This suggests some of the dependent sectors, such as the tackle shops, may not see a proportional downturn in business, but many of the

associated industries, such as charter boats and bait providers, will inevitably be hard hit. Clear beneficiaries of displacement activity away from sea angling in the South West are likely to be coarse fisheries with 29% saying they would do take coarse fishing up instead.

Of those surveyed, 22% of anglers would opt to spend the time they spent angling engaged in some other outdoor activity. The most popular responses in this category were as follows: walking, golf, boating and field sports (including fly fishing and shooting). With walking quoted as the number one alternative activity, spend on leisure activities by this group may reduce to be redistributed elsewhere within the South West economy. The continued emphasis on outdoor activities is good news in terms of public health as only 9% propose they would pursue non-outdoor activities, which are not necessarily worse for health than angling. Indeed some of the alternative activities such as walking are seen to have significant health benefits.

Table 7.5. Alternative activities were sea angling to reach an unacceptable level

Activity	Proportion of respondents
Coarse angling	29%
Sea angling elsewhere in the UK	26%
Other outdoor activity	22%
Sea angling overseas	12%
Other activity	9%

In terms of economic impact on the South West economy, these findings suggest some inevitable leakage of spend outside the South West. Assuming coarse angling will be undertaken at locations in the South West this leakage may be around 40% with sea angling elsewhere and overseas. As such trips are likely to be less often but entail more cost, spend associated with continued angling may be unchanged for those opting to fish elsewhere, but the spend may alter in emphasis to be more on travel costs going outside the local economy. This activity leads to additional impacts to be considered in any regulatory impact assessment, such as the environmental consequences of increased travel to continue angling.

The largest impact of the reduction of the South West sea angling product to an unacceptable level is likely to be in terms of visitors and their associated spend. The Centre for the Economics and Management of Aquatic Resources at the University of Portsmouth (Cemare) and The Centre for Environment, Fisheries and Aquaculture Science (CEFAS) are currently developing a bio-economic model for Invest in Fish South West that explore the impact of angler activity and associated issues more fully.

7.3 Suggestions for management

7.3.1 Management measures elsewhere

Anglers were asked whether they had experienced or heard of management measures elsewhere that they would like to see considered for the South West. Such open-ended questions are difficult to analyse quantitatively, but can be a useful source of anecdotal information.

The most commonly recurring management example mentioned is the **bass fishery** management by the **Republic of Ireland** where, since 1990, the BASS (RESTRICTION ON SALE) ORDER makes it an offence to sell bass, or offer it for sale. The bass resource is effectively allocated to recreational anglers, with management measures in place to control angling including a bag limit, a minimum landing size greater than the EU size, and a closed season.

Several interviewees also mention the **striped bass fishery** in the **US**. Striped bass are managed under a fishery management plan developed by the Atlantic States Marine Fisheries Commission under the authority of a Striped Bass Conservation Act. Some states have no commercial fishery whilst others allocate a proportion of resources for commercial exploitation. Controls are highly restrictive, and are robustly enforced by European standards. These controls include annual quotas with carcass tagging for commercial fishermen, and bag limits for recreational anglers. Size limits and seasonal closures apply to both sectors, and all fisheries are restricted to state waters only (inside three miles).

Commercial fishing restrictions in Australia in certain areas (such as nursery areas) are cited as an example for the UK to follow. Fisheries management measures vary from state to state but use a range of seasonal closed areas and marine reserves. In addition to closed areas and commercial restrictions, most Australian states impose **bag and possession limits** on recreational fishers. Several interviewees specifically mentioned these catch limits.

Other suggestions occurring several times include the introduction of **licences**, with Florida mentioned as an example. Sports fishing in Floridian waters requires each angler to have a licence, which currently costs Florida residents $13.50 for 12 months and non-residents $16.50 for a week. Sea angling licences are certainly not universally approved of, however (see Section 7.1). A few sea anglers also suggest the management regime applying to **freshwater** fisheries in the UK should be applied to the marine environment.

7.3.2 Anglers' own suggestions

Restricting commercial fishing

By far the most common response from anglers, when asked about their favoured management options, was for restrictions on commercial fishing. This is reflected in the examples of management elsewhere that are mentioned above, and in the support for Marine Protected Areas detailed below. Anglers also favoured **gear restrictions** (either total bans or restrictions in certain areas), **minimum landing sizes** (perhaps linked to a gear restriction), **seasonal closures** (particularly to protect spawning stocks), and **protection for specific species**. Another clear theme was the need for improved **enforcement** (see Section 8.2.1).

Marine Protected Areas

Anglers were asked "are there any geographical areas that you would particularly like to see protected?" The vast majority interpreted this as protection from commercial fishing as opposed to protection from *all* fishing. The most common response was to protect spawning grounds either all year or seasonally. There were also calls to protect known nursery areas, e.g. estuaries. Other areas proposed were more specific, such as well-known marks including Eddystone Reef, The Skerries Banks, Chesil Bank and the Tamar estuary. Anglers also suggested some of the popular bays should be for recreational use only, including Lyme Bay and Torbay.

A popular general proposition was to protect "all inshore waters" (suggested distances from shore varied between 1 and 12 miles), and in particular protection from trawling. The trawler ban protecting the Skerries is a Devon Sea Fisheries Committee by-law that has proved workable and is viewed as a success for anglers in the area, although there are occasions where trawlers are still spotted on the grounds. Many anglers suggested that trawling should not be permitted inshore at all.

Artificial reefs

Several anglers advocated the use of artificial reefs (some referred to the success of those built in the United States expressly for recreational purposes, including fishing). This might be combined with a Marine Protected Area of some sort. Artificial reefs can have additional benefits if sited appropriately; for example, if sited on inshore areas which are currently rather barren, then this would give local charter boats an additional option to visit in bad weather, helping their businesses to become less vulnerable to the vagaries of our climate. Other benefits may include coastal protection, and the provision of a

physical barrier to prevent commercial fishing in banned areas – and perhaps even preventing motorboats from entering bathing areas.

Maximum landing sizes

There was some support for maximum landing sizes (as well as minimum landing sizes), in recognition of the importance of large individuals to reproductive capacity in the stock. It is clear that anglers derive disproportional benefit from catching larger fish, but they may well be receptive to returning them alive.

Catch and release

Most anglers we spoke to were highly supportive of catch and release by anglers, and the majority claim they already do this. There may be potential to spread this practice more widely, particularly to anglers not associated with clubs. However, this potential is limited by the fact that the catch and release message has already been accepted, the desire by anglers to take home fish that they plan to eat (or use as bait), and the possibility of catch and release becoming *less* prevalent if fish sizes increase (Section 8.2.5). The greatest potential may be through linking catch and release to a maximum landing size.

7.4 Summary

The greatest cause of concern for most sea anglers is the perception that commercial fishing is causing serious damage to fish stocks and habitats. Many sea anglers are highly supportive of measures to restrict commercial fishing activity, including marine protected areas, gear restrictions, minimum landing sizes, seasonal closures, and protection for specific species. In particular, anglers demand improved *enforcement* of current legislation.

Examples of successful management elsewhere include the bass fishery management in the Republic of Ireland, the striped bass fishery in the US and commercial fishing restrictions in Australia. Other suggestions for management included artificial reefs, maximum landing sizes and increased take-up of catch and release.

Environmental issues and fisheries management are seen as the two most important angling issues. The most favoured management measures that would affect recreational angling directly were areas closed to all fishing and increased minimum landing sizes. Sea angling licences (with ring-fencing of revenue) were the least popular option, although opinions were highly diverse on this issue.

A change in the quality of sea angling can affect the value of sea angling through a number of mechanisms: it can attract new entrants to the sport; it can change the activity level of existing anglers; and it can change the value that sea anglers gain from their sport. The qualitative investigation from our angler survey

indicates that there would be some inertia to change from anglers, with around half indicating that their activity level would not change if the angling experience either improved or worsened. Historical evidence supports this, suggesting that there has been little change in participation levels, despite a substantial decline in stocks. However, there may be a lag between stocks falling and a fall in sea angling participation – so participation levels may be vulnerable to continued declines in stocks.

Results derived from the choice experiment indicate that a 50% increase in the size of fish would result in existing anglers making 43% more trips; a 50% increase in the catch of the favourite species would mean 33% more trips; and a 50% increase in the catch of other species would result in 11% more trips. However, these results should be treated with caution, as there is a great deal of uncertainty around them. Some evidence exists that, in the USA, increasing a fish stock can lead to corresponding increases in the number of angling trips taken. We recommend that an additional piece of work be commissioned to investigate this further.

The most popular alternative activities to switch to if sea angling was deemed unacceptable are to continue to go sea angling elsewhere in the UK, to switch to coarse angling, or to take up another outdoor activity.

8 Trends

The following issues and trends were highlighted through discussions with anglers and associated industries; each one could impact upon future management of resources and the sector itself.

8.1 Angling trends

8.1.1 Participation levels

The Defra report suggests there is a stable or increasing demand for sea angling, but growth in the sector in England and Wales may be inhibited by a lack of fish or poor fish quality. As with the commercial sector, many charter skippers believe improved technology masks the full impact of stock declines, as nowadays they are better at targeting the fish that remain. In the relatively short term therefore, participation levels may decrease if successful stock recovery measures are not put into place. In the South West it is already recognised that more and more British sea anglers are going abroad to find better angling opportunities; this means both fewer visiting anglers choosing the South West, and fewer angling trips made by regional anglers in the region.

The survey responses suggest that any decline in angler activity over the last five years has been very marginal. The overall level of activity appears to be relatively stable, which supports the findings from the Defra report. With increasing numbers of retirees in the population and particularly in the South West, it could be expected that the number of angler trips may remain stable, but the average age of anglers will increase.

Some anglers suggest that there are fewer young people taking up angling as a pastime. This may in part be a result of a decline in the resources being targeted – a poor fishing trip early on is more likely to dissuade from future trips – but also due to the change in how youngsters spend their free time. Less time is spent outdoors being active, leading to growing childhood obesity levels. The National Diet and Nutrition Survey published in 2000 found that 40–69% of children over the age of six years old are largely inactive, spending less than one hour per day participating in moderate-intensity activities. While angling is not seen as a high intensity exercise there are recognised therapeutic benefits to participating in the sport, such as reducing stress and getting outdoors.

Whilst wider lifestyle issues may point to a trend towards inactivity, it is intuitive that an improved resource is likely to help attract more people into the sport as well as increased angler spend and activity. With the great majority of the population in the South West living a short travel time from the sea, sea angling may well benefit from successful initiatives encouraging outdoor activities in

young people, but only if the quality of the resource is sufficient to maintain interest. There is likely to be a lag between stocks falling and any corresponding fall in sea angling participation – so the level of sea angling activity may be vulnerable to a further decline in stocks, despite the evidence that participation has not fallen much in recent years.

8.1.2 Saltwater fly-fishing

One growth area for sea angling is saltwater fly-fishing (mainly targeting bass or pollack). This sub-sector appears to be attracting new participants via game fishing enthusiasts, as well as existing sea anglers.

The increasing interest from game fishermen is partly a result of the decline in the numbers of salmon and trout and the growing costs of participation in payment to private fisheries. A great appeal in the switch to sea angling is that it is seen as a low-cost alternative. But as expenditure per head is far greater in salmon and trout fly fisheries than for other angling sectors, increased participation in sea angling by this sector could result in significant expenditure increases on sea angling.

In a poll of Salmon and Trout Association members, around 40% expressed an interest in saltwater fly-fishing. As the association has around 115,000 members, if saltwater fly-fishing's popularity continues to grow it could result in significant numbers entering the sea-angling sector.

8.1.3 Animal welfare

There are concerns amongst the angling lobby that animal welfare campaigners will at some point in the future turn their full attention to fishing – particularly following the successful lobbying for the banning of hunting with hounds.

Other activities such as shooting are thought to be a higher priority for animal welfare campaigners than angling. This will certainly be the case if anglers continue to reduce their impacts upon the fish through greater rates of catch and release, and ensuring humane landing and handling of the fish. It is therefore expected that angling will continue to be a popular pastime that is increasingly recognised within fisheries management.

8.1.4 Red diesel

An issue of importance to boat anglers is the possibility of recreational boaters losing the right to use red diesel for fuel. The derogation permitting use of duty-free fuel by recreational boaters is due to end in 2006 and would immediately result in a price increase of up to three times current fuel prices.

An Royal Yachting Association (RYA) survey of boat owners in 2004 asked what their reactions would be to a fuel price increase of 200%. 36% would get fuel from abroad, 16% would move their boats abroad and 10% would give up all boating all together. Such intentions rarely translate accurately into actual impacts, particularly so far in advance of the event, but it is clear that participation levels and associated revenues could reduce as a result.

As most anglers operate petrol-engines on their vessels, a significant impact on the angling sector is not expected despite the major contribution boat anglers make to spend by the sector as a whole.

8.2 Management trends

8.2.1 Enforcement

It is clear that anglers believe that greater controls over commercial fishing are required to curb the perceived trend of decreases in many stocks. Until these are in place, some anglers will resist any management measures proposed that may restrict them in their activities. Other sections of the angling community take a more holistic view and wish angling to be considered within the wider management of marine resources.

Much of the CFP reform from 2002 (mapping out the CFP's structure to 2012) focused on improving enforcement through more joined-up operations and the establishment of a European inspectorate to better co-ordinate member state enforcement efforts. It also proposed better integrating environmental concerns, and introducing the concept of ecosystem-based management. The intention is also to move towards longer-term management plans. It is early days for the reforms proposed in 2002 and there has been little impact upon the workings of fisheries management to date.

8.2.2 Regional Advisory Councils (RACs)

The establishment of RACs is seen as the most positive element of the reform package. The structure and membership of these bodies is still being debated. The most advanced is the North Sea RAC, which is still to hold its inaugural meeting but has proposed the following membership of its executive committee:

North Sea Regional Advisory Council Executive Committee Membership (proposed)

Catchers' Organisation Belgium
Catchers' Organisation France x 2
Catchers' Organisation Denmark x 2
Catchers' Organisation Germany
Catchers' Organisation Netherlands x 2
Catchers' Organisation Poland
Catchers' Organisation Spain
Catchers' Organisation South Westeden
Catchers' Organisation United Kingdom x 2
European Organisation for Fish Traders
European Association of Fishing Ports and Auctions
European Transport Worker's Federation
16

Green-NGO x 3
Consumer
Aquaculture Producer
Fisher-Recreational
North Sea Women's Network
One Other Organisation
8

Total: <u>24 members</u>

It is clear from the above that commercial fishing interests are to dominate RAC membership – at least initially. The South Western Waters RAC, which along with the Pelagic Stocks RAC is of most significance to the South West of England, is likely to be dominated by the Producer Organisations of the three main fleets: the UK, France and Ireland. These groups have already started to work together in recent years, in response to a threat of increasing control measures.

8.2.3 Licensing

It is a positive step that more regional management (albeit at first only an advisory basis) of fisheries resources is progressing. It is also a positive development for recreational anglers to be included within that management (albeit without the parity many anglers suggest is appropriate). Increased recognition, however, often leads to increased accountability. As anglers become accepted as a part of a co-management structure, their own activities come under scrutiny.

Recommendations from the recent Strategy Unit report and the Review of Marine Fisheries & Environmental Enforcement ("the Bradley report") support the inclusion of recreational fishing, but they also propose the introduction of licensing. This is a highly contentious issue in the angling world, despite assurances that monies will be ring-fenced for recreational fisheries management. Some in the industry are supportive of a licence fee with those provisos, while others see the development as inevitable.

If specific species were managed for recreational angling only, some form of control over angling's impact is expected and advocated. Without this control, a recreational stock can become overexploited in the same way that commercial

stocks can. It can also have knock-on ecosystem impacts. The following extract from a recent US research paper in *Science*[9] illustrates this:

> Recreational anglers are operating below the radar screen of management. While the individual may take relatively few fish, we show that a few fish per person times millions of fishermen can have an enormous impact. Besides accounting for a sizeable chunk of total catches, anglers tend to target bigger fish. The study says the removal of these top-level predators can cause dramatic changes in ocean food webs, which in turn unbalances the ecosystem. In the Gulf of Mexico the removal of larger reef fish like grouper and snapper has led to a population boom in prey species, such as grunts.

The significant impacts identified in the report are occurring in the US, a country that is at the forefront of recreational fisheries management. US sports fisheries may be becoming victims of their own success and leading to a point where capping effort is necessary in addition to the individual controls (bag limits for example). The South West is some way off this situation, but it does illustrate that, as management moves towards an equitable consideration of interest groups, the impact of all groups on the resource must be managed.

8.2.4 The grey economy

The grey economy of individuals angling for fish in unlicensed boats, and then illegally selling their catch to local restaurants, is a real problem within fisheries management. Many anglers and businesses that we spoke to acknowledged that this practice does occur. However we were not able to ascertain the scale of the problem in any detail.

Two key concerns have been expressed: that selling fish directly to hotels, restaurants and pubs damages the commercial market (although it has been noted by some that many bona fide fishermen also sell directly to hotels, restaurants and pubs); and that it is impossible to record such landings, creating difficulties for fisheries managers trying to quantify levels of fishing mortality.

Whilst there may be disagreement over whether those culpable should be classified as “anglers” or as “commercial fishermen”, this debate is really missing the point. It does not matter what we call this phenomenon simply that it goes on in significant volumes, and makes the job of managing the fishery rather more difficult.

8.2.5 Catch and release

Catch and release is already widely practised by most groups of anglers, and it may be difficult to increase this much further. Indeed, it has been suggested that catch and release rates could potentially reduce if the resource improves.

[9] Coleman, F.C., Figueira, W.F., Ueland, J.S. and Crowder, L.B. (2004) The impact of United States recreational fisheries on marine fish populations, *Science*, 305 (24 September 2004), pp. 1958–1960.

Many anglers release undersized fish and only keep individuals for the table or the freezer when they are of a sufficient size. If resources improve, more of the catch would be suitable for food and may therefore result in less being returned. This points to a need for some form of catch restriction – such as rod or bag limits – in recreational fisheries where target species are food fish, as seen in a number of US and Australian fisheries.

8.3 Summary

Overall participation in the sea angling sector appears to be stable in the short term. However, the average age of participants may be increasing as fewer youngsters are attracted to the sport. There is the potential for growth if the sport improves (including improved fish resources) through increased activity from existing anglers, attracting more visitors to the South West and encouraging youngsters into the sport. The emergence of salt-water fly-fishing could lead to increased participation and higher expenditure levels.

Threats to the sector include the likelihood of participation levels falling if stocks continue to decline; the possibility (considered remote at present) of animal welfare interests threatening angling as an activity; and the prospect of red diesel being withdrawn from recreational boaters.

Meanwhile, the management of marine fisheries is also changing, including the move towards setting up RACs. Many sea anglers believe that the key lies in enforcing legislation more effectively than is presently achieved. However there are highly variable views about the proposal to introduce sea angling licences, and a degree of cynicism about the prospects for any new management initiative. Matters are complicated further by the presence of a grey economy of individuals angling for fish, and then illegally selling their catch to local restaurants – a practice condemned by angling groups, but which certainly takes place.

9 Conclusions

The Invest in Fish South West project proposes management options that balance economic, social and environmental benefits. The findings from this report contribute to this process and give a clear message that anglers want and merit a say in wider fisheries management, particularly as that management becomes more regionalised and ecosystem-based. The report shows that the socio-economic contribution of angling to the South West justifies this demand.

Sea angling in the South West is popular, extensive and diverse. The region offers some of the finest sea angling opportunities in the UK and large numbers of people of all ages enjoy the activity, spending large sums of money in the process.

Gear and boats make up the majority of resident anglers' **expenditure**, whilst visiting anglers also spend substantial amounts on transport and parking, accommodation, charter boat fees and food. Charter boats, mackerel trips and tackle shops are directly dependent upon sea angling, and many other sectors derive benefit as well. In addition to this expenditure, recreational sea angling generates **consumer surplus**, which makes up a substantial portion of the value of angling.

The size of individual fish is particularly important to anglers. Although this varies by species, overall it is fair to say that increasing the size of fish could have a larger impact on the angling experience than increasing **catch levels**. The number of fish caught per day becomes important when catches are at low levels. However, once catches are above a certain threshold, increasing catches further will have little impact. This threshold is not currently being reached for key stocks such as cod and bass.

Angling mortality is substantial for some species, although competition with the commercial sector for stocks is limited to a small number of species – most notably bass, mackerel, cod and plaice. It is clear that the interaction between commercial and recreational interests does not have to be based on conflict, because of the limited number of species that are of interest to both sectors.

However, to get to a point where all interest groups' needs are being met, we must first overcome the cynicism exhibited by many anglers towards any fisheries management scheme, brought about by the failures of past management, and the failure of previous decision-makers to listen to anglers. Sea anglers are currently in favour of restricting the activities of the commercial fishing sector through marine protected areas, gear restrictions, minimum landing sizes, seasonal closures and protection for specific species. They are even more strongly in favour of enhancing the enforcement of existing legislation. Other **management options** proposed by anglers included artificial reefs, maximum landing sizes and increased take-up of catch and release.

The level of participation in sea angling has not significantly reduced in recent years, despite the undoubted deterioration in many key fish stocks. This does not provide a great source of comfort, as participation levels are in danger of falling substantially if the situation continues to worsen at its present rate. Now is the time for action. Now is the time to manage and enhance fish stocks. The future for sea angling can be bright, if all resource users and stakeholders come together to work effectively and fairly towards their common goal of preserving stocks for future generations. The South West would then be a wealthier place.

Annex A: Socio-economics

A1. Regression of total expenditure

The table below shows the results of a linear regression, with Total Expenditure as the dependent variable, run in SPSS. We constrain the constant term to be zero, to avoid obtaining a negative value for fixed cost for charter boat anglers who are not club-members. These results show the way in which the total expenditure of an angler varies as the angling type varies; as the number of days fished p.a. varies; and as club membership varies.

A dummy variable for residence (resident in the South West = 1; not resident = 0) was included in the original model. However this was found to be insignificant so was excluded from the final model shown below. The results are therefore taken to be representative of anglers resident in the South West. DAYSCHAR is the slope dummy variable for charter boat anglers; DAYSSHOR is the slope dummy variable for shore anglers.

Some of the variables in the final model are statistically insignificant, but are critically required in the model in order to allow us to obtain differentiated estimates of fixed and variable costs for each angling type (which are used in the calculation of the total expenditure by the population), and to enable us to adjust for the impact of on-site sampling bias. These insignificant variables have therefore been left in the model.

Table A1. Results of linear regression, total expenditure as dependent variable

	Unstandardised Coefficients *B*	Std. Error	Standardized Coefficients Beta	*t*	Sig.
Club Member	**803**	357	0.183	2.251	**0.025**
Shore	**87**	366	0.018	0.238	**0.812**
Private boat	**3,179**	948	0.329	3.354	**0.001**
Days fished pa	**24.42**	15.1	0.344	1.62	**0.106**
DAYSCHAR	**32.28**	21.5	0.1	1.5	**0.135**
DAYSSHOR	**- 11.94**	17.6	-0.127	-0.679	**0.498**

A2. Expenditure on boats

The fixed cost for private boat anglers has been adjusted to provide a more realistic estimate of the expenditure on boats. Before the adjustment, this category accounts for over a third of total expenditure – but our sample size for private boat anglers was only 45. In addition, boat anglers will only buy a boat once every 10 or more years; so we would expect only a very small number out

of our sample to have bought in the last 12 months. This is far too small a sample to give a reliable estimate. In fact, rather more respondents than expected quoted large amounts of expenditure on boats, causing our estimate to be unexpectedly high. To overcome this problem, we combine our results with data from the recent Defra report, which obtained a sample of 208 private boat anglers from across England and Wales, as shown in Table A2.

Table A2. Expenditure on boats

	Sample size	Expenditure on boats p.a.
Our sample	45	£2800
The Defra report sample	208	£1693
Combined sample	**253**	**£1890**

We incorporate this change into our results by adjusting our estimate of fixed cost for private boat anglers by *the difference between the estimate from our sample and the revised estimate based on the combined sample* i.e. we subtract £910 (£2800 – £1890) from our estimate of private boat anglers' fixed costs.

A3. Fixed and variable costs

Results from the linear regression described above can be used to indicate the fixed costs (costs that do not vary as the number of trips taken varies) and variable costs (costs that are proportional to the number of trips taken) for each angler type. These are shown in Tables A3.1 and A3.2. Note that these fixed/variable costs are derived from the raw data through a linear regression, rather than by examining the split of expenditure by category; they represent the best statistical fit to the actual data. Table A3.3 shows how these values are used to find the annual spend per participating household in the South West, and hence the overall spend by each angling type.

Table A3.1. Fixed costs by angler type and club membership

	Shore	Charter	Private boat	Average
Club member	**890**	**803**	**3072**	**1341**
Non member	**87**	**0**	**2269**	**539**
Average	**261**	**174**	**2443**	**713**

Table A3.2. Variable costs by angler type

	Shore	Charter	Private boat	Average
All anglers	**12.48**	**56.70**	**24.42**	**24.84**

As expected, private boat owners have the highest fixed costs (a large part of which is purchasing their boat). Charter boat anglers have a much smaller fixed cost (here it is fixed to be zero, the unconstrained regression predicted a negative fixed cost) but much higher variable costs than the other angling types (this includes travel, accommodation and charter boat fees). Shore anglers have the lowest expenditures.

Table A3.3. Expenditure by households in the South West, by angling type

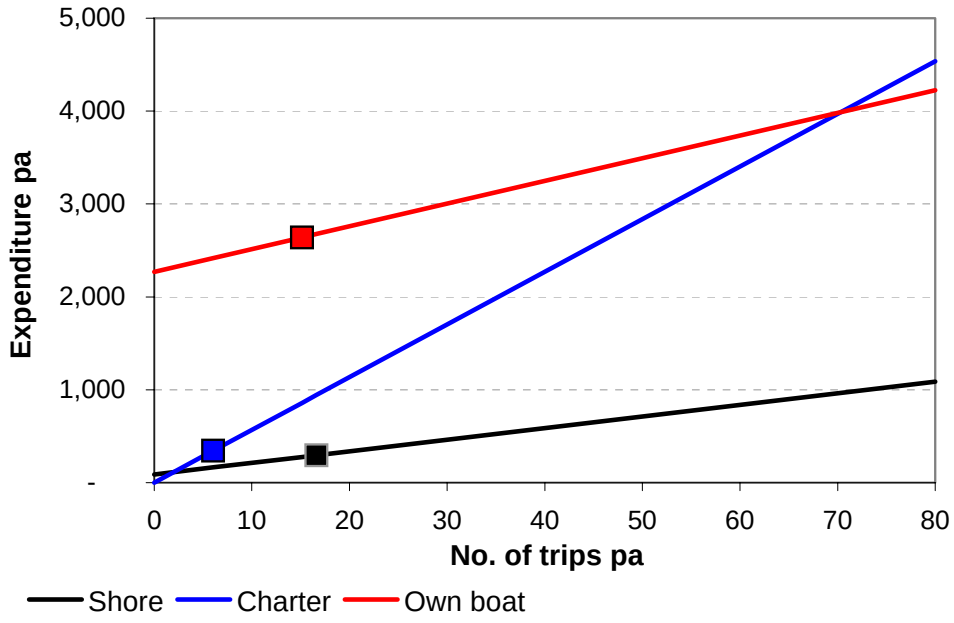
	Split of house-holds[10]	Costs		No. days pa per h/hold[8]	Annual spend		% of spend
		Fixed	Per trip		Per participating household	Total (£m)	
Shore	55.0%	£261	£12.48	16.6	£469	48	25%
Charter	21.6%	£174	£56.70	6.1	£517	21	11%
Private boat	23.4%	£2,443	£24.42	15.1	£2813	122	64%
Total				**14.0**	**£1028**	**190**	

These relationships can perhaps be most easily viewed by plotting a graph of expenditure (per annum) against number of days angling. Figure A3.1 shows these relationships for non-club members; for club members, all graphs will have the same slope as here, but have a fixed cost, which is £803 higher than shown here. The markers on each line indicate the position of the average number of trips made per annum. We read off the average expenditure by each angling type from these markers.

The degree of uncertainty surrounding the resulting estimates of expenditure is influenced by both uncertainty over the linear regression model used here (see Table A1) and uncertainty over the Defra report's estimates of the numbers of participating households and the number of days fished per annum. Standard deviations and confidence intervals are not given for these data in the Defra report. Their sample was based on a representative Omnibus household survey of 10,980 adults in England and Wales.

[10] Source: The Defra report.

Figure A3.1. Expenditure against number of days angling for non club-members



A4. Proportion of resident anglers' spend which is in South West

Table A4. Proportion of resident anglers' spend which is in South West

		Gear	Trans-port	Parking	Food	Accomm-odation	Competit-ions	Club fees	Maga-zines	Boats	Insur-ance	Charter fees	Harbour dues	Other	Total
Angler type	Shore	60%	70%	70%	70%	70%	50%	90%	20%	50%	20%	65%	100%	80%	**61%**
	Charter boat	60%	60%	60%	60%	60%	50%	90%	20%	50%	20%	65%	100%	70%	**60%**
	Private boat	60%	70%	70%	70%	70%	50%	90%	20%	50%	20%	65%	100%	80%	**56%**
	Mixed	60%	60%	60%	60%	60%	50%	90%	20%	50%	20%	65%	100%	70%	**56%**
Average		60%	68%	68%	69%	65%	50%	90%	20%	50%	20%	65%	100%	74%	**58%**

A5. Comparison with previously published estimate of sea anglers' expenditure

This section explains in more detail the three reasons given in Section 3.2.4 for the difference between our estimate of expenditure per participating household (£1028) and the estimate in the Defra report (£489).

1. Anglers in the South West could spend more than anglers elsewhere

The difference could be a genuine difference between the spend of anglers in the South West and those elsewhere in England and Wales. This is entirely likely, given the widespread opportunities for sea angling in the South West. However, we believe that the difference between the two studies' results is too large to be explained in this way alone.

Both studies use the same data source[11] for the split between shore, charter boat and private boat anglers and the number of households participating in sea angling, so the difference in expenditure is not due to differences in these factors.

Both studies also use the same source for the number of days angling each year – anglers in the South West were found to make 24% more trips than a typical angler in England and Wales. This accounts for 24% of the difference in expenditure.

2. How expenditure is adjusted to allow for on-site sampling bias

Both studies allow for on-site sampling bias; they start with an expenditure estimate from a *sample* spending an average of over 40 days angling per annum, and adjust this to estimate expenditure for a *population* spending only 14 days angling per annum.

As discussed in Section 4.3.2, our study sample over-represents anglers who go angling more often. It therefore also over-represents anglers who spend more money – so a naïve analysis of expenditure from our sample would provide an overestimate of total expenditure. The Defra study also suffers from this bias. Both studies attempt to adjust for this bias, but do so in different ways:

– As explained above, we carried out a regression of total expenditure on the number of days angling, splitting expenditure into fixed costs and variable costs; from the resulting graphs (Figure A3.1) we read off the expenditure corresponding to the average number of days fished by the population (14).

– The Defra study calculates the *expenditure per day* from their sample data, and then multiplies this by the number of days that they estimate an

[11] The Omnibus household survey in the Defra report.

"average" angler fishes each year (14).

These two approaches differ in the allowance made for *fixed expenses*. An angler making 14 trips a year will incur the same level of fixed expenses as an angler making over 40 trips a year … it is only the variable expenses that will fall as the number of trips falls. The approach used in the Defra study does not take this fully into account – calculating expenditure per day and then multiplying by 14 will reduce the fixed costs as well as the variable costs. We believe that this approach underestimates total expenditure by the angling population.

This difference can be severe; if we were to use the "expenditure per day" approach on our data then our final estimate would be around half of the result we present here. This is therefore the major reason for the difference between the two studies' results.

3. "Recall effect"

The Defra study presented anglers with fewer categories of expenditure to prompt their memory on how much they spent in the previous 12 months. We hypothesise that respondents find it difficult to remember every item of expenditure in a survey of this kind – it is easy to forget about a given category of expenditure (buying angling magazines, say) unless you are specifically prompted on this. Our study prompted respondents with the additional categories of: Parking, Competitions, Club fees, Magazines, Insurance and Harbour dues.

When combined with our "Other" category, these totalled to 15% of total expenditure. In contrast, in the Defra study, the "Other" category (which by implication includes all of these expenditure types) was only 5% of total expenditure – we suggest this is because of this "recall effect".

Indeed, expenditure could be divided into even more categories; this might increase expenditure estimates even further. For example, "Bait", "Fuel" and "Boat Maintenance" could have been given their own categories.

A6. Split of expenditure by category

Table A5. Split of expenditure in South West – resident anglers

		Gear	Trans-port	Parking	Food	Accomm-odation	Compet-itions	Club fees	Magaz-ines	Boats	Insur-ance	Charter fees	Harbour dues	Other
Angler type	Shore	61%	16%	2%	4%	4%	4%	3%	1%	1%	0%	2%	0%	2%
	Charter boat	28%	11%	2%	3%	13%	7%	4%	1%	0%	0%	23%	0%	8%
	Private boat	24%	4%	1%	2%	1%	1%	2%	1%	48%	2%	1%	12%	2%
Total		**36%**	**8%**	**1%**	**3%**	**4%**	**3%**	**2%**	**1%**	**28%**	**1%**	**4%**	**7%**	**3%**

Table A6. Split of expenditure in South West – visiting anglers[12]

	Gear	Trans-port	Parking	Food	Accomm-odation	Compet-itions	Club fees	Magaz-ines	Boats	Insur-ance	Charter fees	Harbour dues	Other
Total	**16%**	**21%**	**4%**	**9%**	**16%**				**17%**		**14%**		**3%**

Table A7. Split of expenditure in South West – all anglers

	Gear	Trans-port	Parking	Food	Accomm-odation	Compet-itions	Club fees	Magaz-ines	Boats	Insur-ance	Charter fees	Harbour dues	Other
Total	**30%**	**13%**	**2%**	**5%**	**8%**	**2%**	**1%**	**1%**	**24%**	**1%**	**7%**	**5%**	**3%**

[12] Source: The Defra report.

A7. Charter boats and mackerel trips

We base our estimates of turnover, costs and employment for charter boats and mackerel trips on our interviews with skippers. Our estimates of turnover are generated from estimates of the number of trips taken per year, as shown in Table A8. Tables A9 and A10 present a breakdown of our costs estimate.

Table A8. Working for turnover and profit for charter boats & mackerel trips

F/T boats	Overall income per trip	**300**
	Number of trips pa	**150**
	Turnover pa	**45,000**
	Costs p.a.	**24,818**
	Turnover less costs	**20,182**
	Profit margin	**45%**
P/T boats:	% of F/T boat's turnover	**70%**
	Turnover	**31,500**
	% of F/T boat's costs	**75%**
	Costs	**18,614**
	Turnover less costs	**12,886**
	Profit margin	**41%**
Mackerel trips	Overall income per trip	**100**
	Number of trips pa	**360**
	Turnover pa	**36,000**
	Costs p.a.	**22,088**
	Turnover less costs	**13,913**
	Profit margin	**39%**

Table A9. Costs for full-time charter boats

Boat & engine	Maintenance	Harbour dues	Fuel	Insurance	Surveys	Advertising	**Total**
12,750	**2,000**	**2100**	**6500**	**1083**	**85**	**300**	**24,818**

Table A10. Costs for mackerel trips

Boat & engine	Maintenance	Harbour dues	Fuel	Insurance	Surveys	Gear	**Total**
9563	**2000**	**1440**	**5000**	**2000**	**85**	**2000**	**22,088**

The Defra report found that average turnover for charter boats was £36,500 (*n*=54). As this includes both part-time and full-time boats, this estimate is close to our own.

A8. Tackle shops

We calculate estimates of turnover, costs and employment for tackle shops on our fieldwork results. Many shop owners showed refused to give out financial information about their businesses. However, five tackle shops were willing to give us estimates of their turnover, and one gave an indication of their profit margin. These five responses were converted into an estimate of turnover per FTE.

A further six shops provided an indication of their staffing levels (FTE) and the proportion of their business that is from sea angling. The turnover per FTE figure was combined with these to find an estimate of the turnover from sea angling from these six shops, so that we have estimates of turnover from sea angling from a total of 11 shops. These were assumed to be representative of tackle shops in the region as a whole.

Table A11. Working used to generate turnover and profit for tackle shops

	Average	Sample size
Turnover	**192,000**	5
Staff: FTE	**2.9**	11
Turnover per FTE	**66,606**	5
% of trade which is sea angling	**61%**	12
Turnover from sea angling … extrapolated to 11 shops	**114,770**	11
FTE for sea angling	**1.8**	11
Profit margin	**26%**	1

As the resulting sample is still very small, we also refer to the results in the Defra report. They found an average turnover of £165,400 for a sample size of 51. However it is not clear whether this entire turnover relates to trade in sea angling. If this figure relates to total turnover, then it is closely consistent with our estimate.

Annex B: Survey results

B1. Characteristics of our sample

Figure B1. Age distribution of our sample

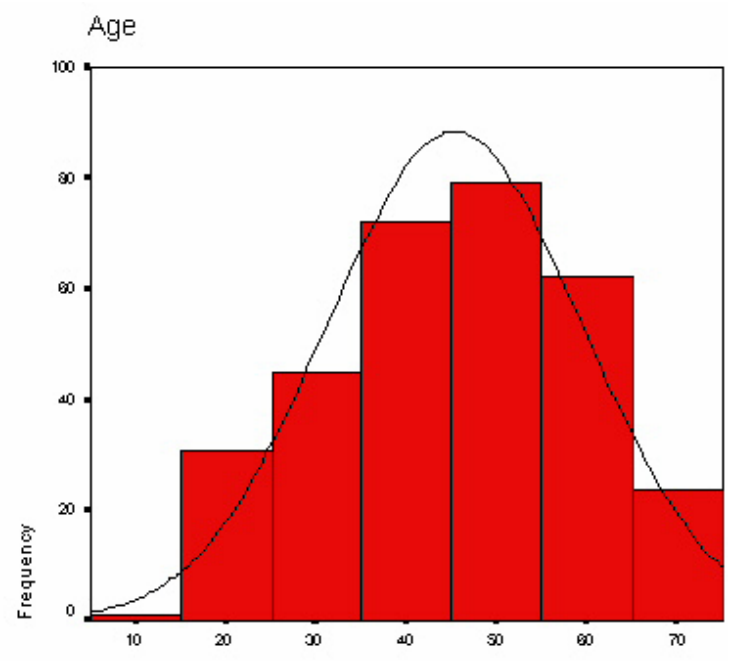


Table B1. Cluster Centres

	1 Shore anglers	2 Charter boat anglers	3 Mixed anglers	4 Private boat anglers
shore	0.95	0.07	0.44	0.07
charter boat	0.03	0.91	0.20	0.03
private boat	0.01	0.01	0.36	0.90

B2. Results by species

Table B2. Trends in fish stocks from Question 11

	Increase	No change	Decrease	Index
mackerel	10%	34%	56%	- 46
Pollack	2%	25%	73%	- 71
bass	11%	9%	80%	- 69
dogfish	57%	31%	12%	44
rays & sharks	18%	35%	47%	- 29
cod	3%	3%	94%	- 92
wrasse	9%	58%	33%	- 24
whiting	11%	48%	41%	- 30
plaice	6%	6%	88%	- 81
garfish	6%	50%	44%	- 39
flounder	15%	15%	70%	- 55
conger	26%	37%	37%	- 11
mullet	11%	37%	53%	- 42
Total	**15**	**28**	**57**	**- 41**

This table shows the proportion of anglers who stated there has been an increase, no change or a decrease in stocks of each species. The index is calculated as the percentage who stated there had been an increase, less the percentage who stated there had been an decrease; a positive value indicates that the majority of anglers thought that stocks had increased, and vice versa. In Table 4.6 we represent these indices with arrows:
⇧⇧ Index between +40 and +70; ⇧ Index between +10 and +40; No symbol for index between -10 and +10; ⇩ Index between -40 and -10; ⇩⇩ Index between -70 and -40; ⇩⇩⇩ Index between -100 and -70.

B3. Potential sources of bias

On-site sampling bias

As described in Section 4.3.2, we apply weights to the questionnaire data as appropriate to remove the effect of on-site sampling bias. Data from respondents who fish less often are given a higher weight and vice versa, to allow for the fact that those who fish less often are less likely to have been observed by our interviewers. Weights are chosen so that the *average* weighting for a face-to-face respondent is exactly 1. Phone respondents are all assigned a weighting of 1, as on-site sampling bias does not apply there.

Table B3 shows the weights used, and how these were derived. For example, data from anglers who answered that they had been sea angling "more than 50" days in the South West in the last 12 months would be assigned a weight of 0.1.

We start by finding the probability that each angler goes angling on a given day This probability (denoted *B*) is equal to the number of days fished (denoted *A*, taken from responses to questionnaire Q6) divided by 365.25. We can correct for on-site sampling bias by applying weights that are proportional to 1/*B*.

In order to standardise the weights so that the average weighting for a face-to-face respondent is exactly 1, we multiply 1/*B* by an appropriate scaling constant. This constant turns out to be the total number of face-to-face respondents (138) divided by the summed product $\sum \frac{C}{B}$. The resulting constant is 0.01887, as described in algebraic form below. The final weights used are therefore 0.01887/*B*.

$$\sum \frac{C}{B} = 7{,}314 \; ; \; \sum C = 138 \; ; \; \frac{\sum C}{\sum \frac{C}{B}} = 0.01887$$

Table B3. Weighting methodology

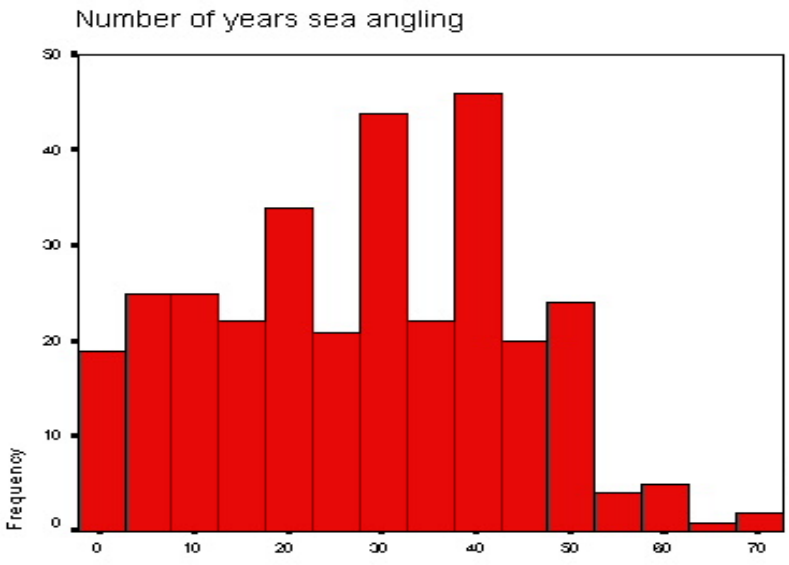
Days fished in South West in last year (from q'naire Q6)	more than 50	26 – 50	11– 25	3–10	1 or 2	none	Total
Centre of band (*A*)	75	38	18	6.5	1.5	1	
Chance of angling on a given day (*B*)	21%	10%	5%	2%	0.4%	0.3%	
1/*B*	4.9	9.6	20.3	56.2	243.5	365.3	
No. observed (*C*)	35	24	37	23	17	2	138
Weight (0.01887/*B*)	**0.1**	**0.2**	**0.4**	**1.1**	**4.6**	**6.9**	

Some care is required here, as the resulting outputs are very sensitive to the data from a small number of respondents (those who answered "1 or 2" or "none" to Q6 of the questionnaire).

The two figures below illustrate the effect of removing on-site sampling bias from one variable – the number of years respondents had been going sea angling for. Figure B2.1 shows the distribution of this variable from the raw data in our sample: the mean is 28 years. Figure B2.2 shows how the same chart looks after the data have been weighted to correct for on-site sampling bias: the distribution is now skewed to the left, and the mean has fallen to 24 years. This is because the raw, unweighted data in our sample over-represents those anglers who go angling more often. As there is a positive correlation between number of days fished and number of years angling, it also over-represents those anglers who have been going sea angling for a long time.

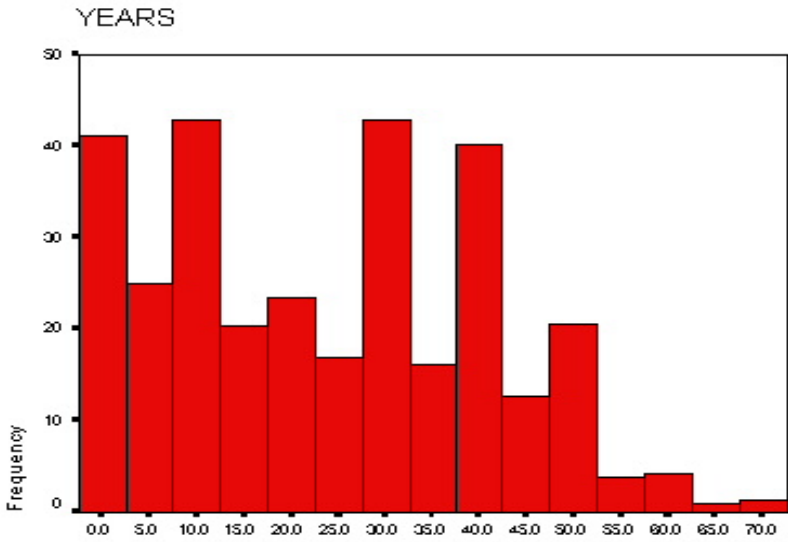
Figure B2. Removing on-site sampling bias from the number of years angling

B2.1 Unweighted sample



Mean = 28
Std. Dev = 15.82
N = 314

B2.2 Weighted sample



Mean = 24.1
Std. Dev = 16.82
N = 314

Seasonality

Table B4 shows the responses to Q9 of our survey. This ties in with Section 4.3.3 on the potential for seasonal bias.

Table B4. Seasonality of angling activity for phone and face-to-face respondents

	Summer only	Part of year, including summer	All seasons	Did not fish in summer
Face	21	26	88	3
Phone	1	15	153	7
Total	**22**	**41**	**241**	**10**

Annex C: Choice experiment

C1. Methodology: Choice set construction

Attribute levels were combined together to produce 60 different hypothetical angling sites in such a way that the resulting choice set was as efficient as possible and as orthogonal as possible.

Attribute levels were combined into hypothetical sites and paired up in such a way that each pairing provided useful information about anglers' decision-making process. Each site was given a score based on a crude estimate of how anglers' preferences might look. Sites were then paired with other sites that had a roughly similar score, to ensure that the decision between the sites took some thought, rather than being "obvious". For similar reasons, care was taken to avoid dominant sites in a pairing (i.e. where one site is as good or better than its pair for all attributes).

Correlations between attributes were calculated and minimised. The highest correlation in the final design was only 0.03. Of more importance are the correlations between attributes in terms of the *differences in levels* between one site in a pair and its partner. The strongest correlation here was -0.30 between the difference in levels of catch of favourite species and the difference in levels of the size of fish. Most other correlations were of much smaller magnitude than this. This is an acceptable degree of correlation. Indeed, a small amount of negative correlation with respect to the differences in levels is to be expected, because the process used to pair sites together will naturally result in this effect.

C2. Methodology: Model construction

The model was constructed in Limdep using multinomial logit. A model of utility was built, using a general-to-simple approach. We systematically tried expressing utility as a function of all site attributes (catch per day; environment quality etc) and a wide range of angler attributes (favourite species; shore/charter/private boat angler; age; days fished p.a.; club membership; residence; and number of years angling). This included testing interactions between angler type variables and site attributes. Insignificant variables were eliminated in turn until the most parsimonious model was achieved.

We start with a linear form for the indirect utility function, with the random term taking a Gumbel distribution. We also try with quadratic, cubic and fourth-power forms for the catch of favourite species and for the catch of other species.

The Random Utility Model (RUM) describes how individuals make their choices. It assumes that individuals are utility maximisers. The welfare change associated with a defined change in attribute levels can be found from the

formula for compensating variation in Hanemann (1982).[13] WTP was calculated using the Wald command in Limdep, so that standards deviations could be generated.

Further detail on the theory underlying the choice experiment can be found in Louviere *et al*. (2000).[14] More detail on the choice experiment used in this study can be found in Lawrence (in Press).[15]

C3. Final model results

The table below shows the coefficients on the variables included in our final model for the choice experiment. The baseline is the set of anglers that target "other" species, fish for 0 days p.a., are charter or private boat anglers, non-club members, do not live in the South West, and are age 0. To find the coefficients for anglers with different attributes, we add on the adjustments for that type; for example, to find the favourite species coefficient for a 40 year old angler who fishes for cod, we take the baseline figure (0.42), subtract 0.041 and subtract 40 x 0.001; the coefficient would be 0.34. Insignificant coefficients have been excluded from the model.

Table C1. Coefficients and adjustments by angler type

	Constant	Favourite Species	Other Species	Size	Catch Restrict-ions	Environ-mental Quality	Cost
Baseline	1.12	0.42	0.04	0.72	-0.18	0.14	- 0.027
Bass	- 0.491	-	-	-	-	-	-
Cod	0.332	- 0.041	-	- 0.473	-	- 0.552	-
Mack	- 0.333	- 0.037	-	-	-	-	- 0.009
Days_pa	- 0.014	-	-	-	0.004	-	0.0002
Shore	- 0.156	-	-	-	-	-	- 0.010
Club	0.146	-	- 0.018	0.342	-	-	0.010
South West	0.399	-	-	-	-	-	-
Age	0.003	- 0.001	-	- 0.010	-	-	-

[13] Hanemann, W. M. (1982) "Applied welfare analysis with qualitative response models". Working Paper No. 241, University of California, Berkeley, CA.
[14] Louviere, J.J., Hensher, D.A. and South Westait, J.D. (2000) *Stated Choice Methods: Analysis and Application* (Cambridge University Press).
[15] Lawrence, K. (2005) "Assessing the value of recreational sea angling in South West England". In press.

The model uses a cubic form for the relationship with favourite species, with coefficients that do not vary by angler type:

Favourite species quadratic term: -0.036

Favourite species cubic term: 0.0011

The *pseudo-R^2 statistic*[16] for this model is 0.197, indicating an acceptable fit to the data. The log-likelihood statistic is 3132.7. The model produces results that largely fit with our expectations, and appear to describe the decision-making process well, giving us good confidence in it.

The results by site attribute (Section 3.2) are derived from a simplified version of this model that does not distinguish between different types of angler.

C4. Characteristics of a "typical" angler and a "typical" angling site

Tables C2 and C3 present the characteristics of a "typical" sea angling site by a "typical" sea angler, as generated from our survey results. These are used in the calculation of total consumer surplus (Section 5.4).

Table C2. Characteristics of a "typical" angler

Species	46% Bass; 11% Cod; 10% Mackerel; 34% Other
Days fished p.a.	10.86 (based on 13.99 trips per household, and 1.31 anglers per household[17])
% shore fishing	55%
% club members	22%
% living in South West	100%
Age	45

[16] A measure of how well the model fits the data. Pseudo-R^2 values are commonly lower than values of the more familiar R^2 statistic.
[17] Source: the Defra report.

Table C3. Characteristics of a "typical" angling site in the South West

Catch of favourite species	4.1
Catch of other species	3
Size of fish	0
Catch restrictions	0
Environment	0
Cost	0

C5. Uncertainty over the constant term

One difficulty in the calculation of total consumer surplus is the ambiguity over how to interpret the constant term in the utility equation; results indicate that anglers would still prefer to go sea angling rather than doing a different activity, even if the angling experience was poor – anglers were still willing to pay around £30 per trip even if there were no fish to catch. Three explanations are possible:

1. Sea anglers would genuinely still go fishing even if there were no fish to catch. This is plausible in the short-term, as many anglers are highly committed to their sport and will often have a barren day which they nevertheless enjoy.
2. Not all respondents were fully considering option C (do something other than sea angling) when making their choices. Whilst some respondents chose option C on an apparently rational basis, others did not choose option C on any of their ten choice occasions. These respondents may have been drawn towards options A & B more because of the way they were presented than because they genuinely preferred them.
3. Respondents did not believe us when we told them they would not catch any fish. Many sea anglers are "eternal optimists" in this regard, and will fish in areas where they are told there are no fish, because they believe they can still catch something. This effect will be short-term in nature, as even the most optimistic angler will give up eventually if nothing is caught over a very long period.

If the first explanation is true, then we should include all of the constant term in our calculation of WTP. If the second and third explanations are true then we should ignore all of the constant term. The uncertainty over this means that we produce a range of estimates for WTP.

We believe that there is some truth in all three explanations, but that the first explanation is the weakest of the three, in the long-term at least. We therefore produce "best-guess" estimates of WTP which include 25% of the constant term, reflecting our belief than explanations 2 and 3 are more likely to be true than explanation 1.

Annex D: Sea angler questionnaire

Questionnaire Ref		Time of day		Region (A-F)	
Date		Location			

Investinfish Sea Angler Survey

Please introduce yourself to the respondent, making the following points:

- ❑ My name is …
- ❑ Survey of sea anglers in the South West
- ❑ Part of the Invest in Fish South West project[18]
- ❑ Funded by Defra and WWF, amongst others
- ❑ Should take around 15-20 minutes
- ❑ Responses are anonymous
- ❑ Thank you for your time

Your details

Gender	Male	Female
(Don't ask this Q! Please tick one box)		

Q2 Where do you live?	In the South West	In the UK (outside the South West)	Outside the UK
(Please tick one box)			

Q3 Club membership	Angling club	NFSA	Other (please specify)
Are you a member of a sea angling club or organisation? *(Tick all that apply)*			

Q4 Which age group are you in?	
Under 16	
16-24	
25-34	
35-44	
45-54	
55-64	
65+	

[18] www.investinfish.org.

Q5 Experience	
How many years have you been sea angling for?	years

Your sea angling activity

Q6 How many days on average did you go sea angling in the last 12 months? *(please tick one box in each column)*	In the South West	In the UK (outside the South West)	Outside the UK
More than 50 days (i.e. more than once a week)			
26 to 50 days (about once a week)			
11 to 25 days (more than once a month)			
3 to 10 days			
One or two days			
None			

Q7 Where did you go fishing in the last 12 months? (Please enter estimated proportion of time spent fishing in each area)	
Dorset	%
Somerset	%
North Devon	%
South Devon	%
North Cornwall	%
South Cornwall	%

Q8 Has the number of sea angling trips you make changed over the last 5 years?	
Enter: + increase; = no change; – decrease	
If there has been a change in your sea angling, why is this?	

Q9 In which seasons do you go sea angling?	Spring	Summer	Autumn	Winter
(Please tick all that apply)				

Q10 What types of angling do you undertake?	Shore	Charter boat	Own / friend's boat
(Estimate % time spent fishing in each category)	%	%	%

Q11 What species of fish do you most regularly catch & what is the 5-year trend?			
Species (provide top species, ranked by number currently caught; only ask follow-up Qs for top 3)	Average number of fish caught per day	Proportion returned alive (%)	Trend in fish stocks over last 5 yrs (= no change, + improved, – worsened)
1.		%	
2.		%	
3.		%	
4.			
5.			

Your expenditure

Q12 How much have you spent personally on sea angling in the last 12 months?			
Item	In the South West	In the UK (outside the South West)	Outside the UK
All anglers			
Gear (purchase and rental) – fishing rods, reels, clothing, hooks, line, bait			
Transport to angling location			
Car parking			
Food & drink			
Accommodation			
Competition fees			
Club membership			
Fishing magazines / books			
Other (please specify)			
Other (please specify)			
Boat anglers only			
Boat/trailer purchase, maintenance, fuel			
Insurance on above			
Charter boat fees			
Harbour dues for own boat			
Other (please specify)			
Other (please specify)			
TOTAL			

Your opinions

Please read to the respondent:

We're interested in anglers' opinions including ways to improve your sport and increasing number and size of fish in the South West. Nothing is ruled in or out at this stage; these suggestions are *not* necessarily likely to be implemented.

Q13 How important are these angling issues to you? *5 = very important; 4 =important; 3 = no opinion/neutral; 2= not important; 1=irrelevant*	
Accessibility & Facilities (e.g. piers, car-parking)	
Environmental Issues (e.g. litter, water quality)	
Fisheries Management (e.g. improving stocks)	
Social Events & Competitions	
Wider recognition of sea angling's importance	

Q14 Please tell me your level of support for these *potential* management options for commercial fisheries? *5 = strongly support; 4 =support; 3 = no opinion/neutral; 2= don't support; 1= oppose strongly*	
Areas of sea are designated as being exclusively for recreational angling	
Designation of 'recreational species' which are managed for recreational anglers	
Minimum landing sizes are increased for commercial fishing	
Restrictions to fishing methods that conflict with sea angling in specific areas	
Stronger enforcement to restrict commercial fishing activity in inshore waters	

Q15 Please tell me your level of support for these *potential* management options for recreational fisheries *5 = strongly support; 4 =support; 3 = no opinion/neutral; 2= don't support; 1= oppose strongly*	
Appropriate areas of sea closed to both recreational & commercial fishermen	
Bag / rod limits for anglers	
Minimum landing sizes are increased for both recreational & commercial fishing	
Sea angling licences, with ring-fenced revenues used to improve sea angling	
Seasonal closures for both recreational & commercial fishermen	

Q16 Which ONE of the following statements best explains the reasoning behind the rankings you have just made?	
I want to have the best possible angling experience	
Measures are needed to ensure good fishing for future generations	
Measures need to be taken to preserve the environment	
Commercial fishing activity needs to be restricted	
Most of the time I was just guessing	
Other *(specify)*	

Q17 Have you seen management measures elsewhere that you would like to see adopted for sea angling in the South West?	
Description of measure	
Location (country / fishery)	

Q18 If there were substantially more or bigger fish would you …	
a) Go sea angling much more often?	
b) Go sea angling somewhat more often?	
c) There would be no change	

Q19 If there were substantially fewer or smaller fish would you …	
a) Go sea angling much less often?	
b) Go sea angling somewhat less often?	
c) There would be no change	

Q20 If the sea angling experience in the South West became unacceptable, which ONE of the following would you be most likely to do instead?		Tick one box
Sea angling elsewhere in the UK		
Sea angling overseas		
Coarse angling in the South West		
Other outdoor activity *(specify)*		
Other activity *(specify)*		

Q21 Are there any geographical areas that you would particularly like to see protected? *These can be specific locations, or more general areas such as "within X metres of shore"*

Choice Experiment

Q22 Favourite Species	
What is your favourite species to target when sea angling in the South West?	

Q23 Cards chosen (please tick relevant boxes)			
Set of cards used			
Pair number	*A*	*B*	*C*
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

Q24 Which ONE of the following statements best explains the reasoning behind the choices you have just made?	
a. I wanted to pay as little as possible	
b. I chose the best possible angling site, irrespective of cost	
c. I was interested in one site characteristic above all others *(specify)*	
d. I chose sites that offered a good balance of all the features, including cost	
e. Most of the time I was just guessing	
f. Other *(specify)*	

Q25 Any other comments about angling or this survey

End of Questionnaire	
Thank you very much for your time. Would you be willing to discuss your responses at a later date?	Yes / No
If Yes: What is your name?	
Your phone number?	
When is the best time to call?	

D1. Explanatory text provided for the choice experiment

The following text was read out to the respondent, and they were shown an example pair of angling sites (as shown in Figure 2.1), to illustrate how the process works.

"This is the final section of the questionnaire.

It is possible to travel to two sea angling marks. Please look carefully at the two sites, and indicate which one you would choose to visit on your next trip. These are the only two sites available to you. If neither site is attractive to you, and you would instead decide to do some other activity instead of going sea angling, please choose option C.

The two sites differ in terms of the average catch per day of *[your favourite species]* and of other species; the size of fish caught; whether there are restrictions on the catch allowed, such as a bag limit; and the quality of the surrounding environment (including such factors as water quality, visual appeal, and available facilities).

Going sea angling costs money; you have to pay for such things as transport, parking, accommodation and equipment. These costs vary depending on the site visited. The cost per day is listed under each site. This cost does *not* refer to a new charge to go sea angling e.g. a rod licence or an entrance fee. "

For example, look at the two alternatives below.

If you were most interested in catching larger fish, and were happy to pay £20 per day to go angling, you might pick Site A.

If you were more interested in catching larger numbers of *[favourite species]*, you were not so bothered about the size of those fish, and you were happy to pay £60 per day, you might choose Site B.

If neither alternative is attractive to you, and you would instead decide not to go sea angling, you would select Option C.

This process will be repeated ten times, for ten different pairs of locations.

Annex E: Bait species

Table E1. The most commonly collected shoreline species*[19]

Phylum	Family	Species	Summary of life history and ecology
Polychaeta (Bristle worms)	Nereidae, Ragworms	Harbour rag Hediste (Nereis) diversicolor King rag Neanthes (Nereis) virens Ragworm Perinereis cultrifera	Free-living, omnivorous, fast-growing worms which breed only once in their lifecycle before dying. They are farmed commercially for bait. Sexes are separate, and all mature worms spawn on the same day. Some mature after one year, but wild king ragworms are usually two or three years old at maturity. Usually one third or more of the population breeds each year and recruitment to the population is rapid. Some populations have much larger, older worms. These reproduce slowly and are more vulnerable to over-collection.
	Nephtyidae, Catworms or silver rag	Nephtys caeca Nephtys cirrosa Nephtys hombergi	Catworms actively swim and burrow in clean sand beaches in search of prey. They are long-lived, have separate sexes, and may breed several times in a lifetime. All mature worms in a population breed on the same day, but not always every year. Larvae spend up to 5 weeks in the plankton before settling onto the bottom. An average 3 inch worm is usually 4–5 years old. The largest may be up to 12 years old. Large worms are highly valued by match anglers. Their slow growth, infrequent spawning and low recruitment rates make them vulnerable to over-collection. Research into farming is underway.
	Arenicolidae, Lugworms	Blow lug, lobworm or yellowtail Arenicola marina Black lug or runnydown Arenicola defodiens	Lugworms live in U or J-shaped burrows on sandy and muddy sand shores and in the sublittoral, and feed on decaying seaweed, diatoms and bacteria. Sand casts are left above one burrow entrance. They begin to breed and are large enough for bait at 2 years old, and may live for 6 years reaching weights of 10 g (NE England) to 25 g (south and west). They breed several times during their life. Each worm spawns in a day, and all worms on a beach spawn within a few days, but those on different beaches spawn at different times. Some worms die after spawning. Others stop feeding and casting until their larvae leave the adult burrow to spend 6 months below the low water mark. They then swim to upper shore juvenile lugworm beds. Maturing worms move down the shore to adult beds. This life cycle makes most lugworm populations able to recover quickly from over-digging. Both species should soon be available from bait farms.
Crustacea	Portunidae	Shore crab or green crab Carcinus maenas Velvet fiddler or velvet South Westimming crab Necora puber Edible crab Cancer pagurus	Crustacea grow by regularly moulting their external shells and expanding before the new shell has hardened. Crabs entering the moult are called “peelers” and “soft shell crabs” after moulting and before hardening. Peeler crabs release hormones that attract fish (making them very valuable as bait) so hide under rocks or other shelters to escape predators during these vulnerable stages. Bait collectors take peeler crabs of all species, including commercially fished species, but the common shore crab Carcinus maenus is most abundant and widely used. This species is also collected for human consumption in many parts of Europe, and for fun by “crabbing” children. Minimum landing sizes apply to velvet and edible crabs.
	Cancridae		
Mollusca	Class Gastropoda Subclass Prosobranchia		Molluscs usually characterised by a single coiled shell, sealed by a horny operculum attached to the top of the animal’s foot.

[19] From Fowler, S.L. (1999) “Guidelines for managing the collection of bait and other shoreline animals within UK European marine sites” English Nature (UK Marine SACs Project), http://www.ukmarinesac.org.uk/bait-collection.htm.

	Littorinidae, Winkles	Common periwinkle Littorina littorea	Winkles are common mid and low tide levels on almost all rocky shores, except on some islands. An important source of food in prehistoric times, but now mainly exported to the Continent. UK harvests are probably over 2000 tonnes per annum. Harvesting reduces numbers and average size. Winkles usually mature at a shell height of 11–12 mm, and are harvested from 14–15 mm. Maximum size is 32 x 25 mm. Large winkles are infected by trematodes, reducing egg production, and small winkles may naturally yield most egg production. Planktonic egg capsules are laid, so recruitment to the shore may not be from a local population.
Mollusca	Class Bivalvia		Predominantly sedentary with planktonic larvae. Adults live attached to fixed substrata, in crevices, or burrowing in bottom sediments.
	Mytilidae, Mussels	Common mussel Mytilus edulis	Live in small groups on rocky shores or in dense beds on sediment habitats. An important food since prehistory. Collection for fishing bait is now only a fraction of levels 100 years ago. Most commercial collection is from wild stocks in sediment areas (sometimes using relayed wild seed), but there is some mussel cultivation. Length usually 50–100 mm, but sometimes only up to 30 mm, or as much 150 mm. Preferred minimum size for sale in the UK is about 55 mm. Wild mussels in Scotland are royal shellfish and Crown property.
	Ostreidae, Oysters	Flat oyster Ostrea edulis Pacific oyster Crassostrea gigas	Formerly very common, native flat oysters have virtually disappeared in the UK because of disease, habitat damage and over-exploitation. Introduced Pacific oysters sometimes breed and settle naturally onto the lower shore in the south and west. Most populations are artificially laid for culture and protected by Several Order in England and Wales, or through their status as royal shellfish in Scotland, where Crown Estate permission is required for their collection.
	Cardiidae, Cockles	Common cockle Cerastoderma edule	Common on all UK coasts and estuaries in sandy muds, sands and fine gravels from mid tide level to just below the extreme low water mark of spring tides. Sometimes found in extremely dense beds, and often associated with bait worms. Collected commercially by hand and mechanically, and by hand for personal consumption.
	Veneridae, Venus or carpet shells	Quahog Mercenaria mercenaria	A large (to 120 mm) and valuable edible bivalve, introduced into the UK from the USA and found on the lower shore and in shallow sublittoral muddy habitats. Exploited for personal use and commercially, by hand digging and dredge.
	Solenidae, Razor shells	Common razor shell Ensis ensis	Large (up to 130 mm long) bivalve actively burrowing in fine sand on the lower shore and shallow sublittoral. Traditionally hand collected for food and bait for personal use and for resale (usually exported for food to Europe). Recently harvested by suction dredger.
	Myacidae, Gaper shells	Sand gaper, or soft shell clam Mya arenaria	Large (up to 150 mm long) bivalve of high commercial importance in parts of the world (used in American clam chowder). May be extremely common in estuaries, where extensive beds are sometimes found, but apparently not widely harvested in the UK.

Annex F: Australian National Code of Practice

THE NATIONAL CODE OF PRACTICE FOR RECREATIONAL AND SPORT FISHING, 2001

The National Code of Practice is a voluntary agreement among Recfish Australia's 11 national and state/territory fishing member associations, which prepared and endorsed its 13 points. These associations represent a diverse range of recreational and sports fishing practices, including inland and saltwater fishing, diving, rock fishing and game fishing.

The Code addresses four main areas of fishing responsibility. These include *looking after our fisheries, protecting the environment, treating fish humanely* and *respecting the rights of others.* The four objectives are a framework for the 13 more specific principles explained in this brochure.

Recfish Australia's mission is to represent the interests of recreational and sport fishers at a national level to ensure quality fishing. We seek your support in promoting this code and applying its principles in all your fishing activities.

A. Looking after our fisheries by:

1. Taking no More than our Immediate Needs

A vital way we can participate in conserving fish stocks is to limit our catch by taking only our immediate personal needs. Over fishing has a detrimental effect on fish stocks and in extreme cases, entire fish species. Looking after our fisheries means:

- using common-sense and constraint when fishing, for example, return unwanted, endangered or threatened species to the water.
- carefully returning unwanted live bait to the waters they were taken from. Live bait is an important part of the food chain so it is important to leave some to support the fish we wish to catch in the future.

2. Understanding and Observing all Fishing Regulations and Reporting Illegal Fishing Activities

State and Territory Fishery departments make regulations to manage the fisheries for now and the future. To protect fish stocks and fish habitat, report illegal fishing activities to the relevant authorities. It is important that the fishing community does not ignore activities that threaten the fisheries and damage the reputation of responsible fishers. Looking after our fisheries means:

- keeping up to date with regulations and observing them because they are based on the best available scientific evidence
- acquainting yourself with State and Territory bag, size and possession limits
- becoming familiar with existing tackle restrictions and checking the dates of local seasonal closures
- helping to explain fishery regulations and the reasons for them to others, especially children
- reporting black marketing of fish by recreational anglers

- reporting poaching, theft and illegal netting to the relevant authorities not presuming to act as officers of the law.

3. SUPPORTING AND ENCOURAGING ACTIVITIES THAT RESTORE AND ENHANCE FISHERIES AND FISH HABITAT

We are all dependent on healthy ecosystems. Habitat destruction and modification, resulting largely from human activities, presents a huge threat to the maintenance of fish stocks and the availability of other species such as shell fish, rock lobsters and crabs. Restoring and enhancing fisheries and fish habitat means:

- recognising the fragility and environmental diversity of streamside vegetation, estuaries, sea grass, mangroves, and reefs. These areas provide food, shelter and important breeding and nursery areas for many fish species
- participating in research, rehabilitation and monitoring programs such as Coastcare, Waterwatch, Rivercare, Landcare and tagging programs
- educating others, especially children, in sustainable fishing practices
- becoming familiar with the life cycles and breeding seasons of aquatic species and other fauna
- becoming involved in programs that restore coastal and streamside vegetation such as Rivercare and Fishcare
- keeping a safe distance from aquatic wildlife and avoiding undue noise when birds are roosting or nesting
- never using non-indigenous fish as live bait or introducing exotic fish into natural waters

B. Protecting the Environment by:

4. PREVENTING POLLUTION AND PROTECTING WILDLIFE BY REMOVING RUBBISH

Pollution affects the health of the environment and spoils our experience of the outdoors. Natural areas continue to suffer major problems due to the side effects of human activities. We can help! Preventing pollution means:

- taking fishing line, polystyrene foam packaging, bottles, six pack holders, bait bags, cups and packaging, etc away from fishing sites. All items must be disposed of correctly to avoid potentially entrapping birds and other creatures
- not leaving bait to foul rocks, river banks or beaches
- not washing rubbish, chemicals or other waste into storm water systems. Most storm water drains run directly into waterways
- participating in programs such as “Clean up Australia” and “Oceancare Day”.

5. USING ESTABLISHED ROADS AND TRACKS

Off-road driving or “bush-bashing” can be a major cause of erosion and vegetation loss; likewise trampling across dune systems, reef beds and other fragile areas. Using established roads and tracks means:

- using walking tracks and avoiding driving on beaches. The protection of sand dunes, coastal, and streamside vegetation will help minimise beach and streamside erosion
- avoiding straying from established roads and tracks
- treating all natural areas with care.

6. TAKING CARE WHEN BOATING AND ANCHORING TO AVOID DAMAGING SENSITIVE AREAS

Boating increases the range of fishing possibilities but unskilled and thoughtless use of boats can lead to environmental damage. Taking care when boating means:

- showing care when anchoring, particularly around reef or seagrass areas
- avoiding disturbance to wildlife by excessive noise or harassment
- keeping a constant vigil when boating to avoid hitting wildlife

- refuelling on land wherever possible and not discharging wastes, oil or sewage into the water
- being aware of your boating speed to minimise erosion of riverbanks from excessive wave action
- avoiding modification of or disturbance to fish habitat while diving.

7. REPORTING ENVIRONMENTAL DAMAGE AND POLLUTION TO THE RELEVANT AUTHORITIES

The protection of the environment is everyone's responsibility. By reporting pollution problems to the relevant authorities, we help ensure that our waters become pollutant free and discourage practices that destroy fish habitat. Reporting environmental damage means:

- reporting any fuel and oil spills
- reporting all stranded or dead aquatic animals and protected species
- reporting any signs of discharge of polluted waste waters and runoff containing fertilisers and pesticides
- reporting any vegetation or stream damage, e.g. sedimentation, declining water quality, algae, etc.
- reporting sightings of suspected aquatic pest organisms such as carp, salvinia weed, or caulerpia.

8. AVOIDING INTERACTIONS WITH THREATENED SPECIES AND THEIR CRITICAL HABITATS

While fishing and accessing fishing grounds it is easy to inadvertently disturb the habitats of protected species or disturb the species themselves. Habitat destruction and modification are the major threat to the continued survival of threatened species. Avoiding threatened species means:

- being aware of and avoiding disturbance to threatened species that inhabit areas you intend to fish
- observing and obeying signage or guidelines in areas where threatened species live
- obeying guidelines for activity in the vicinity of marine mammals
- reporting any inappropriate behaviour we witness which may affect threatened species
- reporting sightings of threatened species in distress
- quickly and correctly returning to the water any inadvertently caught threatened species.

3. Treating fish humanely by:

9. QUICKLY AND CORRECTLY RETURNING UNWANTED OR ILLEGAL CATCH TO THE WATER

Incorrect handling damages fish and reduces their chances of survival after release. A fish out of water cannot live for more than three or four minutes because of brain damage caused by lack of oxygen. An exhausted fish played too long, may not recover. Correctly returning fish means:

- retrieving fish as quickly as possible
- ensuring that fish are not left to flop and flail around
- using wet hands and a minimum of handling to ensure that released fish have a good chance of survival
- reviving tired or semi-conscious fish. Hold the fish gently and move it forward to force water through its gills. When it has revived, and is able to swim normally, set it free.

10. USING ONLY LEGAL TACKLE, ATTENDING OUR GEAR AND VALUING OUR CATCH

Good treatment and handling of fish is not just about maintaining table fish quality. It is also a mark of respect that fishers have for fish. Treating fish humanely and avoiding waste means:

- using only tackle that is appropriate for the size and type of fish
- attending gear to ensure that fish are retrieved as soon as they are caught
- dispatching fish immediately with a firm tap on the head with a suitable blunt object or by pithin
- icing fish down and storing them away from sunlight, preferably in a moist bag or cooler.

4. Respecting the rights of others by:

11. PRACTISING COURTESY TOWARDS ALL THOSE WHO USE INLAND AND COASTAL WATERS

Lakes, creeks, rivers, and coasts are used for a variety of purposes. By recognising the rights of others to use the waters for their recreation and livelihood, recreational fishers help ensure that all are equally able to enjoy their activities. Respecting the rights of others means:

- being courteous to those whose communities we enter when fishing. Remember this is their home.
- realising that friendly rivalry can exist between recreational fishers without the need for anyone to dominate.
- preparing your boat and trailer before launching at boat ramps to avoid annoying delays.

12. OBTAINING PERMISSION FROM LANDHOLDERS AND TRADITIONAL OWNERS BEFORE ENTERING LAND

Having access to land held in trust to landholders and traditional owners is a privilege, not a right. Respecting the rights of others means:

- gaining permission before entering land and clearly indicating where you are going
- recognising the cultural and spiritual attachment indigenous people feel for their land and water
- obtaining permission before lighting fires
- avoiding interference with land, stock or crops in any way
- leaving all gates as they were found
- leaving the gun and dog at home to avoid harming or harassing livestock or wildlife.

13. CARING FOR OUR OWN SAFETY AND THE SAFETY OF OTHERS WHEN FISHING

Playing it safe while fishing is good common-sense. Never risk a life while trying to catch a fish. Caring about safety means:

- observing and understanding all boating regulations, including the carrying of the required safety equipment
- keeping a safe distance from shore-based anglers, jetties, swimmers and other boats
- being aware of the dangers of rock fishing and seeking local knowledge of tides and wave conditions
- gaining local knowledge of common beach dangers including rip currents, large waves, shore platforms, deep water, offshore reefs and tidal currents
- exercising caution and planning for contingencies when fishing inland waters and mountain lakes and streams. Submerged logs, sudden squalls, icy waters and extremely cold temperatures can create life-threatening difficulties.