

HETEROGENEITY AMONG RECREATIONAL SEA ANGLERS IN ENGLAND AND WALES

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ABSTRACT

The Fisheries Act 2020 embedded recreational sea angling in the UK policy framework. Policy and associated management strategies are improved when catering for diverse needs and expectations of stakeholders. Understanding heterogeneity among recreational sea anglers is therefore vital for effectively managing marine-based UK fisheries. By developing a survey-based data collection framework centred on a cognitive hierarchy model, supported by qualitative in-depth interviews, this study presents the first typology of recreational sea anglers in England and Wales to inform future fisheries policy in the UK. Heterogeneity across anglers taking part in the study was best described by a typology consisting of four types: consumers; trophy anglers, leisure-identity anglers; and social anglers. Each angler type is described by performance across 10 factors (latent constructs) drawn from the data framework in addition to several independent variables. The typology was validated by a unique angler verification method. Several data-driven conclusions are made in comparison to existing literature on angler heterogeneity: the angler types reflect those generated by other studies on mixed/freshwater fisheries outside the UK; attitudinal measures showed more variance across the sample than behavioural metrics, specifically involvement, centrality, environmentalism, and attitudes to catch. Specialisation did not feature as appropriate theory to describe diversity in the sample. Divisions between angler segments were less evident in a qualitative analysis of views towards governance and management. Building on the findings, a refined data collection tool based on angler self-allocation is presented to inform future work aiming to replicate the typology and account for potential sample bias in statutory catch reporting programmes. Characteristics of the angler types are also discussed in context of future management scenarios, demonstrating variation in likely stakeholder responses to different policy objectives.

DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of the University of Gloucestershire (UoG) and is original except where indicated by specific reference in the text. No part of the thesis has been submitted as part of any other academic award. The thesis has not been presented to any other education institution in the United Kingdom or overseas. This thesis is a product of my own work and is not the result of anything done in collaboration.

Any views expressed in the thesis are those of the author and in no way represent those of the University. I agree that this thesis may be available for reference and photocopying, at the discretion of the University.

Signed:

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CHAPTER ONE

INTRODUCTION AND BACKGROUND

1.1 INTRODUCTION

This thesis presents a typology of heterogeneity among recreational sea anglers in England and Wales, and in doing so, presents descriptions, analysis and discussion of angler values, attitudes and behaviours that are important for the future sustainable management of UK marine-based fisheries.

Fisheries are defined as places (marine or freshwater bodies of water) where fish are caught for commercial or recreational purposes (FAO 2023a). Fish are a vital part of food security: its nutritional value as a high source of protein has led to its recognition globally as a critical food source (FAO 2022). In the last six decades global human consumption of fish per capita has more than doubled (20.2kg per capita in 2020), globally accounting for 17% of the population's intake of animal proteins in 2019. In some countries (e.g. Cambodia, Ghana, Bangladesh) fish account for over half of the intake of animal protein (FAO 2022). Fishery capture rates are at an all-time high with 90.3 million tonnes recorded in 2020, including 78.8 million from marine environments (FAO 2022). However, there are worrying trends surrounding these figures in relation to marine fisheries: the fraction of biologically sustainable fish stocks has decreased from 90% in 1974 to 65% in 2019 while the biologically unsustainable (over-fished) proportion has risen from 10% to 34% (FAO 2022). The solution to slowing these trends is multifaceted, but it is widely accepted that ensuring the sustainability of global fish stocks is dependent on the effective interplay between policy makers, individuals and the environment itself (Cooke & Cowx 2005; Arlinghaus et al. 2010; 2019). The aim of fishery policies should be to balance the sustainability of natural resources against economic, social or wellbeing benefits, while management strategies should determine the way in which policy is implemented in the applied world. Management strategies are therefore key in ensuring human needs are met while fish stocks remain sustainable (Hilborn et al. 2020).

While the commercial fishing sector has gained much attention in this respect, the environmental footprint of recreational fishing is becoming critically important for two main reasons. Firstly, several studies have highlighted its potential high impact on fish stock biomass (Lewin et al. 2006; Hyder et al. 2018; Radford et al. 2018; Arlinghaus et al. 2019; Lewin et al. 2019; Kleiven 2019). Research by Cooke and Cowx (2005) estimated that recreational fishing accounted for 12% of the global fish harvest in the early 2000s (weight of fish stock retained), although some caution is recommended when interpreting this figure due to its calculation being based on the extrapolation of fish capture data in Canada. Other national studies (United States of America, USA) have reported recreational harvest percentages as high as 23% (Coleman et al. 2004). Secondly, this is set against a growing backdrop of evidence statements by the Department for Environment, Food and Rural Affairs (Defra 2019) highlighting the health and wellbeing effects of engaging with marine and coastal areas, and wider pressure on the marine environment caused by climate change (Jiao et al. 2015).

In response, environmental policies in several countries worldwide have given more weight to marine recreational fishing. However, Potts et al. (2020) argues that recreational fisheries (inclusive of marine and freshwater systems) are still not being effectively managed. There are two main reasons why this is the case. Firstly, the recreational angling community is heterogeneous, meaning that a 'one-size-fits-all' approach is unlikely to be appropriate for managing the relationship between angler choice, benefits they seek to reap from engaging with the activity, and the impact of their pursuits on the environment (Beardmore et al. 2011). This is confounded by the fact that angler choice is influenced and dependant on an almost uncountable number of factors that change in different contexts (Beardmore et al. 2011; Brinson 2013). Secondly, while the notable lack of empirical research on the social dimensions of marine recreational angling is frequently highlighted (Arlinghaus et al. 2008; Johnston et al. 2013; Nyugen et al. 2013), scholars have claimed that there is an acute disconnect between the research that does exist and how its findings inform the implementation of management strategies/policy (Johnston et al. 2010; Hunt et al. 2013; Johnston et al. 2013). Hunt et al. (2013) suggested that one of the potential reasons behind this disconnect is that those involved in fisheries

management, whose expertise lay within the biological science of fisheries, perhaps view the findings of social research as too complex and often accompanied by too many caveats, or that findings are not important enough for inclusion into management strategies. Conversely, it has been suggested that social research on fisheries often neglects detailed consideration of the biological aspects of fish stocks when reviewing findings (Hunt et al. 2013).

These issues, specifically those associated with angler heterogeneity, became particularly relevant to the UK with the introduction of the Fisheries Act 2020, which embedded recreational sea angling in the fisheries policy framework for the first time. The management of fisheries in the UK (and across the globe) has focused more on the commercial fishing sector, working towards the goal of achieving maximum sustainable yield from fish stocks (Potts et al. 2020; Andrews et al. 2021). Pre-2020 management of fisheries in the UK was part of the EU Common Fisheries Policy (CFP). Legislation and control of policy at a national level was directed by Defra, operationalised by the Marine Management Organisation (MMO) and regionally based Inshore Fishing and Conservation Authorities (IFCAs). In this framework, recreational sea angling is required to conform to a number of guidelines: minimum sizes for retention (across all species, and usually in line with those applied in the commercial sector); no fishing in designated nursery areas and/or marine protected zones; and a requirement to conform to species-specific regulations (e.g. those stipulating additional protection measures for sea bass such as limited daily catch or seasonal no-fish periods). While anglers were/are not required to hold any form of licence to take part in recreational fishing, they are also subject to the Marine and Coastal Access Act (2009) which stated that all users of the marine environment must take note of all relevant environmental management decisions. In reality, due to the sheer size of the coastline and un-paralleled investment in on-site monitoring, the aforementioned rules and regulations are un-policed, with regulatory compliance relying on voluntary behaviour. The regulation of UK recreational angling could be viewed as one of more lenient frameworks in comparison to other countries, particularly in the Europe, USA and Australia (Pawson et al. 2008).

The departure of the UK from the European Union (EU) in January 2020 saw an end to required compliance to the CFP. In its place, the newly formed Fisheries Act 2020 provided a new framework for managing the UK's coastlines, fish stocks and fishery zones. This was a pivotal landmark in recreational angling: in the development of the Fisheries Act, the supporting 'Fisheries White Paper: sustainable fisheries for future generations' (2018) formally made reference to the inclusion of recreational fisheries in the future policy framework, outside of the simple requirement among anglers to conform to minimum sizes or special species-specific regulations. As stated in the white paper: *"We will consider how we can further integrate recreational angling within the new fisheries framework recognising the societal benefits of this activity and impacts on some stocks"* (p.13)... *"Recreational angling is a popular sport in England bringing both economic and social benefits to the UK. Defra will look at how to further integrate recreational angling into fishery management governance and decisions. This could include managing some stocks specifically for the recreational angling sector only"* (Fisheries White Paper 2018, p.28).

The Fisheries Act 2020 mandated central and devolved administrations with the task of operationalising the policy framework through the Joint Fisheries Statement (JFS 2022), and subsequent Fishery Management Plans (FMPs). Forty-three FMPs are currently being implemented (2023) at either a species or zonal level, detailing policies of how local stakeholders under guidance of fishery authorities will achieve a sustainable fish stock in UK waters. The FMPs are responsible for monitoring the implementation of policies and reporting back to Defra every three years. As of September 2023, recreational anglers have been included in the development and monitoring of the FMPs, and also featured significantly in the JFS (2023) itself: *"The fisheries policy authorities will continue to work together - where possible, practicable and appropriate - to ensure recreational sea fishing is environmentally, socially and economically sustainable, and therefore contributes to the achievement of the sustainability objective. We will aim, where possible, to take account of recreational sea fishing in wider fisheries management, underpinned by encouraging data collection on catches, economic impact, and species-specific data across the recreational sea fishing sector, and ensuring recreational interests are*

part of relevant stakeholder engagement processes. In doing so, we will contribute to the ecosystem and scientific evidence objectives” (JFS 2022, p.46).

The policy changes are justified not only by the environmental footprint of recreational fishing being realised, but also by the activity’s popularity in the UK. Although estimates vary from year to year and from source to source, it can be assumed that several hundreds of thousands of adults take part in this activity yearly in the UK: estimated 758,000 in 2018 and 551,000 in 2019 (Hyder et al. 2021). These estimates are based on extrapolation from data gathered in the UK Watersports Participation Survey (WPS), including approximately 12,000 residents. The fluctuation in yearly numbers results from fluctuation in the WPS data trends (for angling): small differences in yearly trends in the WPS sample results in larger differences when extrapolating data for generating population-based estimates. Recreational anglers take part in approximately 6 million days fished per year and 46 million tonnes of fish landed, of which most (80%) are released (Hyder et al. 2021). In terms of impact on fish stocks, a programme of data collection is conducted by Cefas (as a statutory requirement) involving angler diarists who record catch and avidity on an annual basis (Hyder et al. 2021). Modelling techniques are applied to induce data trends at a UK level. Although there is recognition of the limitations of the data extrapolation/modelling, efforts have yet to fully account for the potential impact of sample bias. Recruitment to angler data collection programmes is likely to attract certain ‘types’ of angler, perhaps more ‘avid’ or ‘interested’ in the activity, or simply those with more time to invest. Such research is recognised as likely to attract those more invested in the topic at hand, or those who are most likely to lose/win from policy change. Therefore, arguments cannot be made to suggest that the sampling approaches in the current UK recreational angling catch reporting programme include accurate methods to ensure all ‘types’ of angler are included. This has potential ramifications on the data produced, which in turn, therefore, has potential implications on the claimed impacts on fish stocks, and more importantly, this may affect subsequent regulation or species control.

The easy and obvious answer is to account for angler ‘types’ in UK catch reporting samples. Unfortunately, however, there is no existing model that describes how recreational sea anglers differ in the UK, and no single method on how to determine

angler 'type' (once a model is recognised/established). In this regard, the need for understanding angler heterogeneity transcends from the abstract problem relating to policy's inability to account for diversity when the degree of diversity is unknown, to a very real problem for which a practical solution is required.

The political changes and practicalities of catch monitoring in the UK should be considered in context of its geographical landscape. As an island, the UK has approximately 17,820 km of coastline¹, not including estuaries and tributaries. The coastline includes numerous access points, including harbours, piers, beaches and rock shores. While there are 22 recognised commercial ports in the UK, there is a large number (unquantified) of private marinas and publicly/privately owned deepwater and tidal moorings used by small to medium sized vessels. The coastline and recreational marine fisheries around the UK is considered an 'open access' resource. This means that access is largely unrestricted; users do not face time or geographical restrictions in accessing the coast (apart from the small proportion of coast/water regarded as nursery areas or marine protected zones). Open access resources are specific in that they host environmental or natural assets which are considered exhaustible, meaning that once a user depletes the resource (harvesting), it is no longer immediately available to other users (Andrews et al. 2021). Management is therefore required to mitigate against the impacts of over-exploitation, but also maximise the benefits users expect from engaging with the resource (Andrews et. al. 2021; Arlinghaus and Mehner, 2005).

In summary, accounting for potential biases in catch data and successful inclusion of recreational angling in UK policy both hinge on one key factor: understanding the recreational angler population. This provokes wider questions: how much information currently exists on UK recreational anglers, and what type of information is most useful to assist in delivering sustainable fisheries? In relation to the former, the answer is simple, little is known about the UK recreational angling community, other than information on catch quantities/species, avidity (days spend fishing), and economic data (e.g. spend and sector level revenue generated). The second

¹ <https://web.archive.org/web/20120419075053/http://earthtrends.wri.org/text/coastal-marine/variable-61.html>

question requires a thorough answer and is discussed appropriately in Chapter Two; in summary it is likely to require a broad remit of data on angler values, attitudes and behaviours. Evidently, there is a clear requirement for a typological model that methodologically explains different types of recreational sea angler in the UK. Such knowledge is fundamental for 1) informing future catch reporting programmes/sampling and 2) providing a foundation of knowledge that can inform the future UK fisheries framework.

1.2 RESEARCH AIMS AND OBJECTIVES

The aim of the research was to understand heterogeneity in the values, attitudes and behaviours of recreational sea anglers in the UK, specifically England and Wales. In order to fulfil this aim, five objectives were achieved:

- Objective 1: review existing literature and theoretical approaches on recreational angler heterogeneity and produce a framework for collecting appropriate data that allowed the capture of differences in values, attitudes and behaviours. As part of this: 1) describe factors (latent constructs) demonstrating high value in measuring heterogeneity; 2) review the strength of the latent constructs in context of existing theoretical/conceptually based frameworks.
- Objective 2: produce a typology that best describes heterogeneity among recreational sea anglers in England and Wales. In relation to this: 1) define key characteristics of the constituent angler groups; 2) use appropriate and novel techniques to verify/validate the angler typology; and 3) compare angler groups to those produced in research outside the UK.
- Objective 3: use qualitative methods to explore views on fishery governance and management among angler groups identified in the typology.

- Objective 4: highlight implications arising from angler heterogeneity regarding the further inclusion of recreational sea angling in the future UK policy framework.
- Objective 5: recommend methods for the future capture of angler types identified in this study.

1.3 DEFINITION OF RECREATIONAL SEA ANGLING

Recreational fishing is defined as the capture of “aquatic animals (mainly fish) that does not constitute the individual’s primary resource to meet basic nutrition needs and are not generally sold or otherwise traded on export, domestic or black markets” (FAO, 2023). This incorporates a wide variety of methods including rod and reel, line and hook, netting and spearing. The focus of this research was specifically on recreational sea angling. Sea angling in this study is defined as methods using rod, line and hook from ashore or afloat a vessel.

1.4 THESIS STRUCTURE

This Chapter has presented a justification for why the research carried out in this study was required and has provided an overview of its objectives. Chapter Two considers the theoretical and conceptual issues related to angler heterogeneity and its role in a policy context; it explains and critiques the approaches used in previous research to conceptualise and measure angler heterogeneity and in doing so describes the model of data collection used to form the angler typology in this study. Chapter Three describes the methodological background and methods used in data collection (namely, survey questionnaire and interviews). Chapter Four presents the results of the survey questionnaire and analysis techniques used in forming the typology of recreational sea anglers. The constituent groups are profiled and described using a proven sequential process based on a range of data captured in the survey questionnaire. Chapter Five presents the findings of qualitative interviews with anglers representing the groups developed in the typology; this includes an

exploration of issues arising from the survey analysis, views towards governance, policy and, importantly, the results of an angler-based typology verification exercise. An in-depth discussion of the results is provided in Chapter Six drawing upon comparisons with existing theory on angler heterogeneity. Chapter Six is framed by the research aims and objectives, highlighting key contributions to knowledge and recommendations for future research and future policy making.

CHAPTER TWO

MEASURING HETEROGENEITY AMONG ANGLERS – A LITERATURE REVIEW

2.1 INTRODUCTION

This Chapter reviews the academic and relevant grey literature on heterogeneity among anglers. The primary function of the literature review is to: i) provide an overview of why understanding heterogeneity among anglers is important to the management of aquatic environments and resources (2.2); ii) present and critically analyse existing angler classification typologies, highlighting those based on marine/saltwater environments (2.3); and, iii) systematically outline all possible areas of angler's cognitive, attitudinal and behaviour profile that has proven valuable for exploring and measuring heterogeneity, i.e. where differences among anglers are likely to occur (2.4). Importantly, this will include measures that have proven useful as predictors of behaviour associated with sustainability or sustainable management of marine fisheries.

Typologies are only as strong as the measures and methods used in their formulation, are often multi-disciplinary by nature, and often lack a singular/common methodological grounding. Therefore, a significant proportion of this Chapter is focused on how angler typologies have been developed in previous published research, describing the theories that underpin their conceptual make-up and their suitability for open resource marine environments such as that in England and Wales. This is woven through the sub sections of the Chapter.

The Chapter synthesising the theoretical underpinnings and methods (measures) used to capture angler diversity across existing typologies into a logical model that reflects the entirety of angling experience: from value-based inception (the urge or even first thought that inspires someone to take part in the recreational angling) through to end result (catching, or not, fish and making decision on whether to retain or release). Establishing a clear theory-based model provided a structure on which

the research was operationalised. Research questions guiding the literature review are presented in Figure 1.

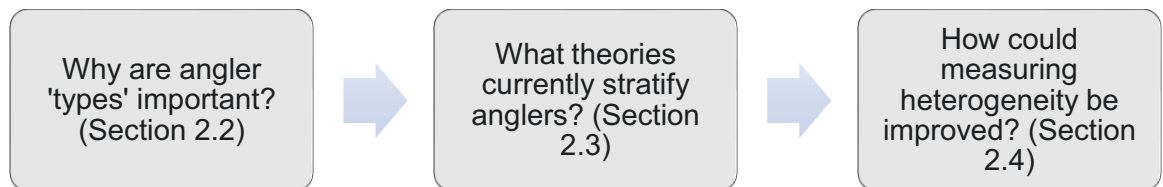


Figure 1: Questions guiding literature review

2.2 IMPORTANCE OF UNDERSTANDING ANGLER HETEROGENEITY

The aim of fishery policies (across both commercial and recreational fishing) should be to balance the sustainability of natural resources against economic, social or wellbeing benefits; management strategies should determine the way in which policy is implemented in the real world. These principles are evident in the Fisheries Act 2020 and associated JFS and FMPs: for example, FMPs are specifically designed to address the management of fish species and areas of coastal water that is of environmental, economic or social importance. Management strategies are therefore key in ensuring that user (beneficiary) needs are met while fish stocks remain sustainable (Hilborn et al. 2020).

Understanding the composition of angling communities is vital because it: 1) informs those responsible for aquatic environments on how to best incentivise behaviours that align with the goals of respective policies and management strategies (Birdsong et al. 2021); and 2) recognises that strategies to enhance policy compliance may be received or require different implementation approaches according to the level of heterogeneity in the target community (Arlinghaus and Mehner 2005; Arlinghaus, 2006b; Beardmore et al. 2011; 2013; Arlinghaus et al. 2019a; 2019b). Understanding differences among anglers also helps shape modes of communication between policy makers and end-users, as well as helping to predict responses to potential policy shifts (Magee et al. 2018). Sustainable management

of fisheries is therefore dependent on thoroughly understanding angler heterogeneity (Matsumura et al. 2019; Johnston et al. 2013). This premise is also supported by research (mainly focused on freshwater environments) suggesting that different types of angler, whether based on level of skill and/or effort (participation), or geographical location, have different ecological footprints on fishery resources (Johnston et al. 2010; 2013; Carruthers et al. 2019).

Matsumura et al. (2019) in a study of freshwater northern pike angling demonstrated a linkage between the amount of angling effort, regional availability of fishing opportunity and fish stocks, showing that high levels of angling participation can result in overfishing when factored against regional level assessments of ecosystem productivity. As a result, they concluded that simplifying the angler population into a homogeneous group with average-based measures of participation and effort underestimated the level of potential regional overfishing and would therefore lead to poor policy outcomes unless angler-based heterogeneity is integrated into local species protection policies. Johnston et al. (2013), again studying freshwater populations of European pike, brown trout, pikeperch, pike and bull trout, found similar results. Using measures that classified anglers into three types (generic, consumption orientated and trophy angler), they confirmed that the impact of angling on vulnerable fish species increased depending on angler types, largely due to each type having different propensities for annual participation and effort (travel). Both fish (life-history, biological, characteristics) and angler diversity was key in predicting the efficacy of management strategies. More importantly Johnston et al. (2013) suggested that failure to recognise these factors can lead to fishery collapse in situations where stock is at fragile levels (Johnston et al. 2013).

Arlinghaus et al. (2020) used angler 'specialisation' based on angling commitment (centrality to life), harvest orientation, and angling utility to form a three-tiered typology of recreational freshwater anglers in Germany (least committed, moderately committed, and highly committed). The research showed that more committed anglers were aligned with preferences for high catch limits, larger fish, and less crowding at sites. The study concluded that freshwater management policies safeguarding the interest of committed anglers would only be successful at locations where such anglers were abundant among the local population.

Importantly, the results showed increased likelihood between these preferences and certain species being targeted (pike, carp, eel and zander). This result confirmed that one-size-fits-all policies are unlikely to be optimal for more generic/less committed anglers (Arlinghaus et al. 2020).

The research carried out by Arlinghaus et al. (2020), Johnston et al. (2010;13), and Matsumara et al. (2019) have a commonality in the 'way' that heterogeneity has been conceptualised and measured: they are based on choice experiment scenarios that follow an economic utility tradition. Rather than understanding heterogeneity and its formulation at a basal level, choice experiments focus more on the application of previously developed heterogeneity measures in understanding angler impacts on local environments or responses to policy interventions. It is important to highlight here that there is a clear distinction between studies and methods that aim to develop frameworks for understanding heterogeneity and studies or frameworks such as choice modelling that aim to understand the impact of angler heterogeneity in carefully described and measured scenarios.

To understand why the primary focus of this research is focused on measuring heterogeneity rather than its impact as discussed previously, attention first must be turned to modelling approaches (primarily, choice models, which reflect the same principles in other modelling approaches such as willingness to pay). Recreation economists seeking explanation for resource depletion focus on models that demonstrate tangible results directly from user-beneficiary choice scenarios. Data organised in these models aim to predict angler impact on fish stock, or impact resulting from a change in policy or management strategy relating to a particular species or fishery (Curtis 2018; Deeley et al. 2019). As Arlinghaus et al. (2020) highlight, the major advantage of choice modelling is that it allows the identification of statistical descriptors of angler preference in relation to given choice scenarios based on, for example, cost per fish or catch composition (wild versus stocked). The statistical descriptors are based on well-defined choice parameters and angler profiles used in the scenario analysis, allowing the test of measures that may not have been previously implemented. The well-prescribed data capture can therefore be transposed to other study areas or other groups of anglers, making the approach

highly useful in policy planning and for other researchers. Arlinghaus et al. (2020) highlighted that this approach has proven to work well in studies involving one local fishery (usually freshwater), where participation is licenced, may involve a ticketing system, studies on specific types of angler in one locality, studies on one or limited numbers of species, or studies involving species and anglers that are confined to follow very prescriptive regulatory requirements (e.g. Oh and Ditton 2008; Dorow et al. 2010). Methodologically, the ability to replicate such data collection in open access, large scale marine fisheries where there are a large abundance of fish species and lack of licensing regulations is very challenging. There are far too many unaccounted choices that affect angler decisions and outcomes (utility) regarding, for example, management preference (Arlinghaus et al. 2020). Choice models breakdown when the parameters are many; they are limited by the inclusion of only a few specific variables. Therefore, developing heterogeneity typologies using a wide range of variables in a choice experiment model is not appropriate. For this reason, a thorough understanding of how to develop ways to measure and conceptualise differences among anglers at a basal level (rather than context specific) is required. Such a model or set of approaches can formulate typologies based on variables that offer more freedom in capturing differences between anglers in open access environments, mainly because they are based on innate values and attitudinal measures of the angler him/herself regardless of context. Research reflecting these parameters has mainly derived from the socio-psychology tradition (human dimension).

2.3 SOCIO-PSYCHOLOGY (HUMAN DIMENSION) APPROACHES

Human dimension research focuses on the subjective attitudes and behaviours of those taking part in recreational angling (Hunt et al. 2013). It has a broad focus and therefore has suffered and benefited from its positioning across many different disciplines and theoretical models. There is no singular discipline-based theoretical background one can draw upon in the literature to understand the human dimension in angling research (particularly in relation to angler heterogeneity). As such, a flexible and inclusive, yet robust, approach has often been applied in previous

research. The glue linking human dimension research together is that concepts used to underpin associated research and respective theoretical conclusions are usually rooted in social science and/or psychology.

Added to this complexity, the broad focus of human dimension research means that one can decide, usually based on strong epistemological arguments, to measure heterogeneity in many different ways that align with various aspects of the angling experience or are justified based on the context of the paper, which is usually related to the needs of a bespoke fishery or the conceptual lens being applied, such as socio-ecological systems (Hunt et al. 2013). There are many ways to cut the cake. Some of the lesser-discussed perspectives and variables used to understand angler heterogeneity include: ethnicity (Hunt and Ditton, 2001); fishing location (Arlinghaus and Mehner, 2005); and species preference (Ross and Loomis, 2001). There are, however, four areas of research which have proven to be key in understanding angler heterogeneity in the human dimension context, ranging from research that has theorised angler differences drawing on an amalgamation of variables (specialisation and involvement) to research focusing on single variables (motivation and attitudes to catch). These are discussed in subsequent subsections.

2.3.1 Specialisation

Specialisation describes the combined cognate, psychological, and behavioural traits of anglers. First introduced by Bryan (1977), the multi-dimensional concept formed an incremental continuum of angler types (beginner to expert) including the 'occasional angler', 'generalist anglers', 'technique specialists', and 'technique setting specialists'. Bryan (1977) presumed that understanding the degree of specialisation among anglers would correlate with wider attitudinal and behaviour characteristics relevant to the management of fisheries, so understanding specialisation alone would allow fishery managers to predict responses to different management scenarios. This sentiment remains and drives much of the current day research on specialisation and heterogeneity among anglers (Arlinghaus et al. 2020).

Bryan (1977), and subsequent research, showed correlation between increasing higher degrees of angling specialisation and 1) lesser importance placed on harvest-consumption of fish caught as measured by motivation (Bryan, 1977; Ditton et al. 1992) and 2) increased willingness to engage in catch and release methods (Arlinghaus et al. 2007). The latter reflects a central tenet of angler specialisation theory: specialised anglers are more willing to engage with stricter and more formal management strategies and regulations than non-specialised anglers (Ditton et al. 1992; Li et al. 2010). This is because the impact of discontinuation, for example, if the angling activity was made illegal due to conservation requirements, would have greater significance on an individual that is more personally invested in the activity, therefore support for the continuation of the activity in a restricted form is preferred to no activity at all (Ditton et al. 1992). This finding was also supported by Salz et al. (2001), who demonstrated higher support among specialised anglers for tighter bag limits, stricter minimum landing sizes, and designated catch and release zones.

Research by Ditton et al. (1992) showed that more specialised anglers are more dependent on specific types of resources to meet their expected outcomes (such as specific angling locations and availability of select species). This also supported by Salz and Loomis (2005), who demonstrated that while specialisation theory may generally suggest that more specialist anglers are increasingly accepting of stricter management regulations, this was not the case for restrictions such as no-fishing zones: their study showed less favourable preferences among specialised anglers for this type of restrictive legislation, more in line with preferences among non-specialist anglers. It was hypothesised that this was due to the high levels of resource dependency among specialised anglers and the counterbalancing affect this had on their ability to gain maximum satisfaction from an angling trip if resources, or sites, are not accessible. Determinants of satisfaction therefore plays an integral part of understanding the relationship between specialisation and preference for different management strategies.

Other studies have highlighted the complexity in using specialisation as a metric of heterogeneity in multivariate behavioural studies, involving complex social-ecological systems. A central tenet of early research on specialisation theory is that

among highly specialised anglers, the importance of catching fish (activity specific outcomes) decreases as the importance of non-catch related aspects angling increases (Ditton et al. 1992; Salz et al. 2001; Salz and Loomis 2005). Revised theories of specialisation demonstrated that the context of the fishing trip, including cultural spheres and culinary value of the species caught, affects the importance of catch related motivations of an angler in the form of harvesting behaviours (Dorow et al. 2010). Beardmore et al. (2011) demonstrated this important caveat in specialisation theory. Their work used context-specific variables (species and site choice) to form angler categories based on primary trip motivations. Anglers motivated by catching trophy fish or the challenge involved with catching fish scored high on measures of specialisation (primarily centrality to life), meaning that specialised anglers were more catch orientated than previously thought (Beardmore et al. 2011). Although, generally the study revealed that non-catch related motives were more important than catch related motives across the study sample.

A significant limitation with the specialisation concept is the failure of research studies to define and use consistent, aggregated, metrics in its measurement, meaning that the term specialisation is used when in reality only one aspects of the concept has been studied. In relation to the former argument, this can be seen through comparison of the Salz et al. (2001) specialisation index based on the work of Ditton et al. (1992), compared to more common approaches that use metrics covering the psychological, behavioural commitment measures and skills/knowledge levels, i.e. the tri-model (Beardmore et al. 2011; 2013; Arlinghaus et al. 2020). Although Salz et al. (2001) used a survey approach that correlated to some degree with the tri-model, their work developed novel questions based on a priori theory of 'social worlds' developed by Unruh (1979). This theory hypothesised that groups of individuals related by an interest in activity such as angling would naturally form different sub-group identities based on shared attitudes, motivations, and beliefs, and could be ordered along a continuum based on four dimensions: personal orientation, experiences, relationships, and commitment (Salz et al. 2001). The theory argued that previous attempts to measure specialisation (e.g. Bryan 1977) were fundamentally flawed by their tautological design: preferences and attitude domains used to form levels of specialisation were then used to explain the same specialisation behaviours. The concept had therefore been defined,

measured, and tested in the same terms. Although Salz et al. (2001) confirmed the four-dimension approach developed by Ditton et al. (1992), showing meaningful segmentation of angling specialisation, the approach has not been widely adopted in recent studies. Therefore, there is a lack of recent empirical evidence demonstrating its efficacy. The criticism of the lack of empirical research demonstrating the impact of specialisation as a predictive tool for environmental managers has also been raised by Arlinghaus et al. (2020).

Even considering its inconsistencies, specialisation is viewed as a key measure of angler heterogeneity, and can be operationalised through the aggregation of metrics across three domains: behavioural commitment; psychological commitment through centrality to life; and cognitive ability (knowledge and skills). Each, however, derive from diverse conceptual and theoretical backgrounds.

2.3.1.1 Behavioural commitment

Behavioural commitment can be conceptualised as the degree of avidity that an individual displays when engaging with an activity. In angling studies, this has been primarily measured as number of days fished within a given time frame and is regarded as a key measure in the formation of many angler typologies (Sutton and Ditton 2001; Beardmore et al. 2013; Magee et al. 2018; Arlinghaus et al. 2020). The use of avidity as a marker of heterogeneity among anglers derives from its strong correlation with angler attitudes and behaviours, so much so that it has often been used as a singular proxy for the specialisation concept (Magee et al. 2018). Sutton and Ditton (2001) demonstrated that avidity through number of days spent angling bore a strong correlation with consumption behaviour among anglers. The second most common way of understanding behavioural commitment is through expenditure on equipment and access to the pursuit of leisure activities; studies have drawn association between spend and avidity (Oh et al. 2005; Oh and Ditton 2006; Magee et al. 2018). Other measure includes specialist organisation membership and willingness to travel/travel (Schroeder et al. 2006; Arlinghaus et al. 2008).

2.3.1.2 Psychological commitment

Kim et al. (1997) defined psychological commitment as the level of personal investment (affective attachment) which reflects an individual's inner convictions towards a leisure activity, and the level of behavioural intention operationalised through the degree to which an individual may shape their behaviour based on: 1) the expectations of others; and 2) the perceived impacts of discontinued involvement in an activity. In this respect, commitment is an integral part of behavioural intention according to a cognitive hierarchy model of planned behaviour (Ajzen 1991; Bruskotter and Fulton 2007). Persistent commitment at both a personal and behavioural level indicates how seriously an activity is viewed by an individual, how central it is to their life and will influence consistent, long term, embedded, behaviours (Kim et al. 1997). Kim et al. (1997) condensed psychological and behaviour investments into a single scale that indicated the degree to which a leisure activity is central to an individual's lifestyle and social networks.

In an angling context, psychological commitment as a measure of centrality to life has continued to be a strong indicator of difference among angler preferences, with scholars mainly employing adaptations of the scale developed by Kim et al. (1997). In a national study of anglers in Sweden, van Huevel et al. (2020) found centrality to life to be higher among those with favourable attitudes towards the potential introduction of mandatory catch reporting. With a more methodological focus, Beardmore et al. (2011; 2013) demonstrated that centrality is one of the strongest measures of specialisation. Their work involved the use of 11 specialisation measures spanning across: 1) activity general indicators (behaviours such as days fishing, centrality to life, and media use); and 2) activity specific measures (skill, catch importance of catch, fish size, use of specialised gear, release orientation, and consumption). The specialisation metrics were correlated with angler groups formed on the basis of trip preference in a hypothetical choice framework involving options for catch outcomes, species, regulations, crowding, and cost. Beardmore et al. (2013) concluded that the majority of specialisation indicators were weak predictors of membership in the latent angler categories, apart from centrality to life.

2.3.1.3 Cognitive ability (skill and knowledge)

Beardmore et al. (2013) operationalised skill level as an activity specific indicator of specialisation through three metrics: firstly, as a revealed score of average fish weight, secondly as a perceived skill in relation to peers, and as a composite index of specialised equipment used. Although Beardmore et al. (2013) provided a detailed framework for behaviours and cognate dimension of skill, the research showed weak evidence as a marker for specialisation and predictor of latent class membership. Dorow et al. (2010) employed a similar technique in measuring skill, but only using angler self-perception among peers (although this formed part of a wider measure of centrality to life).

2.3.2 Involvement

Enduring involvement is an attitudinal measure of the degree of psychological attachment and personal relevance someone holds to a given activity. Personal relevance is achieved when an activity holds attributes that successfully allow the convergence of a person's intrinsic goals, needs, and values, and is usually combined with pleasure gained from taking part in the activity (Kyle et al. 2007). In leisure and tourism, enduring involvement research demonstrated that more 'involved' recreationists were likely to require specific facilities and form attachments to specific settings, meaning that it has important utility in service delivery (Kyle and Chick 2002; Kyle et al. 2004a; 2004b). In angling research, greater levels of involvement have been correlated with increased environmental concern (Seimer and Knuth 2001). While research on involvement in angling is in its infancy, it offers potentially high value as an amalgamation of measures that cover the spectrum of angler values, choices, and behaviours in line with the theory of planned behaviour (Ajzen 1991). While this theory has several uses in this study, it is important to understand the theoretical background and deconstruct how it is measured.

Similar to specialisation, involvement was originally operationalised as a multidimensional concept used to understand influences on consumer behaviour (Consumer Involvement Scale), involving measures of importance (the outcomes of

the activity compared to goals), pleasure, risks associated with poor choices, and 'sign' (the object's or activity's identity compared to an individual's personal identity). Building on this work, McIntyre (1989) measured enduring involvement in leisure, and after testing its use in a variety of settings, the previous concepts of importance and pleasure were combined in the single factor called attraction. McIntyre (1989) also replaced risk items with centrality to life due to their unpredictability in factor loading tests and less appropriate fit with leisure compared to consumer purchasing decisions. Centrality was deemed a more appropriate concept in the context of leisure activities and was conceptualised through financial investment in an activity and the extent to which involvement was socially derived (encouraged through social networks). However, subsequent research (Kyle and Chick 2004) presented a strong case for the influence of peers and social ties on decisions, behaviour, and experience of the leisure activity, suggesting it should be treated as an independent component of the involvement concept, separating it from centrality. The 'sign' domain remained in the scale. This was supported by research demonstrating that intensity of participation in games and leisure was determined by the characteristics of their social networks/worlds (Scott and Godbey 1992; Choi et al. 1994). Finally, an additional development to the concept of 'sign' recognised that it may be more complex than originally thought and can be viewed in terms of two main subdimensions, namely how leisure activities can affirm one's identity to self and be used to express one's identity to other people around them (Haggard and Williams 1992).

Reflecting on these developments, Kyle et al. (2007) developed a modified involvement scale based on five dimensions, each using three statements that aimed to reflect a person's affiliation with each subconstruct: attraction; centrality; social bonding; identity affirmation; and identity expression. The research applied robust testing techniques to understand the validity of the new scale, using data collected from campers in the National Forest and anglers in South Carolina, USA. The data were assessed to understand: the relationships between statements and sub dimensions measured in the scale (using various factor models); the validity, strength and reliability of the best fit model (convergent and discriminate tests); and predictive ability of selected variables/concepts on angler behaviour (using nomological testing and regression). The results suggested that the newly

conceptualised scale performed well, with adequate degrees of reliability and validity, suggesting it as a psychometrically reliable tool. Also, that involvement was a multidimensional rather than unidimensional construct, with a correlated variable model providing best fit for the data (i.e. that its subdimensions are unique, but also covary together). The model provided adequate predictive ability. The most predictive subconstructs were identity expression (correlated to camping and angling satisfaction) and social bonding (correlated with camping experience).

Kyle et al. (2007) highlighted a number of problems to overcome in the use of the modified involvement scale, not least the need for more research to gather empirical data (specifically on angling in this regard). One of the main areas for improvement is the inclusion of other dimensions in the construct of identity; here, Kyle et al. (2007) highlighted the need to recognise and include ways to measure the identity construction, and how it is formed through the process by which individuals assimilate, evaluate, and accommodate information from the social world. Drawing on research by Breakwell (1992) the selection of information to feed into the formation of identity can be divided into four areas: self-esteem (positive self-conception); self-efficacy (desire to feel confident and in control); continuity (self-conception over time); and distinctiveness (the desire to be distinct from other individuals and groups). Another identified problem with involvement is that, because of its roots in psychology and markers or antecedents of behaviour, its subdomains intersect with other concepts in an angling context, such as specialisation (both use centrality as subconstructs). Methodologically this is difficult to overcome but must be factored in when conclusions or inferences are made based on statistical analysis.

2.3.3 Attitudes to catch

Anglers vary in the importance they attach to catch related aspects of the angling experience. Whereas specialisation and involvement combine metrics across different aspects or components of the 'angler' and behaviour. Research on attitudes to catch has a more singular focus on the opinion held by the angler on the quality of the fish caught, the intended purpose of the fish, and the importance of

the fish to the angling experience. It is therefore a multi-dimensional concept that involves attitudes towards all aspects of the experience linked with catching a fish (Graefe et al. 1980; Anderson et al. 2007). The way in which attitudes to catch has been addressed in the literature has often led to an overlap with other concepts defining the angler psyche, namely motivation. Attitude to catch is not to be confused with motivation: the former involves an attitude based on the personal (innate) evaluation of specific objects (fish) which may or may not guide behaviour, while the latter relates to the underlying factors that motivate behaviour. For example, a motivation for an angler may be to eat, or consume fish caught, however an attitude to catch will reflect the importance or outcome of this feature to their personal experience, expressed as statements such as 'I usually eat the fish I catch, or 'I'm just as happy if I release the fish I catch'.

Graefe et al. (1980) pioneered research on catch orientation by developing a six-tiered model reflecting how catch orientation is manifested in the angling experience and how it revealed itself in angler attitudes, including: general consumptiveness (orientation to catch something); number of fish caught; disposition of fish; and orientation towards big fish, game fish, and trophy fish. The scale was developed further by Sutton and Ditton (2001) with four constructs being revealed by the 16 items (statements) including attitudes to: catching something; catching numbers of fish; catching large/ trophy fish; and keeping fish. Several studies used these constructs to measure the degree of heterogeneity among anglers to understand management preference and angler satisfaction, compiling angler types in an incremental gradient comprising low, medium and high catch orientation (Fisher 1997; Arlinghaus and Mehner 2005). Regarding the former, Arlinghaus and Mehner (2005) demonstrated a correlation between lower levels of catch orientation and support for angler funded habitat management strategies as opposed to stocking of fisheries in Germany as a method to improve sustainability of resources. Arlinghaus et al. (2006b) used the attitude to 'catching something' construct developed by Graefe et al. (1980) and Aas and Vitterso (2000) to form three levels (low, medium and high) of angler catch orientation which was then correlated to satisfaction among a sample of anglers in Germany: the research showed that the majority of respondents had low catch orientation but higher levels of satisfaction; higher levels of catch orientation correlated with low levels of satisfaction. The drawback with

Arlinghaus (2006b) is twofold: firstly, it used attitude to catch as a marker of angler motivation, and as noted above, the two concepts fundamentally differ; secondly, it used one dimension of the attitude to catch construct (attitudes to 'catching something versus non-catch related orientation') and was therefore unidimensional in its approach. This relates to a wider problem within the catch orientation literature. Different conceptualisations and methods have been used, with few studies accurately validating the multidimensional scale developed by Graefe et al. (1980) (Aas and Vitterso 2000; Anderson et al. 2007). The problem with the unidimensional approach is that it failed to explore why an angler may fall on either side of the catch something versus non-catch orientation fence or explain how and why some anglers may display both types of catch orientation. The unidimensional approach is therefore limited its ability to inform fishery management. The question therefore needs redirecting from "how do anglers differ in relation to their catch orientation and how does this relate to certain behaviours or presences?", to "how is catch orientation best conceptualised and reliably measured to explain heterogeneity in respect to this particular set of attitudes?".

In this context, Aas and Vitterso (2000) worked with anglers of small freshwater lakes and rivers in Norway with the aim to validate Graefe et al. (1980) original scale as a multi-dimensional concept and make changes for its use in different cultures and settings. The premise for their work was that Graefe's original factor analysis, leading to the six-tiered model, showed poor performance because the statements used to defined each factor were heavily cross-loaded on other dimensions in the model, and that previous research had been too unidimensional in its focus by selecting certain statements or dimensions, leading to poor and undefined conceptual definitions of the catch orientation concept (Aas and Vitterso 2000). Their work highlighted the presence of a (stable) general consumptiveness construct among the data with significant factor loadings for 14 of the original 16 statements. Three other independent and nested factors were identified, attitudes to catching large fish, numbers of catch and propensity to release fish, with positive correlation between releasing and catching large fish. However, because of the high error variance and cross-loadings between factors, again the structural link giving credibility to the scale as a psychometric measure of attitude was weak (Anderson et al. 2007). They concluded that further work was needed to fully understand the

multi-dimensional nature of catch-orientation and how it can be measured (Aas and Vitterso 2000).

Anderson et al. (2007) highlighted a fundamental flaw in the work of Aas and Vitterso (2000): the changes made to the Graefe et al. (1980) scale in order to overcome language barriers across the countries that the grouped statements used to establish the independent dimensions fundamentally measured different attitudes and were therefore psychometrically weak. Anderson et al. (2007) further solidified the conceptualisation of, and importantly, the scale items used to measure attitudes towards catching fish in order to improve the reliability in the use of the concept to predict behaviours and/or preferences, building constructs developed by Graefe et al. (1980) and Sutton and Ditton (2001). Using confirmatory factor analysis and structural equation modelling, Anderson et al. (2007) confirmed the reliability of a 16-item scale in capturing attitudes towards four dimensions of catch orientation: general consumptiveness (or 'catching something'); catching numbers of fish; catching large/trophy game fish; and retaining fish.

Anderson et al. (2007) showed different results to Aas and Vitterso (2000). Firstly, general consumptives (attitude to 'catch something') was uniquely represented by three specific statements in the scale ('A fishing trip can be successful even if no fish are caught', "If I thought I wouldn't catch any fish, I wouldn't go fishing", and "When I go fishing, I'm not satisfied unless I catch at least something"). Discriminate validity testing showed its independence as a viable construct formed by these three observed variables. Whereas Aas and Vitterso (2000) showed general consumptiveness to be constructed and measured across all 16 items, Anderson et al. (2007) showed that attitude towards catching something was a latent factor (or construct) in its own right, and could potentially be used as a proxy measure for general consumptiveness, independent of the other three latent factors (constructs), i.e. large fish, keeping fish, and numbers of fish. Similar correlation scores were taken for the observed variables (statements) for these other three constructs, suggesting that in total four independent attitudes can be used to construct a multi-dimensional measure of consumption orientation among anglers. However, a model best fit between Anderson et al. (2007) conceptualised scale to the data gathered in the study was only achieved by removing three of the variables from the itemised

statements (scale), reducing the number to 12 from 16 (across the four dimensions). Further research is needed to validate the Anderson et al. (2007) scale as a tool for indexing consumption and to fully explore the relationship between the four-dimensional constructs among different angling populations.

Oh and Sutton (2019) used the Anderson et al. (2007) conceptualisation and scale for testing the links between consumption orientation with specialisation among Texas (USA). The research demonstrated a good level of fit between the data and modelling techniques but excluded the fourth dimension on propensity to release fish. This, therefore, partly reinforced the validity of Anderson's scale and subconstructs. Oh and Sutton (2019) found that consumption orientation was a measure showing significant heterogeneity among both angling groups in the study. However, highly specialised freshwater anglers showed attitudes towards a higher degree of consumptiveness than saltwater anglers in both groups, demonstrating the important effects of population backgrounds and fishing settings. More importantly, as the level of specialisation increased, so did consumption orientation, contradicting Bryman's theory and supporting, to an extent, Beardmore et al. (2011). Oh and Sutton (2019) concluded that as anglers become more specialised through avidity, commitment, and skills, they do not necessarily become less interested in catching and keeping fish. However, they recognised that more research is needed to explore reasons why there are differences in the link between consumption orientation and specialisation, hypothesising that the state of the fishery resource (level of endangerment to fish stocks, degree of licensing, and degree of conservation regulations) may be a significant factor.

2.3.4 Motivation

Angling motivation refers to the psychological impulse to partake in an activity based on the expected outcomes (Manfredo and Driver 1996) and is one of the more widely researched areas of angler heterogeneity. Motivation among anglers has been theorised in several ways revolving around the assumption that ways to improve the angling experience and predicting behaviour relies upon understanding the reasons why people fish (Fedler and Ditton 1994; Finn and Loomis 2001). Angler motivation

can be understood through a two-part conceptual framework involving: 1) motives relating specifically to the activities associated directly with catching fish; and 2) those that are not directly related to angling but related, in wider context, to the pursuit of leisure (non-catch motives, such as relaxation). There have been several studies highlighting the prevalence of non-catch over catch related motivations among anglers (Fedler and Ditton 1994; Finn and Loomis 2001; Beardmore et al. 2011).

There is ongoing debate, however, on extent to which understanding motivation aids the management of coastal environments and whether motivation can stand independently as an antecedent of behaviour or marker predicting management preferences (Arlinghaus 2006b). The use of motivation as an antecedent of behaviour is based upon expectancy theory, which states that leisure behaviour is goal orientated and geared towards realising a set of psychological needs (Manfredo et al. 1996; Parkilla et al. 2010). Research supporting its use in this respect includes that by Hunt and Armstrong (2002), which found a link between catch-related motivations and greater levels of harvesting behaviour, and that harvesting levels increased with when fishing with friends and family. Several counter arguments have been made. Firstly, it has been suggested that motivations are contextually changeable (Fedler and Ditton 1994; Beardmore et al. 2011), for example motivation to catch specific species for eating may be abandoned if the local stock is low on a particular day, and alternative fish targeted that are not intended for eating. Secondly, it has been argued that the nature of research on angler motivations is too abstract and attempts to form basal segmentations which are too removed from reality: for example, because anglers can hold several motivations at any one time, its use as a primary predictor of behaviour in situ is difficult to assess, with local context and cultural norms often being more influential (Cooke et al. 2018). Some still hold that understanding motivation is a key ingredient in the mixture of angler profiling characteristics because of its strong reliability as a tool for describing heterogeneity among anglers and relationships (positive or negative) to other key features such as specialisation (Finn and Loomis 2001; Magee et al. 2018). Motivation will therefore always provide vital information on user groups of coastal areas, informing management, and planning strategies (Ormsby et al. 2004).

Beardmore et al. (2011) demonstrated the usefulness of motivation for understanding angling communities in north-eastern Germany, but only in context of other choices involved in the angling experience (in the form of target species and fishing site). Their research employed the 10-item scale reflecting catch related motivations (seven items), which was further conceptualised into two subdomains (to catch trophy fish and to retain fish) and three non-catch items. Five distinct angler groups were identified based on primary motivation: trophy-seeking anglers; non-trophy, challenge-seeking anglers; meal-sharing anglers; nature-oriented anglers; and social anglers. The latter two being termed non-catch related. The research also showed that there were some species of fish retained and consumed more so by (originally intended) non-meal-oriented anglers compared to (originally intended) meal orientated anglers, giving weight to some of the arguments made against motivation as a useful marker of behaviour. Based on these arguments, motivation may not be a suitable indicator of heterogeneity in fisheries with stocks consisting of mixed species (such as marine environments).

Magee et al. (2018) proposed, however, that motivation remains a significant feature of leisure and recreational communities that can aid environmental management strategies. Attempting to overcome a flaw in previous approaches demonstrating heterogeneity among anglers, primarily the overuse of quantitative methods, Magee et al. (2018) employed mixed methods to examine the categorisation of anglers in New South Wales, Australia, based on angler motivation. The method comprised an online survey with latent class analysis and focus groups to test the value of qualitative methods and validate survey findings. In addition, the research used these classifications to observe differences in attitudes among anglers towards the balance of regulation controls between commercial and recreational fisheries and the use of Marine Protected Areas (MPAs) as conservation zones. The study employed a motivational scale drawing on five activity general motivations drawn from Fedler and Ditton (1994) and Schram and Gerrard (2004), conceptualised into three distinct groups: mastery (driven by achievement, skill, competence, and competition); social factors (driven by human interactions); and escapism (driven by

avoidance and relaxation).² Activity specific motivations were based upon a condensed set of catch orientation statements developed by Graefe et al. (1980).³ Their research identified five distinct types of angler based on unique combinations of activity specific and activity general motivations, importantly placing motivation as the primary metric of angler heterogeneity, validated by qualitative data collected in the focus groups. The categories included: social anglers (driven by human interactions); trophy anglers (driven by skills and competition); outdoor enthusiasts (driven by escapism); generalist anglers (with an equal mix of motives); and hunter gatherers (driven by eating the fish they caught). There were no observed patterns among the focus groups between these identified angler categories and attitudes towards fishery management strategies such as support for MPAs. Anglers demonstrating motivations based on mastery (a sub-construct within Magee's model) did show linkages to negative attitudes towards legislation in the form of MPAs, reflecting findings of other studies (Arlinghaus et al. 2006b). It is hypothesised that this is because area restrictions (such as MPAs) impose a physical barrier that prevents an angler from fishing, and therefore restricts opportunity to develop related skills.

Although Magee et al. (2018) demonstrated the validity of motivation as a marker of heterogeneity among anglers, there are fundamental problems in their research method. The operationalisation of activity specific motivations employed statements more in line with angler attitudes towards catch (developed by Anderson et al. 2007), rather than directly capturing motivations driving participation in angling. As noted previously, these are fundamentally different concepts. Beardmore et al. (2011) conceptualisation and measure of motivation is more appropriate, demonstrated by comparing statements used in each respective study. For example, Beardmore et al. (2011) asked anglers to rate the importance of statements relating to why they fish, such as 'I go fishing to catch a trophy fish', Magee conceptualised trophy anglers from statements such as, 'the bigger the fish, the better the fishing trip'. Magee et al. (2018) used the importance that an angler places size of fish in the

² Relaxation; being outdoors; developing or learning new skills; being with family and friends; catching a large or trophy fish.

³ Explained in the section on catch orientation.

success of a fishing trip as an implied motivation. Beardmore et al. (2011) scale therefore demonstrates improved validity between concept and measure.

Schroeder et al. (2006) conceptualised angler motivation in a similar way to Beardmore et al. (2011), instead using more scale-based statements to construct the individual factors (cluster of related motivations) and more items aligning with non-catch related motives. The research focused on gender differences among anglers across several attitude domains and behaviours, with the motivation scale used emerging from focus group discussions with resident anglers of Minnesota (USA). The benefit of this approach is that the expanded scale used by Schroeder et al. (2006) provided opportunity for subdimensions of motivational clusters to be explored, with motivational statements developed from an empirical research base. Factor analysis revealed six motivational clusters with reliable significance scores, including (number of associated scale statements items in parenthesis): appreciation of surroundings (7); skills (3); food (3); catching fish (4); trophy (2); and social (2). The clusters revealed important gender differences, with men more likely to be motivated by developing skills and knowledge and catching trophy fish, and women more likely to be motivated by catching fish for food.

While there is debate on the validity and use of motivation in heterogeneity studies, another factor evident when scanning the large number of motivational factors in both the catch and non-catch dimensions is that little effort is made to determine final position of an angler if they were forced to choose one most important motivating factor. Understandably, motivation for all anglers probably straddles the catch and non-catch divide to varying degrees, and most research studies cater for this optionality in one form or another by presenting multiple responses pre-codes for each type of motivation, leaving room for debate on which is most important. This is because the options are presented to the respondent/participant. In reality, however, every angler is probably driven by a primary reason behind their decision to take part in recreational angling, and this highly important factor is probably masked by the multiple options (and responses) given to anglers in survey research. There is a lack of research that explores the importance of one motivation (either catch or non-catch) when the other is taken away, or the proposition that both catch and non-catch motivation may have parity of importance. Angler typology studies

may see very different results from this potential shift in the approach to capturing motivation.

2.4 STRUCTURING THE MEASURE OF ANGLER HETEROGENEITY

Thus far it has been demonstrated that research capturing angler heterogeneity has focused on several attitudinal, cognitive and behavioural dimensions that arbitrarily relate to, in some respects, disjointed aspects of the angling experience. There are more structured, relational and causal ways in which the angling experience has been conceptualised in previous research. Such research adopts a cognitive hierarchy model to describe angler behaviour, modelling a framework of dimension inclusive of personal values and initial decisions to take part in the activity through to behaviours and decisions in situ. Importantly, this theoretically based model has been employed in the context of the recreational angling research and offers a valid way of structuring the angling experience. This can be used as a model on which measures of heterogeneity, as described thus far, can be hung to provide structure and logic to the exploration of heterogeneity among recreational sea anglers England and Wales.

2.4.1 The cognitive hierarchy model

The cognitive hierarchy model offers a conceptual framework for understanding the process and formative factors that create and influence behaviours. As shown in Figure 2, the cognitive hierarchy model is tiered and sequential starting with underlying values, which are few in number, stable, and transcend across different aspects of life, through to behaviours, which are usually bespoke to specific situations and are quick to change (Bruskotter and Fulton 2007).

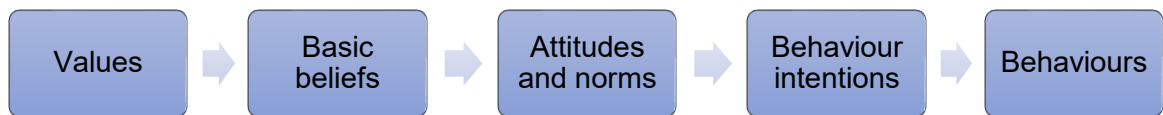


Figure 2: The cognitive hierarchy model of behaviour (Bruskotter and Fulton 2007)

Three areas of the sequential process described by the cognitive hierarchy model have been addressed in the literature on recreational angling, albeit mainly in freshwater non-UK context, including values, attitude/norms, and of course, behaviours themselves. In part, some of these overlap with themes already covered in this Chapter so far, such as attitudes towards catch (attitudes and norms), motivations (behavioural intentions), spend and travel (behaviours associated with specialisation). However, there is a wealth of additional research that presents metrics of use for understanding angler heterogeneity and that aligns with each area of the three keys areas of the model (Figure 2). These are discussed in subsequent subsections.

2.4.1.1 Angler values: new environmental paradigm

Personal values transcend contextual differences and are often shared among communities or groups of people, meaning that they may not directly account for variation in behavioural outcomes. Patterns, or aggregations of values, are referred to as value orientations (Bruskotter and Fulton 2007). Enduring values contribute to the formation of basic beliefs, which in turn form attitudes (focused viewpoints on a specific object or situation) that supports the decision to embark on certain chosen behaviours. Values therefore indirectly impact on high order components of the cognitive hierarchy (i.e. behaviours) from a basal level; this model is strongest when there are no established normative beliefs (social norms) to interrupt the chain of influence (Fulton et al. 1996; van Ripper and Kyle 2014). In such circumstances, there is a high degree of consistency between a person's held values, beliefs, intentions and behaviours (Fulton et al. 1996; Bruskotter and Fulton, 2007). This theoretical process draws upon reasoned action theory which proports that values form a core component behaviour and choice (Fishbein and Ajzen 1975).

Angling studies have operationalised cognitive hierarchy theories in several ways in regard to angler values. Bruskotter and Fulton (2007) drew upon the work of Shindler et al. (1993) who suggested that values can be positioned on a continuum focused on views towards the environment, ranging from the biocentric (natural resources having value beyond that for human benefit or exploitation) to the anthropocentric (natural resource value only exist in providing material benefits to humans). Their work assessed the relationship between angler uptake and attitudes towards technological aids (as a social norm representing the stewardship concept) and value orientation towards the environment, using a series of 14 statements representing bio-anthropocentrism values. Factor analysis reduced (modified) these items to 7 items (3 for biocentric values and 4 for anthropocentric values) but showed its use as a way to categorise anglers in a binary manner. Anglers in the study tended to agree with biocentric statements, i.e. that the environment holds value beyond utility to humans. More importantly, biocentric value orientations were positively correlated with fishing practices reflecting technology aided stewardship principles (as normative judgements) suggesting its use as a predictor of behaviour.

Other studies have promulgated the importance of understanding the degree of pro-environmental values among anglers in effectively deploying management strategies aiming to engender sustainable behaviour towards shared natural resources (Arlinghaus and Mehner, 2005; Arlinghaus, 2006b; Nyugen et al. 2013). These studies employed the New Environmental Paradigm (NEP) as a theoretical framework to explore the predictive value of pro-ecological views towards natural environments among anglers on management preference/behaviour (Dunlap and Van Liere, 1978; Dunlap et al. 2000; Arlinghaus and Mehner, 2005; Arlinghaus, 2006b; Nyugen et al. 2013).

Theoretically, the NEP is often conflated to: 1) assume the role of a measure of an individual's fundamental viewpoint and understanding of the relationship and power balance between humans and the natural environment (Oskamp and Schultz, 2005); and 2) an endorsement scale for pro-ecological world views (Bernstein and Szuster, 2019). The paradigm emerged as the anti-thesis to the Dominant Social Paradigm (DSP), which signified belief in a number of political, economic, and even epistemological standpoints, including: societal progress being dependent on

abundance of resources, limited governmental planning and intervention in environmental management, and the importance of private property rights. The DSP is fundamentally anti-ecological and is geared towards environmental exploitation. A pro-ecological world view with the context of the NEP recognises an equal balance of power between humans and nature and the rejection that nature exists for exploitation by humans. This view accepts that humans are not the ruler of nature but co-exist equally in the world (Dunlap and Van Liere 1978; Cotrell 2003).

In a study of German recreational anglers, Arlinghaus and Mehner (2005) explored preferences towards overstocking or habitat management as a conservation technique in freshwater fisheries. The research showed a relationship between (NEP based) pro-environmental attitudes and habitat management conservation strategies, conceptualising pro-environmental values as the degree of concern anglers held in three regards: the general power balance between the natural environment/human world (reflecting traditional intentions of the NEP discussed above); awareness of impact of anglers on the environment; and responsibility of fishery management/environmental protection. The inclusion of the additional parts of the environmental paradigm (awareness and responsibility) has theoretical significance: they are key factors that influence individual behaviours aimed at resolving environmental problems (Schwartz 1977). These concepts have also proven useful in predicting responses to fishery management strategies. Van den Heuvel et al. (2020) assessed angler views on the potential introduction of a national catch reporting programme in Sweden to assess the pressure of recreational fishing on its fish stocks. The research showed that anglers in support of the programme were affiliated with a strong sense of environmental responsibility. Both Arlinghaus and Mehner (2005) and van den Heuvel (2020) suggested that more empirical research is needed in developing measures of pro-environmentalism among angler in different contexts (cultures and geographies).

2.4.1.2 Angler norms: stewardship

Understanding the role that angler norms play in the context of exploring and measuring angler heterogeneity is difficult without contextualising the focus of the

research. Previously discussed theories, such as specialisation or involvement, can be applied in arbitrary contexts and do not necessarily require a specific theme or topic in which they can be contextualised. One can regard specialisation and similar theories as topics in their own right. Understanding norms, however, must be directly made relevant to a specific area of study, largely because its operationalisation in terms of measurement require specificity; statements capturing norms in survey research, for example, must present the norm in relation to a specific behaviour or attitude. In terms of understanding heterogeneity for the purposes of sustainability and sustainable management, stewardship is at the fore of relevant perspectives and offers a solid conceptual base on which both norms and behaviours can be pivoted.

Stewardship is a concept that cuts across silos in environmental sciences. In angling research, it is grounded in the understanding that the sustainability of common aquatic resources is dependent on users minimising their environmental impact, fostering positive attitudes to conservation action, and developing a sense of responsibility for the self-management of natural environments. In this context, stewardship is defined as the voluntary behaviours among humans to protect and promote the value of the aquatic environment (Landon et al. 2018). Because anglers are at the vanguard of engagement between humans and the environment, contextualised by increasing anthropogenic impacts on climate change, the concept of stewardship among anglers is of paramount importance (Landon et al. 2018). Anglers have aptly been titled the stewards of the aquatic environment (Granke et al. 2008).

A social norm is the perceived moral obligation to behave in a manner that is consistent with one's self-identity or those of peers in a social grouping (Landon et al. 2018; Bova, 2019). They are the "*evaluative standards for how one ought to behave in a given situation. Through social involvement with various groups they [people] learn they are obliged to behave in a certain manner*" (Brustoktter and Fulton 2007, p.3). Norms are internalised through a process of each desired behaviour being rewarded by peers, non-desired behaviours are sanctioned, and the norm becomes perpetuated and internalised. These norms are then engrained in personal morals to the extent where norms and associated behaviours are carried

out even in absence of peers to make judgement on its 'social correctness' (Bruskotter and Fulton 2007). This process is described in several theories including: reasoned action (Fishbein and Azjen 1975); norm activation models (Shwartz 1977); and theory of planned behaviour (Azjen 1991).

More recently, the norms effect has been incorporated as a key component in the cognitive hierarchy model on which this section is based. Landon et al. (2018) demonstrated that internal moral stewardship norms among recreational anglers are a direct psychological antecedent of stewardship behaviour. They theorised that when an object with high value comes under risk (such as the activity of angling), it is intrinsically linked to awareness of a threat being made to that given object or resource that holds the value, and anglers are therefore more aware that they hold the opportunity to mitigate the effects of the risk. Therefore, personal norms emerge where there is high levels of perceived awareness of risk and opportunity to mitigate impacts on the given resource. Norms are therefore core components of practiced stewardships behaviours (Landon et al. 2018).

2.4.1.3 Angler behaviours: stewardship

“Encouraging the adoption of self-regulating stewardship behaviours will enhance the sustainability of recreational fisheries” (Landon et al. 2018, p.558).

Despite its importance as per the quote above, there is a paucity of research on stewardship behaviours among recreational anglers, particularly in relation to measures of heterogeneity. Oh and Ditton (2008) demonstrated that more specialised anglers were more willing to pay for resource (fishery/environment) protection measures (the latter reflecting a proxy measure for 'stewardship'). Landon et al. (2018) strongly linked stewardship behaviour to not only personal stewardship norms, but also 'identity'. The study, focusing on both freshwater and saltwater anglers in Texas, USA, revealed that an individual can hold several identities that change as one engages in different social contexts. Each identity influences that person's evaluation of the external world, and the way they may behave in different contexts. The importance of the identities are hierarchical; more

commitment to the identity of an angler results in more importance given to the perceived ways in which an angler should act or behave when angling (meanings). Considering that people will have different conceptions and meaning associated with what it means to be an angler, there is a strong theoretical suggestion that identity is therefore a significant antecedent of an angler stewardship behaviour. Importantly, the closer the relationship between participation in an activity and one's self identity, the increased likelihood of greater satisfaction from participation, which leads to behaviours which are more focused on sustained the available of the resource which supports the activity (Burke 1991; Landon et al. 2018). There is a strong reciprocal relationship between self-identity and behaviour: if one identifies stewardship as a core part of their angling behaviour it will result in stewardship behaviours that reaffirms one's identity (Landon et al. 2018).

Stewardship behaviours themselves are multidimensional, which in turn drives a degree of heterogeneity in engagement of stewardship behaviours (Landon et al. 2018). They can be defined as behaviours that positively affect or promote the sustainability of environmental resources (Stern 2000). Landon et al. (2018) conceptualised and operationalised the measure of stewardships behaviours using a three tiered framework involving: private sphere behaviours focused on actions an individual may take to reduce their own environmental impact, such as the appropriate disposal of used fishing tackle; public sphere behaviours that are direct actions that provoke changes in the governance of the activity towards more sustainable solutions, such as lobbying public officials, or influencing others; and social stewardship that relate to being involved in preservation/conservation organisations, with social interaction defining engagement.

Analysis of data in Landon et al. (2018) involved structural equation modelling to test the causal relationships between identity, norms, and the three spheres of stewardship behaviour. The study hypothesised that personal norms and angler identity directly influenced personal both public sphere and social stewardship behaviours (supporting identity theory); furthermore, awareness of environmental consequence (as a value) predicted personal norms, private sphere behaviour and social stewardship.

Landon et al. (2018) demonstrated that anglers varied in their engagement in the different domains of stewardship behaviour, and that the identified antecedents of behaviour had different impact on the different spheres of behaviour: angler identity had a significant indirect effect on private sphere behaviour through awareness of consequence and personal stewardship norms. There were no relationships between personal norms and public sphere behaviour, meaning that internalised personalised norms did not manifest in publicly orientated conservation behaviour (Landon et al. 2018). In addition, anglers with increased identity were more satisfied, but did not measure this aspect and its relationship to either identity, norms or the three spheres of behaviour (Landon et al. 2018). The differences found in Landon et al. (2018) may suggest that: firstly, anglers are segmented according to their stewardship preferences or behaviours in each of the behavioural domains, or that other unexplored factors effect stewardships behaviour (e.g. demographics or angling motivation, attitudes to catch, or social bonds); or secondly, the concept of stewardship is too multidimensional to capture in survey research (Landon et al. 2018). A criticism of both Landon et al. (2018) and Oh and Ditton (2006) is that the conceptualisation of private stewardship behaviour fails to account for angler behaviour in situ that directly affects the reduction of fish mortality for those release back to water after being caught. Reflecting Landon et al. (2018) private stewardship realm, these behaviours are surely key in an angler's attempt to protect future resources. Because of the lack of literature on such behaviours specifically in a multispecies, open access, marine environment, environment (and due to the difficulty in fully understanding the impact of fish protection behaviour and mortality rates in marine environments), novel statements capturing this type of behaviour were developed in this study (discussed in Chapter Three).

2.5 CONCLUSIONS

This Chapter has presented key research and literature on studies of heterogeneity and predictors of angler behaviour in recreational fisheries. It has demonstrated a myriad of ways in which heterogeneity among anglers has been measured and

understood. A cognitive hierarchy model offers a valid framework for structuring and combining this broad set of metrics into a logical format (see section 2.5.2).

The Chapter has also demonstrated that research regarding heterogeneity focused on the UK, England, or Wales is limited. Added to this, there is limited research that includes marine or saltwater fisheries, and none that focus purely on open access marine environments for the purpose of exploring heterogeneity or antecedents of behaviour among recreational anglers. A number of angler typologies have been developed outside the UK, which are summarised in section 2.5.1.

2.5.1 Summary of angler types

As shown in Table 1, there are angler groups common across several studies and contexts. These include generic anglers, consumption orientated, trophy anglers, outdoor enthusiasts, and social anglers. It is important to note again that both Magee et al. (2018) and Beardmore et al. (2011) is primarily based on motivation as the defining factor in angler allocations. In addition, both involvement and attitudes to catch have yet to be developed into a gradient system ranking anglers into low-high in respective domains.

Table 1: Summary of angler types

| Angler type | Study | Environment |
|---|--|--------------------|
| Generic / generalist | Johnston et al. (2013); Magee et al. (2018); Bryan (1977) | Freshwater / mixed |
| Consumption orientated / meal sharing | Johnston et al. (2013); Beardmore et al. (2011) | Freshwater / mixed |
| Trophy angler | Johnston et al. (2013); Magee et al. (2018); Beardmore et al. (2011) | Freshwater / mixed |
| Outdoor enthusiasts / nature orientated | Magee et al. (2018); Beardmore et al. (2011) | Mixed |
| Socially driven | Magee et al. (2018); Beardmore et al. (2011) | Mixed |
| Hunter gatherers | Magee et al. (2018) | Mixed |
| Occasional anglers | Bryan (1977) | Freshwater |
| Technique specialist | Bryan (1977) | Freshwater |
| Technique setting specialist | Bryan (1977) | Freshwater |
| Challenge seeking | Beardmore et al. (2011) | Mixed |
| Low, medium and high catch orientation | Anderson et al. (2007) | Freshwater |
| Least committed (specialised) | Arlinghaus et al. (2020) | Mixed |
| Moderately committed (specialised) | | |
| Highly committed (specialised) | | |
| Attitudes to catch (mainly used to indicate consumptive and trophy seeking anglers) | Anderson (2007) | Freshwater |
| Involvement (not yet developed into a low to high graded system of anglers) | Kyle et al. (2007) | n/a |

2.5.2 Conceptual model of the angler profile

The cognitive hierarchy model offers a suitable framework for structuring metrics that are most likely to show potential differences across the angling community in England and Wales. The proposed model (inclusive of measures and theoretical underpinnings) upon which this study is based is shown in Table 2 and conceptualises the angling experience from underlying (deep rooted) personal values through to behaviours in situ. This combination of metrics (data collection framework) not been implemented in any previous literature on heterogeneity among anglers. The dimensions described are sequential in both cognitive hierarchy theory. The operationalisation of measurements in each dimension and a

discussion of relevant analysis to meet the research objectives discussed in Chapter One is presented in more detail in Chapter Three.

Table 2: Conceptual model of the angling journey from values to behaviour, including measures of heterogeneity for each dimension

| Dimension of angling experience | Measurement dimension | Conceptual and theoretical background |
|---|------------------------------|---|
| Values | Environmentalism | Anthro-biocentrism, used in the cognitive hierarchy model and norm activation theory related to stewardship |
| Perceptions and attitudes towards angling related experiences | Attitudes to catch | Antecedent of preference |
| | Psychological commitment | Centrality, used in specialisation and involvement theory |
| | Social bonding | Used in involvement theory |
| | Identity | Affirmation and expression, used in involvement theory |
| | Attraction | Level of enjoyment, used in involvement theory |
| Motivation | Catch versus non catch | Expectancy theory |
| Norms | Stewardship norms | Stewardship theory, drawing on normative activation theory |
| Skills | Self-perception | Specialisation |
| Angling behaviours | Avidity | Specialisation |
| | Spend | Specialisation |
| | Travel | Specialisation |
| | Stewardship | Political, private and social, used in stewardship theory based on norm activation |
| | Release behaviours | Behaviours that potentially reduce stress (mortality) of fish release reflecting protection of the environment (stewardship), relevant for stewardship theory |
| | Species caught | Inform future catch reporting |

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 INTRODUCTION

A programme of robust and rigorous research was undertaken to address the research objectives identified in Chapter One. The purpose of the research was essentially to draw out commonalities and differences among (large numbers of) anglers over a wide geographically dispersed area, so the core research technique involved a survey approach, which was consistent with previous research on heterogeneity among anglers. However, because questionnaires are limited in the ability to fully explain ambiguous data retrospectively, more in-depth research was required, involving semi-structured interviews with anglers completing the survey phase. This sequential amalgamation of techniques allowed for a triangulation of results (Biesta, 2010). Incorporating qualitative techniques in the study of angler heterogeneity is rare, with the best example conducted by Magee et al. (2018). Magee et al. (2018) combined survey data with focus groups to develop a person-centred angler typology in Australia, and highlighted the important role that in depth, discursive data collection techniques add to social research. The inclusion of qualitative semi-structured interviews also offered a unique non-statistical (yet robust) method of verifying results and interpretations of quantitative data used to develop the angler typology.

This Chapter describes each method in the research approach in detail, including: the epistemological rationale for the methods used; the operationalisation of the instruments used for capturing data (survey questionnaire and interview guide); outcomes of relevant pilot exercises; sampling procedures; and an overview of the analytical techniques employed. Prior to this, the epistemological justification for using a mixed methods approach is presented.

3.2 THE MIXED METHOD APPROACH

As demonstrated in Chapter Two, angler typology research has been dominated by quantitative survey techniques. This is understandable as the aim of such research is to usually build a typology of angler characteristics that describes the differences and similarities across large angling communities in a specified geographic location. Census type research is expensive and time-intensive, however, sample-based survey research is far less costly because it involves fewer participants (e.g. Sapsfrod, 2007). However, what surveys fail to achieve is the ability to understand results at a deeper level. For research that involves perceptions, attitudes and values, it is important to understand the reasons behind why a box is ticked in a questionnaire. Furthermore, some topics, and particularly those explored in this study around perceptions of governance, and/or, policy compliance, require a degree of sensitivity and trust between researcher and participant in order to garner data that is both accurate, based in the correct context, and truthful; surveys do not allow for this, and provide an easy option for inaccurate reporting based on what the participant feels like they should say without having to potentially explain why they feel that way. Finally, and in terms of practicality, the exploratory nature of the survey phase of this research (involving numerous concepts and topics as discussed below) meant that there was limited space to capture both heterogeneity measures and data capture on policy or governance related topics. Thus, additional data collection methods were required.

The mixed method approach can overcome the limitations in survey-based research and when employed in a sequential manner can aid the exploration of data and in a fluid way. In this study, the quantitative survey was implemented and results were generated, followed by qualitative telephone interviews to explore and verify findings from the survey, representing both inductive and deductive methods of enquiry, with the first phase (survey) informing the next stage (interviews). This combined and sequential method allowed for a more thorough understanding of the metrics upon which the typology is based, specifically, areas of ambiguity around 'factors' developed in the statistical analysis. This combination of methods is recommended by many scholars, mainly because of: 1) the ability of the two methods to draw a

more complete account of social reality or of the phenomena be studied (Bryman, 1988); and 2) their ability to triangulate and corroborate results and interpretations (Ammerworth, et al. 2003; Clark and Invankova 2016). Using the strongest elements of each of the respective methods allows not only for the most adept way to develop relevant theoretical contexts, but also ensures that findings are most appropriate for end users in an applied context, which in this case, is policy makers involved in UK marine fisheries (Brannan, 1992). This is not to say that mixed methods approaches are without criticism. Creswell (1994) warned against combining both quantitative survey and qualitative enquiry methods (e.g. interviews) as they are based on polar knowledge paradigms: positivism and empiricism versus constructivism (respectively). Others have argued that their convergence does not always lead to a more complete picture of reality, but sometimes may lead to more confusing states of reality (Silverman 2000). Nevertheless, the pragmatist approach still holds that the application of methods deriving from differing paradigms is valid where the priority is to meet the needs of the research question(s) rather than strictly conforming to the researcher's epistemological or ontological position (Rossman and Wilson 1985). The latter can only restrict the development of new paradigms or respective theories.

The combined and sequential approach, involving survey followed by interviews, also offered pragmatic benefits during the unusual time in which the research was designed and data collected. The research was designed in early 2021 during a period of UK government-imposed national lockdown resulting from the COVID pandemic. Regional lockdown strategies continued into late summer 2021. The research required a survey approach regardless of the public health context, meaning that the lockdown periods did not affect the (always) intended (remote) method of survey data collection. However, with uncertainty over when face-to-face contact would be permitted, it was decided in summer 2021 to implement the subsequent interviews over the telephone. Recruitment to interviews took place as the UK emerged from lockdown restrictions but with an understandable and continued concern over public engagement activities (among both researchers and potential participants). The telephone interview approach (discussed in subsequent sections) was a mitigation against possible re-introduction of national lockdowns and a way to overcome potential participant concerns over face-to-face

engagement. The approach also afforded a wide geographical reach in recruitment. Accessing the number of interviewees across England and Wales in face-to-face mode would have been unachievable considering the time constraints of the project. In a wider context, the COVID pandemic provided additional challenges to conducting this (three-year) funded research project. UK lockdowns meant that the researcher had to double as a parent, teacher, and carer for elderly family members, whilst maintaining self-wellbeing. There was no simple mitigation strategy to cope in those unprecedented times, apart from increased effort (hours) and critical time management to ensure the research did not deviate from the intended timeline. The research was completed and submitted within the three-year funding period.

In summary, and based on strengths of employing mixed methods, the specific reasons for sequentially combining survey research and interviews in this study were: exploratory - to explore different approaches to the same topics; developmentally - to use the interviews to expand on the understanding of results from the survey; confirmatory - to corroborate results of the survey analysis (Creswell 1994); and, to mitigate against potential impacts of COVID (i.e. UK safeguarding policies forbidding face-to-face contact). The approach adopted in this study followed distinct stages, shown in Figure 3.

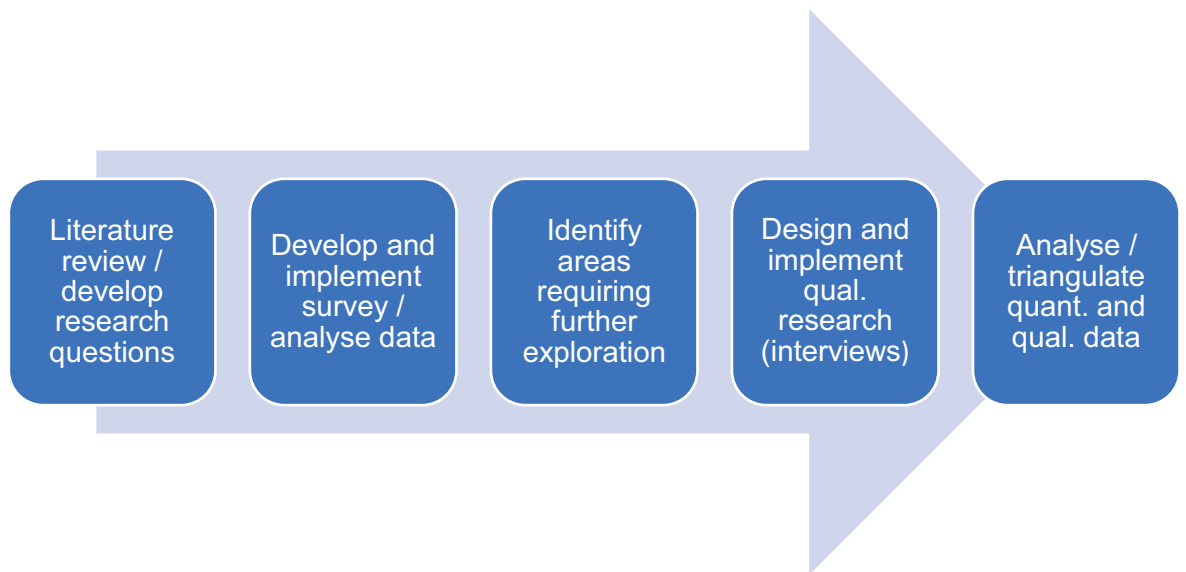


Figure 3: Research stages

The following section outlines details of the two sequential data collection techniques: survey and semi-structured interviews.

3.3 SURVEY

Employing survey questionnaires in angler samples is an appropriate method for making inferences about wider populations that are inaccessible due to time constraints and/or financial limitations. Sampling usually allows the researcher to make general inferences about the characteristics of a given population using appropriate statistical techniques, and in these cases, the sample frame must be representative of demographic characteristics of that particular population or community. In this study, the sampling frame (discussed in more detail below) was based primarily on anglers that had provided details to take part in previous research conducted by Cefas as part of statutory catch reporting. The degree to which this sampling frame was representative of the wider angling community is discussed in Chapter Four. The surveying phase did not monitor or attempt to boost completion based on representation accuracy, purely due to time restraints in the current study; however, it was generally understood that the sampling frame was likely to include enough variation across aspects of angler attitudes, values and behaviours to allow

the development of an exploratory typology that can be tested in a wider representative sample future research. It is possible, in this respect that some angler groups may not have been represented in the sample used for the survey data analysis, reflecting one type of survey sampling error recognised by Dillman (2007). The missing groups could be caused by the lack of inclusion in the sampling frame, or because, for some reason, they chose not to take part even though the offer was made (Dillman 2007). Although it was realised that the sample frame may not have been entirely representative of the wider recreational sea angling population in England and Wales, efforts were still made to ensure that the design and approach conformed to principles that encouraged inclusion of all potential participants.

These efforts were based on a thorough understanding (based on social exchange theory) of why potential survey participants choose to take part (or not) in sample-based research. The theory suggests that human interactions are based on each person's evaluation of the 'return' they may get from taking part in a given interaction: if costs outweigh the perceived benefits or engagement then participation in the interaction is ended, and vice versa, if return (or rewards) are deemed higher than costs, then they are more likely to engage in interaction, such as completing a survey (Dillman 2007). If the perceived rewards (or returns) are realised then trust is built between researcher and participant, and there is increased likelihood of replication of similar interactions. These principles were built into each aspect of engagement with anglers in the sample frame, as described in subsequent subsections.

3.3.1 Survey research design

This section describes the implementation of the survey, from questionnaire design, sampling, piloting through to implementation, closure and follow-up.

3.3.1.1 Sampling

The sample frame consisted of recreational sea anglers that engaged with previous research conducted by Substance (those with home addresses in either England or

Wales and a valid email address, discussed in more detail below). Substance is a consultancy based in the UK and holds a number of contractual research agreements with Cefas, who oversee statutory catch reporting in the UK. The database included 7,000 recreational sea anglers, and access was managed by Substance’s Head of Research. In an attempt to add to the sample frame, advertisements highlighting the survey and research were placed in the monthly e-newsletter of the Angling Trust, and *Sea Angler* magazine.⁴ While it is difficult to establish accurate numbers of anglers engaged via the latter, the Angling Trust Sea Newsletter is sent to 7,000 anglers. In addition, to boost the sample further, fishing groups and clubs were contacted via Facebook, with relevant secretaries and page administrators agreeing to distribute the survey to members. Although this was dependant on the willingness of the administrators, efforts were made to have a representation of clubs/groups in each region of England and Wales. Clubs/groups distributing the survey (including their representative region) and number of members on respective mailing lists (where known) are listed in Table 3.

Table 3: Social media survey dissemination

| Group/club | County / Region | Number of anglers |
|------------------------------------|------------------------|--------------------------|
| Beach and Shore Fishing UK | National | 30,500 |
| Beer and District Sea Angling Club | Dorset / South West | 50 |
| Cambourne Angling Association | Cornwall / South West | Unknown |
| Eastern IFCA | East | Unknown |
| Holt Sea Angling Club | Norfolk / East | 774 |
| North-western IFCA | North West | Unknown |
| North-eastern IFCA | North East | Unknown |
| Sefton Sea Anglers | North West | 314 |
| Thorpe Bay Angling Association | Essex / East | 50 |

Combing the distribution channels outlined previously, the sample frame consisted of 46,172 recreational sea anglers. Although it was not intended to garner a representative sample in this study, the study conformed to collecting a minimum number of questionnaire completions that would meet the number required to be considered as representative, and have enough participants to allow statistical analysis techniques that involve splitting the sample into numerous smaller

⁴ <https://www.magazine.co.uk/magazines/sea-angler-magazine>

groupings. Calculating the minimum number of completed questionnaires needed firstly involved calculating the number of recreational sea anglers in England and Wales. For the UK, Cefas reported an average of 823,000 recreational sea anglers in the period 2015-17 by extrapolating data from the Watersports Participation Survey (WPS) which was based on a sample of 12,000 residents aged 16+ (Hyder et al. 2020b). Data collected through the Office for National Statistics in 2012 estimated a higher number of recreational sea anglers in England: 884,000, representing 2% of all adults (Hargreaves et al., 2013). This percentage can be used as a guide for an indicative number of recreational sea anglers in Wales: 16+ population in Wales is 2,589,044, of which 2% is 51,781.⁵ This gives a combined recreational sea angler population in England and Wales of 935,781 (16+ years old). Based on a 95% confidence level and 5% margin of error a representative sample size would include a minimum of 384 respondents. This is based on the following sample size formula (random sampling):

$$\text{Sample size} = \frac{\frac{z^2 \times p(1-p)}{e^2}}{1 + \left(\frac{z^2 \times p(1-p)}{e^2 N}\right)}$$

Where z=confidence interval at 1.96; p=probability of attribute in the population at 50%, represented as 0.5; e=margin of error at 0.05%; N=population, values shown as:

Infinite population sample (SS1) is $384.1 = 3.8416 \times 0.25 / 0.0025$

Adjusted for required (known) population: $\frac{384.1}{1 + [(384.16-1)/935,781]}$

$384.1 / 1.000409$

= 384

⁵ Data source: <https://statswales.gov.wales/Catalogue/Population-and-Migration/Population/Estimates/nationallevelpopulationestimates-by-year-age-ukcountry>

3.3.1.2 Questionnaire design

The survey was administered as an e-questionnaire. As discussed in Chapter Two, the attempt to build a typology from a grass roots level involved combining several measures and concepts spanning across angler values, attitudes and behaviours. In addition to these topics, the survey involved other questions that aimed to capture data useful for exploring potential differences between the angler types developed in the analysis stages, catch characteristics (species and numbers), release behaviours and reasons for release (specifically to inform future work on catch monitoring conducted by Cefas). Combining these elements required careful management in terms of survey design in order to keep the length of time it took respondents to complete the questionnaire to a minimum to reduce non-response. Too long and anglers would have simply closed the internet page and failed to complete and submit their responses, therefore leading to sample bias as described in the previous section (responses were only submitted once all questions were answered, according to relevant routing, and the submit button was clicked on the very last page of e-questionnaire). In its longest format, the survey took on average 20 minutes to complete, increasing to 22 minutes depending on the level of IT skills held by the respondent. A questionnaire requiring more time than this would have significantly increased the likelihood of non-take up and/or drop out mid-way through completion. See Appendix One for survey questionnaire.

Questions specifically intended to be used in creating an angler typology (areas reflecting the conceptual themes in Chapters Two) were drawn from previously published research that had demonstrated a good degree of statistical reliability in being used to draw distinction between angler characteristics. These questions and related concepts are shown in Table 4, alongside the types of measure used to capture appropriate data for subsequent analysis. Please note that this table should be viewed in combination with the Table 2 in Chapter Two and the questionnaire itself shown in Appendix One regarding question format.

Table 4: Typology - survey questions and concept matrix

| Question | Conceptual theme (theory) | Measurement type | Related study |
|---|--|-------------------------------|---|
| On how many DAYS in the LAST 12 MONTHS have you gone recreational sea angling? | Avidity (specialisation) | Open (free text entry) | This has been used in several forms and in several studies, see: Chi-Ok Oh et al. (2008); Arlinghaus et al. (2008; 2020) |
| Approximately how much money in total have you spent in the past 12 months on equipment and tackle for recreational sea angling? | Spend as behavioural commitment (specialisation) | Open (free text entry) | This has been used in several forms and in several studies, see Arlinghaus et al. (2008; 2020); Beardmore et al. (2011; 13) |
| How far did you travel when you last went recreational sea angling? | Travel as behavioural commitment (specialisation) | Open (free text entry) | Arlinghaus et al. (2008) |
| Which of the statements below BEST DESCRIBES the primary motivation behind why you take part in recreational sea angling? | Motivation: Activity general v Activity specific / catch v non-catch | Pre-coded single response | Bespoke data capture used for this study. Based on theory developed in: Fedler and Ditton (1994); Schramm and Gerrard (2004); Beardmore et al. (2011; 2013); Magee et al. (2018). |
| To what extent do you agree or disagree with the following statements reflecting how central recreational sea angling is to your life? | Centrality as psychological commitment (specialisation and involvement theory) | Likert scale (agree-disagree) | Kyle et al. (2007) |
| To what extent do you agree or disagree with the following statements reflecting how closely recreational sea angling is linked to your friendship circles? | Social bonding (involvement theory) | Likert scale (agree-disagree) | Kyle et al. (2007) |

| | | | |
|---|---|-------------------------------|---|
| To what extent do you agree or disagree with the following statements reflecting how attracted you are to recreational sea angling? | Attraction (involvement theory) | Likert scale (agree-disagree) | Kyle et al. (2007) |
| To what extent do you agree or disagree with the following statements reflecting how recreational sea angling may contribute to how you see yourself? | Identity affirmation and expression (involvement theory) | Likert scale (agree-disagree) | Used by Landon et al. (2018) for stewardship, also used by Kyle et al. (2007) for involvement |
| How would you rate your overall sea angling skills in comparison to other anglers you know? | Skill (specialisation theory) | Likert scale | Bespoke data capture for this study, but based on theory developed in Beardmore et al. (2013); Arlinghaus (2008; 2020) |
| To what extent do you agree or disagree with each of the following statements describing your attitudes towards catching varying numbers of fish when recreational sea angling? | Attitudes to catch (preference for catching something and catching numbers) | Likert scale (agree-disagree) | Anderson et al. (2007) |
| To what extent do you agree or disagree with each of the following statements describing your attitudes towards the size and intention to release fish when recreational sea angling? | Attitudes to catch (preference for catching large fish and releasing fish) | Likert scale (agree-disagree) | Anderson et al. (2007) |
| To what extent do you agree or disagree with each of the following statements describing the relationship between humans and the natural environment? | Bio-anthropocentrism (NEP) | Likert scale (agree-disagree) | Bruskotter and Fulton (2007); Arlinghaus and Mehner (2005); van den Heuvel et al. (2020); Landon et al. (2018) |
| To what extent do you agree or disagree with each of the following statements describing your attitudes toward the level of risk, if any, humans present to the natural environment? | Awareness of environmental consequence / responsibility for environment (NEP) | Likert scale (agree-disagree) | Bruskotter and Fulton (2007); Arlinghaus and Mehner (2005); Arl. (2006a) van den Heuvel et al. (2020); Landon et al. (2018) |

Recreational angling studies are often carried out in different contexts, therefore alterations were required in the phrasing of questions shown in Table 4. Several alterations were also made to the pre-coded responses, or statements to reflect the environment or rules in UK recreational sea angling. Adapting previous questions is an important part of ensuring that previously used data collection techniques are appropriate in different contexts. The changes are detailed as follows, accompanied by a general discussion of how each question was presented:

Behavioural commitment through number of days fished, money spent, and distance travelled (specialisation): raw numeric data was captured for these questions. In order to replicate other studies, a time period of 12 months was used to capture (complete) days spent fishing (avidity). Regarding distance, there is variation across other studies in terms of how this data is collected. In this study it was decided to capture one way travel only, as this was regarded as the best way to reduce burden and potential memory bias for respondents, replicating Beardmore et al. (2011). In relation to spend, to replicate other studies, travel and accommodation was excluded here, so that spend was directly attributable to activities or benefits resulting from recreational angling itself and not for other benefits associated with being away from home (e.g. general leisure or relaxation time while staying in holiday accommodation). Capturing these data in numeric format meant that conversions into categorical (interval) data could be made retrospectively at the data analysis stage (as appropriate). The raw numeric questions were generally presented as shown in Figure 4.

Q. How far did you travel when you last went recreational sea angling?

Please answer in reference to your outward journey **ONLY** (e.g from your home to the place you last fished in England or Wales). Please type your answer in **MILES** in the space provided below. Use up to one decimal place for part miles. For example, one mile and a half, would be 1.5. If the distance is less than one mile, then use 0. as a prefix: for example, a quarter of a mile would be 0.25, and three quarters of a mile would be 0.75.

If you are unsure or don't know, please leave blank and click next to continue. *Optional*

Please enter a number.
 The number should be 1000 or lower.
 Your answer should be no more than 6 characters long.

Figure 4: Days, money spent and distance travelled question design

Motivation: motivation among anglers was conceptualised to reflect ‘activity specific’ items, also called ‘catch related’ motivation (such as the thrill of catching and landing a fish), and ‘activity general’ items, sometimes called ‘non-catch’ related motivation, such as being outdoors or relaxation (Fedler and Ditton 1994; Schramm and Gerrad 2004; Schroeder et al. 2006; Beardmore et al. 2011). In this study the primary aim of collecting angler motivation data was to understand which overarching type was of most importance to anglers, rather than understanding the degree of importance attached to individual motivations. To achieve this goal, respondents were asked to choose one statement only reflecting ‘activity specific’ and ‘activity general’ motivation, or asked to highlight equal parity between both, as shown in Figure 5.

Q. Which of the statements below BEST DESCRIBES the primary motivation behind why you take part in recreational sea angling?

Please select **ONE** statement only. * *Required*

- I am primarily motivated by experiences that only come from catching fish (e.g. the thrill of playing and landing a fish or to eat what I catch)
- I am primarily motivated by other experiences that are not related to catching fish (e.g. being outdoors or relaxation)
- I am motivated equally by each of the above (i.e. experiences related to both catching fish and other non-catch related aspects of angling)
- Don't know

Figure 5: Motivation question design

Centrality as psychological commitment: as discussed in the literature review, centrality straddles both specialisation and involvement theory. Factor analysis requires at multiple statements for robust identification, interpretation, and statistical accuracy in measuring the presence of latent constructs. While conforming to this principle, it was decided that more than three centrality-based statements would have increased the questionnaire length, therefore risking participant drop out or response bias. Kyle et al. (2007) use of centrality in the development of involvement theory has proven strong predictors of the 'centrality' concept and entailed just three statements. Similar statements were used in studies by Beardmore et al. (2013) and Arlinghaus et al. (2008; 2020). Kyle et al. (2007) centrality statements were therefore used in this study. All Likert scales used in the survey questionnaire were presented as shown Figure 6.

Q. To what extent do you agree or disagree with the following statements reflecting how central recreational sea angling is to your life?

Please answer using the scale shown below by selecting ONE option for EACH statement.

| | * Required | | | | |
|---|-----------------------|-----------------------|---------------------------|-----------------------|-----------------------|
| | Strongly disagree | Disagree | Neither disagree or agree | Agree | Strongly agree |
| I find that a lot of my life is organized around recreational sea angling | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Recreational sea angling occupies a central role in my life | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| To change my preference from recreational sea angling to another recreation activity would require major rethinking | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

Figure 6: Centrality question design

Social bonding: The questionnaire employed the three statements used by Kyle et al. (2007) to measure degree of social bonding from angling ‘involvement’: ‘most of my friends are in some way connected with recreational sea angling’; ‘I enjoy discussed recreational sea angling with my friends’; and ‘participating in recreational sea angling provides me with opportunity to be with friends’.

Attraction: The questionnaire employed the three statements used by Kyle et al. (2007) to measure degree of attraction to angling ‘involvement’: ‘recreational sea angling is one of the most enjoyable things I can do’; recreational angling is very important to me’; ‘recreational sea angling is one of the most satisfying things I can do.’

Identity: the questionnaire employed six statements used by Kyle et al. (2007) to measure degree of 1) identity affirmation (three statements) and 2) identity expression (three statements). Both formed part of involvement scale (Kyle et al. 2007) and are shown in Figure 7:

Q. To what extent do you agree or disagree with the following statements reflecting how recreational sea angling may contribute to how you see yourself?

Please answer using the scale shown below by selecting ONE option for EACH statement.

| | <i>* Required</i> | | | | |
|--|-----------------------|-----------------------|---------------------------|-----------------------|-----------------------|
| | Strongly disagree | Disagree | Neither disagree or agree | Agree | Strongly agree |
| When I participate in recreational sea angling I can really be myself | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I identify with the people and image associated with recreational sea angling | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| When I'm sea angling for recreation I don't have to be concerned about the way I look | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| You can tell a lot about a person by seeing them take part in recreational sea angling | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Participating in recreational sea angling says a lot about who I am | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| When I participate in recreational sea angling people see me the way I want them to see me | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

Figure 7: Identity question design

Skill (as part of specialisation): the questionnaire measured skill of the angler as a self-perception comparing to other anglers respondents knew, reflecting the approach used by Beardmore et al. (2013). The scale used is shown in Figure 8.

Q. How would you rate your overall sea angling skills in comparison to other anglers you know?

Please select ONE option from the list below. * *Required*

- Much worse
- Worse
- About the same
- Better
- Much better
- Don't know

Figure 8: Skill question design

Attitudes to catch: in order to reduce the length of the questionnaire, an adapted version of Anderson et al. (2007) 16 item attitude to catch scale was used (12 statements, reflecting 3 per dimensions, based on highest leading variables). The statements were divided into two sets with two related questions for each in order to improve the presentability of the list of items on screen (Figures 9 and 10).

The first question included six statements, attitudes to catching something, and catching numbers (the first three statements shown in Figure 9 reflect the former dimension and 4-6 represented the latter dimension). The statements originally used by Anderson (2007) but excluded here include: 'when I go fishing, I'm just as happy if I don't catch any fish' (dimension one, catch something); and, 'catching more fish than I usually catch is the best indicator of a good fishing trip' (dimension two, catching numbers).

Wording amendments were also made to the Anderson et al. (2007) items to reflect its use in a marine, open access environment. Two statements in the original list of items under the 'catching numbers' dimension ('A full stringer is the best indicator of a good fishing trip' and 'I'm happiest with a fishing trip if I catch at least the limit'), were deemed inappropriate for recreational sea angling in England and Wales: firstly, because only a few species caught by recreational anglers are protected by regulations limiting numbers caught/retained (e.g. sea bass) and secondly, and a stringer of fish implies a catch limit has been reached, or that fish are intended to be

retained for eating. In the UK, stringers are not commonly used by anglers. However, it is important to capture levels of happiness in the context of a limited or targeted measure and more than two variables are required for optimal factor analysis, so the statements were amended to: 'Catching more fish than I usually catch is the best indicator of a good fishing trip' and 'I'm happiest with a fishing trip if I catch more than other anglers around me'.

Q. To what extent do you agree or disagree with each of the following statements describing your attitudes towards catching varying numbers of fish when recreational sea angling?

Please answer using the scale shown below by selecting ONE option for EACH statement.

| | <i>* Required</i> | | | | |
|---|-----------------------|-----------------------|---------------------------|-----------------------|-----------------------|
| | Strongly disagree | Disagree | Neither disagree or agree | Agree | Strongly agree |
| A fishing session can be successful even if no fish are caught | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| If I thought I wouldn't catch any fish, I wouldn't go fishing | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| When I go fishing, I'm not satisfied unless I catch at least something | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| The more fish I catch, the happier I am | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| A successful fishing session is one in which many fish are caught | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I'm happiest with a fishing session if I catch more than other anglers around me' | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

Figure 9: Attitudes to catch question design (part 1)

The second question included the remaining six statements, attitudes to large or trophy fish, and attitudes towards retaining fish (the first three statements shown in Figure 10 reflect the former dimension and 4-6 represented the latter dimension). The statements originally used by Anderson et al. (2007) but excluded here include: 'The bigger the fish I catch, the better the fishing trip' (dimension three, catch

large/trophy fish); and 'I'm just as happy if I don't keep the fish I catch' (dimension four, retaining fish). The latter statement was excluded because it overlapped considerably, in its meaning, with the statement 'I'm just as happy if I release the fish I catch', rather than having the lowest factor score as per the rule for other dimensions. The exception emerged as a result of the survey piloting, discussed in more detail subsequently. Two statements in this question were amended slightly in order to fit more in line with open access marine fisheries. Regarding the last two statements, the following text was added before the original wording, 'thinking about my angling experience generally and the species I usually encounter'. The reason for this addition was that in its original format, the answer to how much an angler agrees is dependent on the species being targeted or caught (and was originally used by Anderson et al. (2007) in a setting where one or two species or fish were dominant). In the amended format the question is applicable in an environment where multiple species are available in nearly all fishing locations. See Figure 10.

Q. To what extent do you agree or disagree with each of the following statements describing your attitudes towards the size and intention to release fish when recreational sea angling?

Please answer using the scale shown below by selecting ONE option for EACH statement.

| | * Required | | | | |
|---|-----------------------|-----------------------|---------------------------|-----------------------|-----------------------|
| | Strongly disagree | Disagree | Neither disagree or agree | Agree | Strongly agree |
| I would rather catch 1 or 2 big fish than 10 smaller fish | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I'm happiest with a fishing session if I hook a fish that is challenging to catch | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I like to fish where I know I have a chance to catch a trophy fish | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I usually eat the fish I catch | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Thinking about my angling experiences and the range of species I usually encounter, I want to keep the fish I catch | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Thinking about my angling experiences and the range of species I usually encounter, I'm just as happy if I release the fish I catch instead of keeping them | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

Figure 10: Attitudes to catch question design (part 2)

Bio-anthropocentrism, environmental awareness and responsibility: as discussed in Chapter Two, environmental attitudes among anglers have been studied in several ways, often based on adapted statements reflecting the NEP, but tailored to fishing contexts. In this study it was decided to capture environmental attitudes in three ways, covering aspects of the original NEP set of statements, and additional areas developed in subsequent research on perspectives towards management. The three areas included: general world view through a measure of bio-anthropocentrism, awareness of environmental consequences, and feelings of environmental responsibility. Each are discussed separately.

Bio-anthropocentrism: The first question in this section of the questionnaire addressed bio-anthropocentric views. Research by Bruksotter and Fulton (2007) had successfully used a series of 14 statements reflecting each side of the dichotomy (8 for anthropocentric views and 6 for biocentric viewpoints), based on the original NEP scale developed by Dunlap et al. (2000). In order to reduce the length of this question, the three statements with strongest factor loadings for each of the two viewpoints were used and presented in an alternating format to reduce the likelihood of repeat response bias, as shown in Figure 11 (note, statements one, three and five represent biocentric views and statements two, four and six represent anthropocentric views).

Q. To what extent do you agree or disagree with each of the following statements describing the relationship between humans and the natural environment?

Please answer using the scale shown below by selecting ONE option for EACH statement.

| | <i>* Required</i> | | | | |
|---|-----------------------|-----------------------|---------------------------|-----------------------|-----------------------|
| | Strongly disagree | Disagree | Neither disagree or agree | Agree | Strongly agree |
| Fish have as much right to exist as humans | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Humans have a right to change the natural world to suit their needs | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Fish are valuable in their own right, regardless of people | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Humans were meant to rule over the rest of nature | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Humans are not more important than other parts of nature | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Fish should primarily be managed for human benefit | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

Figure 11: Bio-anthropocentrism question design

Awareness of consequence and responsibility for the environment: in order to reduce the number of screen pages that the survey entailed, awareness of consequence/impact and responsibility for the environment was addressed in one question, with statements taken mainly from Arlinghaus (2006a), as shown in Figure 12. The first set of three statements primarily addressed the awareness among respondents of a potential eco-crisis and consequence of actions (as per the domain name in the original NEP), but was phrased by Arlinghaus (2006a) as awareness of consequences and impact. Due to the conflation in previous research, it was decided to take the two strongest performing statements from Arlinghaus's research ('when humans interfere....' And 'if things continue') and merge one of the strongest performing statements in this domain in the original NEP ('humans are severely abusing the environment') (Lundmark, 2015; Dunlap, 2007). The second set of three statements in the Figure (4-6) addressed feelings of responsibility for the future environment among anglers, and have been taken from Arlinghaus and Mehner (2005).

Q. To what extent do you agree or disagree with each of the following statements describing your attitudes toward the level of risk, if any, humans present to the natural environment?

Please answer using the scale shown below by selecting **ONE** option for **EACH** statement.

Please note: the term 'aquatic ecosystem' (below) refers to a body of water (such as the sea) where interactions take place between living and non-living parts of the environment. Ecology or ecological refers to the relationship between living organisms and their physical surroundings (the environment).

The term 'interfere' below means to intervene in a situation when it is not absolutely necessary, or to prevent something from taking its natural course.

| | <i>* Required</i> | | | | |
|--|-----------------------|-----------------------|---------------------------|-----------------------|-----------------------|
| | Strongly disagree | Disagree | Neither disagree or agree | Agree | Strongly agree |
| When humans interfere with nature it often produces disastrous consequences | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Humans are severely abusing the environment | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| If things continue on their present course, we will soon experience an ecological catastrophe | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| We anglers do not do enough to protect aquatic ecosystems | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| We anglers are well qualified to manage and protect aquatic ecosystems | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| We anglers should be willing to change our present angling behaviour to protect aquatic ecosystems | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

Figure 12: Awareness of consequence and responsibility for the environment question design

Additional questions were included in the survey, which were intended to be used for describing the behaviours (or in some cases normative views) of anglers based on variables previously described in Chapter Two, including: stewardship; catch and release behaviours; and demographics. These were not used in developing the typology. An overview of their source and theoretical background is discussed next.

Stewardship: previous angling research had focused not only on stewardship behaviours and their value-based or attitudinal antecedents (Landon et al. 2018), including identity, norms and values via environmental attitudes (bio-anthropocentrism). Although the primary focus of this study was not to perform regression between these elements, questions in the survey questionnaire had already replicated aspects of Landon et al. (2018) data capture in the form of environmental values and identity. It was therefore a logical decision to employ their conceptualisation and measurement of the remaining two aspects in the regression chain, namely stewardship norms and stewardship behaviour as standalone attempts to explore differences in the characteristics of angler types developed in this study. Using Likert agreement scales, measurement of angler stewardships norms was based on the following three statements: ‘people like me should do whatever they can to conserve fishery resources and aquatic environments’; and ‘I would feel guilty if I didn’t do my part to conserve fisheries and aquatic ecosystems’. The intended aim of this part of the research was not to perform factor analysis (negating the need for three confirmatory variables), therefore it was decided to alter Landon third normative statement from a positive affirmation of stewardship norms to a negative affirmation, in order to identify and address repeat response bias at analysis stages. Therefore, the third statement was presented as ‘I do not feel morally obliged to try to conserve fishery resources and aquatic ecosystems’, rather than ‘I do feel...’. See Figure 13.

Q. To what extent do you agree or disagree with each of the following statements about how you think you and others should act when taking part in recreational sea angling?

Please answer using the scale shown below by selecting ONE option for EACH statement.

Please note: the term 'fishery' (below) refers to a body of water (such as the sea or rivers) that holds a stock of fish and/or other aquatic lifeforms

| | * Required | | | | |
|---|-----------------------|-----------------------|---------------------------|-----------------------|-----------------------|
| | Strongly disagree | Disagree | Neither disagree or agree | Agree | Strongly agree |
| People like me should do whatever they can to conserve fishery resources and aquatic ecosystems | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I do not feel morally obliged to try to conserve fishery resources and aquatic ecosystems | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I would feel guilty if I didn't do my part to conserve fishery resources and aquatic ecosystems | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

Figure 13: Stewardship norms question design

Measuring stewardship behaviour presented slightly more complex considerations. As discussed in Chapter Two, stewardship behaviours had been theorised into private, public and social types. The latter two types were simple to address and were based on two best performing statements in Landon et al. (2018) (Figure 14). Again, because these statements were not intended for factor analysis, they were captured in a single response mode over a specified time period. The first two statements used captured public stewardship while the second and third statement represented social stewardship.

Q. Below is a list of actions that anglers may carry out to support the conservation of fishing sites and the environment. Please tell us which of these actions, if any, you have carried out in the past 12 months by selecting relevant boxes.

Please select ALL that apply to you. *Optional*

- Contacted a political representative (e.g. local MP) about a fishery or aquatic conservation-related issue
- Donated money to an organisation that supports fishery or aquatic conservation (e.g. the Angling Trust)
- Participated as an active member in a fishery or aquatic conservation organization
- Talked to others in my angling community about appropriate conservation behaviours (online or in person)

Figure 14: Public and social stewardship behaviour question design

Measuring private stewardship behaviour was slightly more problematic because its conceptualisation by Landon et al. (2018) was based on statements relevant to Texan (USA) fishing and were less appropriate for UK recreational sea angling. For example, one statement described the propensity of anglers to ‘take precautionary measures to stop the spread of invasive disease’. This is not an issue in the UK at the current time when the research took place but has been highlighted as a future risk in marine systems (Lewin et al. 2019). Other statements had potential to only be relevant to certain groups of anglers likely to complete the survey for this study (boat anglers), therefore potentially reducing the respondent sample size for that variable. On reflection, the key part of private stewardship was to focus on behaviours, through the direct control of the angler, that had potential to prolong or protect other life forms in the environment in which the activity takes place. The most direct way in which this could be captured was considered to be actions taken by anglers that have potential to improve the life expectancy of fish that had been caught but returned to the water. There are several studies focusing on the mortality of fish and catch-release practices (Huhn and Arlinghaus 2011; Cooke et al. 2012), but few focus on environments comparable to UK coastlines or contexts, methods and species, encountered by recreational anglers in the UK. Personal experience suggested, however, that ‘fish friendly’ practices do take place among recreational

anglers in the UK, particularly for protected species such as sea bass. These often reflect those practiced by catch and release freshwater anglers. Private stewardship behaviour in this study was therefore measured using a set of four exploratory statements (behaviours), with frequency of behaviour captured over a specified timeframe. See Figure 15.

Q. In the past 12 months, how often have you demonstrated the following behaviours when catching and releasing fish back to the water?

Please answer using the scale shown below by selecting ONE option for EACH statement.

| | * Required | | | | |
|---|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| | Never | Rarely | Sometimes | Often | Always |
| Returned fish that are intended to be released back to the water as quickly as possible | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Cradled fish in water to ensure they can swim before being released | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Kept fish to be released in water while being unhooked | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Used barbless hooks | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

Figure 15: Private stewardship behaviour question design

Catch and release behaviour: a key objective was to understand how potential angler types may differ in terms of the species of fish they catch, release trends, and reasons behind why fish are released. To reduce the length of the survey, the most popular species of fish caught by recreational sea anglers in the UK (based on Hyder et al. 2021) were presented to respondents, with each angler being asked to select one species that they had caught regularly over the previous 12 months. Number of fish caught was captured in raw numeric form. It was anticipated that memory bias may have led to inaccurate data on the proportion or number of these fish that were released back to the water, therefore respondents were asked to select a statement that best reflected the frequency of release: I have never released these fish; I released these fish occasionally; I released these fish more often than not; I always released these fish; don't know; prefer not to say. Most likely reasons for releasing

fish were then presented to the respondents (pre-coded multiple responses), with an option to add one additional reason using free-open text.

Demographics: data was collected using a combination of pre-codes and open text entry, including age, gender, income, disability, region of domicile, and ethnicity.

3.3.1.3 Questionnaire piloting

The majority of questions and related statements (particularly those intended for use in developing the typology) were drawn from previous studies. For this reason, it seemed repetitive (and not a good use of time) to perform a pilot study and subsequent principal component analysis to validate constructs and concepts being addressed in the questionnaire. However, the questionnaire remained quite lengthy and included topics that many anglers had potentially not contemplated previously. For these reasons, it was decided to hold a piloting phase, involving a smaller number of participants but with more in-depth methods of collecting feedback through a cognitive interviewing method (Collins, 2014). In line with this method, the pilot phase involved asking a small number of anglers to complete the initial draft of the survey, and then take part in a short telephone interview focusing on their experience of the process and how they interpreted the questions.

Those piloting the survey were sent a summary sheet explaining how to access the survey and guidance on what to consider while completing the questionnaire or just afterwards (see Appendix Two). Ten anglers completed the pilot survey, with four of the 10 taking part in post-survey interviews. Those interviewed took between 15 and 24 minutes to complete the survey (on a laptop or mobile phone device). All four interviewed found the survey questionnaire easy to navigate and found the questions easy to answer. While three of the four admitted that they had not really thought about the topics in the survey before, they fully understood the concepts, language and words used. Although not interviewed, the remaining six anglers piloting the survey provided feedback via email (it is of note that these anglers were based in organisations that had some involvement in social research and/or angling, such as the Angling Trust and Cefas). Four of the six felt the survey was easy to

follow and easy to understand, with no suggested alterations. Two anglers felt that some additional instructions were required to further explain how to answer the questions on distance travelled and number of days fished. As a result, the survey questionnaire was amended.

3.3.1.4 Data collection and ethics

The link to the survey questionnaire was distributed in an email via Substance. For other channels, including, for example, the Angling Trust newsletter, information was given about the research and the survey URL embedded within the associated text. The survey was likely to be accessed via a number of different devices, therefore the introduction text provided detailed information about the research and how the information collected would be used. In addition, all those accessing the initial page of the survey were instructed to follow links to further e-documents that detailed additional information on the background and aims of the research, how the data would be handled and stored, and how the findings would be disseminated in the future (see Appendix Three). In addition, links were provided to the University of Gloucestershire's GDPR policy. All those deciding to continue with the research were asked to give their online consent by ticking a series of boxes at the outset of the questionnaire. The research was purposefully aimed at collecting data from anglers taking part in recreational sea fishing at least twice in the 12 months prior to completing the questionnaire. This was explained in the supporting information and woven into the consent text.

The survey was designed so that no personally identifiable information was collected, conforming to anonymity promised to respondents. Participants were asked to provide a memorable word so that their survey questionnaire could be retrieved and deleted if they no longer wished to be part of the research post-completion. Information was also given on how respondents could continue to be involved in the research after completing the survey (via the telephone interviews). This involved clicking a link to another survey where questions were asked regarding preferred contact options. This standalone mini questionnaire was in no way connected to main survey questionnaire, therefore conforming to the stipulated

anonymity protocol. Both the contact details and survey data were stored in a password protected folder on a password protected laptop, only accessed by the lead researcher.

The data collection and survey questions presented very little cause for concern in terms of ethical considerations, with the above processes ensuring that all standard aspects of survey data collection, handling and participation information was addressed adequately and in full.

The questionnaire, supporting information and sampling strategy was approved by the University of Gloucestershire School of Natural and Social Sciences Ethics Committee. The survey was launched in January 2021 and was closed in February 2021. Due to time restrictions and a good response rate, subsequent reminder mailings were not required.

3.3.1.5 Overview of survey analysis technique

The primary function of the survey questionnaire was to collect data to develop the angler typology. While detailed descriptions of analysis techniques are provided in relevant analysis sections, an overview is provided here.

Non-hierarchical factor analysis was used to firstly reduced the number of variables into a manageable number, and secondly, identify latent constructs (factors). Hierarchical factor analysis was then used to explore the strength of models that involved different numbers of factors and their ability to describe the data most effectively (this was an iterative process based on interpretation of results). The factors were then subject to cluster analysis in order to classify anglers into distinct groups (forming a typology) based on their attitudes, values and behaviours (as reflected by the factors). The typology was verified and validated by means comparisons of other data captured in the survey (independent variables), and a unique angler verification technique carried out through the qualitative stages of data collection discussed in the next section. This approach described here has been used in other typology formation studies (Urquhart 2009) and followed

statistical procedures for the analytical techniques as described in Hair et al. (2014). Statistical analysis was performed in SPSS 28.0.

3.4 SEMI-STRUCTURED INTERVIEWS

The primary focus of the angler interviews was to: 1) further explore findings and interpretation emerging from the survey analysis, including both topics that retrospectively needed unpacking qualitatively, or topics that could not be addressed by the limited nature of survey (quantitative) data collection; 2) collect data to verify the allocation of anglers completing the survey in the typology emerging from the quantitative analysis; and 3) collect data on more sensitive topics involving angler behaviours (such as compliance) that would aid in describing differences between the angler types described by the typology. Methodologically, the qualitative approach is represented by a less structured format to exploring experiences of research participants in the context of their own lived world, without the primary aim of quantifying findings (Kvale 2007). It was therefore important to choose a research method that allows both collection data around thematic core topics, but also allows an instrumental dialogue in which the research participants can provide context to views held or reasons behind certain behaviours regarding the chosen social phenomena. In its broadest sense, interviews, as a research technique, provided the necessary format to develop these conversations (Kvale 2007).

It must be noted here that the interviews were based on the premise that related data is contextualised by the lived world of the participant. This reflects an underlying interpretivist paradigm that stands in opposition (in traditional literature) to the positivist position of the survey approach (Alharahsheh and Pius 2019). The survey in this study reflected an empirical method to classify anglers based on the premise that one can predict different responses to angling policy based on personal values, norms and behaviour. The dual approach presented by the survey and interviews is purposeful. It recognises that research problems in the social sciences, that are guided or respond to policy, often require adoption of differing ontological and epistemological standpoints to produce research and findings that has real world,

applied, value and are solution orientated. This study therefore conformed to a pragmatist approach.

Interviews are not without their limitations. Face-to-face data collection can be negatively affected by unintentional social cues or even dress code displayed by the interviewer, affecting the power relationship between those involved and therefore influencing participants' responses (Opdenaker 2006). This is particularly pertinent when addressing potentially sensitive topics. Even the venue in which face-to-face interviews take place can also impinge on the effectiveness of interviews as a research method. It is therefore important to carefully choose venues or scenarios in which both the interviewee and interviewer feel comfortable to discuss topics freely but also discretely (Wengraf, 2001). Cognate interview bias can also arise and shape the direction of interviews and data collected. For example, the interviewer can easily convey agreement with responses of the participant if they align with their own viewpoints and opinions; this can lead to an over-rapport that shapes the participant's responses, in hope of receiving further positive reinforcement from the interviewer (Frey, 2018). This type of acquiescence bias is based on the premise that everybody wants their opinions to be in line and liked by others.

Telephone interviews were chosen as an appropriate method to help overcome some of the issues identified with data bias. Firstly, they were conducted at time and location convenient to the respondent and in a location secure enough for the free discussion of potentially sensitive information. Secondly, they eliminated some of the potential biases resulting from the behaviour/visual cues. Furthermore, studies have shown that telephone interviews are at least as effective in collecting in-depth and accurate data when compared to their face-to-face counterparts (Carr and Worth, 2001; Block and Erskine 2012). In addition to this and, reflecting some of the more recognised benefits of telephone interviews, the method allowed an efficient process of engaging with anglers from across England and Wales in a timely and cost-efficient manner (Block and Erskine 2012).

3.4.1 Interview design

This section describes the implementation of the interviews from question design through to implementation, closure and follow-up.

3.4.1.1 Question design

The interviews were designed based on the intention that all questions would be asked to the participant in the order presented in the interview schedule shown in Appendix Four, and subsequent/related questions asked if required (depending on initial response). Probing was used to either collect further detailed information in the given response, or to prompt the respondent into answering if the question was not received well. The semi-structured aspects of this design left the decision around when and how to probe with further questioning up to the researcher. Interviews are often at the mercy of free flowing, multi-topical, conversation, therefore the researcher was also free to change the structure/order of questioning, or omit questions, making these judgements in context of answers to previous questions and the general feel of how well the interview was going. The intended structure of the interviews was as follows: general introductory question about angling activity; relationship between angling and identity (based on analysis of survey responses); views on governance; and angler categories (typology verification). Questions were mainly presented in an open style such as that shown in Figure 16. Where necessary, appropriate instructional information or classification of key terms were read to the interviewees (in such cases, the words were read in script fashion from the interview schedule, so that each respondent received the same supporting information).

Q10. Thinking more generally about regulations, in your opinion what influences anglers' decisions to follow the rules (or not)?

Prompt (but only if needed):

- Morality?
- Peer/angler pressure?
- Fear of prosecution or being caught?

Figure 16: Interview question structure

3.4.1.2 Recruitment

Anglers completing the online survey were asked if they would be willing to take part in further research on their recreational angling experiences. Those agreeing to take part were emailed with details of the interview and how to sign up. Those that signed up were booked in for an interview and were sent full details of the research by email prior to the interview, including an informed consent form that required completion prior to the interview taking place, information on how their data would be treated/stored, and details of participant protection (anonymity) in research outputs. The documents sent to interviewees can be found in Appendix Five and Six. At the outset it was anticipated that at least 20 anglers would be required for this stage of the research in order to ensure views were collected from each group of the angler typology. All those that took part were offered a £10 voucher for an angling store of their choice as a token of appreciation.

3.4.1.3 Data collection and ethics

The interviews took place in December 2022. The researcher received a completed consent form (described in previous section) prior to the interview taking place. All interviewees agreed to the interviews being recorded to aid subsequent analysis. Each interview was transcribed (verbatim) and additional notes taken by the researcher at the time of interview. The recording and interview transcripts were stored in a password protected folder, on a password protected laptop, in compliance with the University of Gloucestershire's GDPR policy. The interviews

and associated processes were approved by the UoG’s School of Natural and Social Sciences ethics committee.

3.4.1.4 Overview of interview analysis technique

The interview transcripts were subject to thematic content analysis in Nvivo. This approach is a recognised qualitative “*method for identifying, analysing, organizing, describing, and reporting themes found within a [qualitative] data set*” (Nowell et al. 2017, p.2). The process involved generating accurate codes that reflected themes in the data relating to each question area. The rationale behind this process was to ensure that the themes and codes were data driven and not (subjectively) researcher-interpreted. The process should therefore be replicable by others with similar conclusions made regarding the information garnered from the interview transcripts. To achieve this objective transparency, the analysis followed specific stages suggested by Nowell et al. (2017), as shown Table 5.

Table 5: Process for thematic content analysis

| Phase of analysis | Method to ensure robust findings |
|---|--|
| 1: Familiarization with data | Prolonged engagement with data; triangulate data collection modes (notes and recording accuracy); document reflective thoughts and potential codes; store well organised and secure raw data. |
| 2: Generate initial codes for data | Generate coding frame; reflective journaling of changes in coding frame; audit trail of code generation; seek peer review; document peer review. |
| 3: Generate themes across codes and patterns of meaning | Diagramming to make sense of connections in codes and themes; keep detailed notes of coding hierarchies; seek peer review; document peer review. |
| 4: Defined and name themes | Attain peer consensus; document theme meaning. |
| 5: Reporting | Provide thick description of context and themes/findings; describe the audit trail of decision making; report on the theoretical, methodological, and analytical choices made throughout the study (phases 1-4). |

Source: Adapted from Nowell et al. (2017)

3.5 CONCLUSION

To summarise, this Chapter has presented a justification for a sequential mixed method approach for establishing and verifying a typology of recreational sea

anglers in England and Wales, and exploration of associated research questions presented in Chapter One. The approach was based on a survey questionnaire, subject to factor and cluster analysis, and subsequent interviews with anglers, subject to thematic content analysis. More detailed description of the quantitative analysis method is given alongside the results in Chapter Three; this approach is more suited to the presentation of factor/cluster analysis because of sequential and interpretive nature of each stage involved in generating results. The combination of approaches (survey and interviews) reflects a methodology that is pragmatist by nature, encompassing both positivist and interpretivist epistemologies.

It is important to highlight that approach outlined in this Chapter has been affected by the positionality of the researcher. Positionality is defined as the views, perspectives and epistemologies / ontologies held by the researcher in a given study and the process in which these views affect the way the research is conducted (Gary and Holmes 2020). A framework developed by Savin-Baden and Major (2013) proposed three ways in which positionality is embedded in research studies. This framework is used here to understand the positive and negative effects of the researcher who conducted this study being an angler themselves. Strategies employed to embrace positionality and mitigate against negative effects are explained, mainly in the context of data collection.

The first domains is the *subject*, where the researcher is aware that personal angling related views may align or misalign with views of participants. In these contexts, unconscious body language and facial expression between researcher and participant may negatively affect the information collected during data collection. For example, more information may be collected during an interview where the participant expresses views that align with the researcher's own views, therefore encouraging the researcher to ask more questions on that topic compared to areas of conversation where there is misalignment of personal views. This was mitigated firstly by the fact that the interviews were conducted over the telephone, therefore eliminating the effect of visual gestures. Audio gestures theoretically remained likely in such circumstances. However, the researcher had spent 12 years as a socio-economic consultant prior to carrying out the research presented here and was therefore experienced in ensuring that only the pre-selected questions in the

interview schedule were asked with no additional verbal gestures that may have encouraged or discouraged answers that aligned with the researcher's own beliefs.

The second area of the framework concerns *participants*, where preconceived views are held by the researcher about participants and vice versa. For example, the researcher can wrongly assume a level of knowledge among participants regarding a topic intended for discussion during interview or survey; participants may view researchers as highly educated people with no real-world experience in topics discussed. These underlying views effect what is being said at point of data collection and may influence the accuracy of the opinions being presented by the participant in response to a question. In this study, the researcher was able to overcome these problems by using firsthand experience of engaging with other anglers as an angler themselves to shape the wording used in the survey, the interview schedule and verbal phrasing used in conversation with anglers over the telephone. This helped to break potential barriers between with participants in the interviews, leading to more accurate data, and helped reduce bias in the survey data resulting from participants potentially misunderstanding questions presented.

The third domain is *research context*, where the researcher is aware and responds to the effects of positionality. Mitigation in this respect is to predict and reduce negative outcomes of positionality as per strategies delivered in respect to the first two domains discussed thus far; conversely, to embrace benefits afforded by positionality. The positionality of the researcher conducting this study being an angler themselves has had significant positive outcomes in terms of research design and data collection.

CHAPTER FOUR

ANALYSIS AND RESULTS - SURVEY

4.1 INTRODUCTION

This Chapter presents the analysis and results of the angler survey, working towards the primary aim of developing a statistically robust typology of recreational sea anglers in England and Wales. Factor and cluster analysis were the central techniques used in forming the angler typology, with data being subject to several cleaning and validation processes, which are also discussed in this Chapter. With this aim, the Chapter begins with an overview of responses to the survey and rationale for omitting cases (responses) deemed unfit for inclusion in the analysis. This is followed by a descriptive analysis of the sample in comparison to other known data on recreational sea anglers in the UK. The Chapter then focuses on three stages of analysis, including discussion of data preparation for the multivariate techniques. The stages include: factor analysis; cluster analysis; and validity testing of the angler profiles. Following this, the individual segments (clusters) identified in the typology are described to further explore inter-segment variances in data not used as part of the profiling techniques.

4.2 OVERVIEW OF SURVEY RESPONSES

The survey received 567 responses. Although clear explanation of the project aims was given as part of these introduction to the questionnaire, including information on who should have taken part ('active' anglers), a number of responses were unsuitable for inclusion in the study. This occurrence is attributed to the nature of the survey dissemination, and limited control over the survey link after it has been distributed by the gatekeeping organisations (see Chapter Three). The most important variable for inclusion in the study was number of days spent recreational sea angling in the last 12 months (responses reflecting status as an active angler). Cases (respondents) were omitted from further analysis where 0 days were

reported, or data was missing (combined, n=66). It was also important to ensure that respondents provided data in relation to their sea angling experiences. Therefore, cases were also omitted where, upon preliminary qualitative analysis, answers to open questions clearly revealed that they only fished in other (freshwater) environments (n=2). Because previous literature on angler heterogeneity, specifically specialisation theory, heavily draws on economic and behavioural variables, other cases were omitted from the sample where data was missing for spend over the last 12 months (n=13), and travel (n=5). Remaining cases were then initially reviewed (precursory to statistical outlier analysis discussed in subsequent sections) across all variables to ensure responses were within reasonable (and realistic) parameters. Nine cases were subsequently removed from the analysis where unrealistic data was reported for distance travelled on last fishing trip, spend on sea angling equipment over the last 12 months, and/or catch records (these data usually coincided with repeat response patterns, anomalous responses for other survey questions and/or missing demographic data). A total of 472 usable cases remained in sample for subsequent descriptive and inferential analysis.

4.3 DESCRIPTIVE RESULTS

This section describes the characteristics of the sample to support the forthcoming multivariate analysis. The section describes: settings in which anglers fished; number of days spent recreational sea angling in the past 12 months; angler spend; distance travelled on last angling trip; angling motivation; age and gender; income; disability; region of domicile; ethnicity. Where possible, the sample characteristics are compared to both Cefas Diarist data and data drawn from the UK WPS (Hyder et al. 2021). The latter represents the most comprehensive random sample survey that describes selected characteristics of the recreational sea angling community in the UK. Comparing these data against the current sample allowed an estimation of how representative the sample was compared to the wider sea angling population, informing findings of the multivariate analysis in subsequent sections.

4.3.1 Settings in which anglers fished

Nearly half of the anglers in this study (46.8%) took part in recreational sea angling in more than one type of setting (shore and afloat either a chartered/private boat or kayak). The shoreline was the most common individual setting where respondents fished, including estuaries, beaches, rocks, harbours and piers (reported by 88.2% of anglers). The second most common setting was chartered boats (35.7%), followed by a privately owned boat (25.7%). Only 11% of the sample reported that they fished from a kayak or other type of flotation device. While the setting data reflects participation trends reported by Hyder et al. (2021) based on the WPS, with shore angling historically being the most common setting for recreational angling, there is a higher proportion of those that fished from chartered boats in the current sample compared to previous studies collecting data on recreational sea angling participation in UK: angling from privately owned boats is usually the second most common type of setting in which recreational angling takes place (Hyder et al. 2021).

4.3.2 Age and gender

Recreational sea anglers in this study were aged between 21 and 82 years old, with the average age being 62.⁶ Nearly all anglers were male (99.2%). The significant gender bias towards male anglers is important to note. Practically, for this study, the very small representation of female anglers (n=3) meant that data analysis and presentation would not have benefited from methods of gender division or weighting: their numbers were far too few to gain meaningful insights. Nevertheless, there are important considerations that require attention regarding the conclusions on angler heterogeneity from this research study, which draws on previous research suggesting that female anglers show propensity for different angling motivations and ethics compared to males (Schroeder et al. 2006). These are discussed in Chapter Six.

In order to assess the age profile of the sample in this study to previous studies describing the characteristics of recreational sea anglers in the UK, age data were

⁶ Optional response, total n=469 (missing data: 3)

grouped into categories reported by Hyder et al. (2021) drawing on data from the WPS 2019, and Cefas Diary programme 2019: 18-34; 35-54; and 55+. Table 6 shows that there was a higher proportion of older anglers in this study (aged 55+, accounting for 79.9% of the sample) compared to both the Diarists and WPS samples (53.9% and 28.9% respectively). While those aged less than 34 years represent the lowest age group across the three studies, the proportion in the sample for this current study was considerably lower at just 1.7%.

Table 6: Age of recreational sea anglers

| Age category | Count | % Sample | % Diarists | % WPS |
|--------------------|-------|----------|------------|-------|
| 18-34 ⁷ | 8 | 1.7 | 11.6 | 27.5 |
| 35-54 | 84 | 17.8 | 34.5 | 44.3 |
| 55+ | 377 | 79.9 | 53.9 | 28.9 |
| Prefer not to say | 3 | 0.6 | n/a | n/a |
| Total | 472 | 100.0 | 100.0 | 100.0 |

4.3.3 Number of days spent recreational sea angling (avidity)

On average, recreational sea anglers in this study fished on 27 days over the 12 months preceding completion of the survey questionnaire. The number of days fished by anglers in sample over the previous 12-month period ranged from 1 to 300.⁸ In order to assess the number of days fished by angler in this sample to previous studies describing the characteristics of recreational sea anglers in the UK, avidity data were grouped into the categories reported by Hyder et al. 2021 (drawing on data from the WPS 2019, and Cefas Diary programme 2019): frequent (35>); regular (13-35 days); occasional (6-12 days); rarely (2-5 days) and once. Table 7 shows that the majority of anglers in this study (32.2%) took part in recreational sea angling regularly (13-35 days over the 12-month period previous to completing the questionnaire). This replicates the avidity profile of Cefas Diarists in 2019 (29.7%), with a further similarity reflected in the least common category being once (1 day) per year. The current study sample, and the Diarists, showed different avidity profiles compared to the WPS: the latter suggests that recreational sea anglers in the UK take part in the activity less frequently, with most fishing 2-5 days over a month period (37.0%

⁷ Please note that the WPS and Diary study used in this Table included 16-17 year old in this category, whereas this sample only includes 18 years plus. Because of the low number of anglers in the <18 years age brackets it is anticipated that this difference in category parameters will have marginal affect on the percentages presented.

⁸ Outliers were removed from the dataset.

compared to 16.9% and 17.3% respectively). The WPS sample also had a considerably higher proportion of anglers that fished once per year (21.7% compared to 5.1% and 2.9% respectively).

Table 7: Avidity of recreational sea anglers

| Category | Count | % Sample | % Diarists | % WPS |
|------------------------|-------|----------|------------|-------|
| Once (1 day) | 24 | 5.1 | 2.9 | 21.7 |
| Rarely (2-5 days) | 80 | 16.9 | 17.3 | 37.0 |
| Occasional (6-12) days | 110 | 23.3 | 26.9 | 15.8 |
| Regular (13-35 days) | 152 | 32.2 | 29.7 | 16.6 |
| Frequent (35+ days) | 106 | 22.5 | 23.3 | 8.9 |
| Total | 472 | 100.0 | 100.0 | 100.0 |

Although the data suggests that anglers in the sample fished more regularly than those in other studies describing participation in the UK, the average number of days (n=27) is lower than that reported in studies elsewhere in continental Europe. An average of 39-42 days per year, was reported by Arlinghaus et al. (2008), inclusive of all angling in fresh and saltwater; and 43 days per year for angler in Sweden, specifically in saltwater environments (van den Heuvel et al. 2020). Other studies at a European level, suggest countries such as Spain, Portugal and Latvia also have higher rates (33, 37 and 37 days per year respectively); adding to the complexity in comparing participation across Europe, countries such as France, Finland and Denmark, have lower rates: 7, 11, and 6 days respectively (Hyder et al. 2018).

The majority of anglers in this study (64.2% of respondents) reported that the COVID-19 pandemic had affected the number of days spent recreational sea angling over the past 12 months. Of those reporting some kind of an impact, 29.7% claimed they had fished 'significantly less' and 32.2% reported fishing 'less'. Very few anglers reported that the COVID-19 pandemic increased their opportunity and uptake of days spent recreationally sea angling. This suggests that the average number of days fished by anglers in the current sample (n=27) is lower than what would have been the case if the sample completed the survey in non-pandemic times.

4.3.4 Angler spend

Recreational sea anglers in this study spent on average £365 (cumulatively) on equipment and tackle over the previous 12 months to completing the questionnaire.⁹ The amounts ranged from £0 to £4,700.¹⁰ Spend in this study was used as a proxy indicator of behavioural commitment to recreational sea angling. Anglers were asked to report spend on equipment including rods, reels, landing nets, and tackle including hooks, weights, and lures. Anglers were asked to exclude any costs associated with boat ownership because this would disproportionately skew data due to the high costs of mooring, fuel and maintenance. The spend parameters suggested to anglers was an attempt to gather accurate data (cumulatively) over the 12 months prior to completing the questionnaire (minimising impacts of recall bias). Because of the differences in how spend is captured and reported, comparison with other studies is difficult. However, in general the spend among anglers in this study seemed lower than reported elsewhere. For example, Hyder et al. (2020b) reported that the yearly recreational sea angler spend on capital items such as rods and tackle (i.e. the most comparable category of items to the areas of spend captured in the survey used in this study) was £841 (2017).

4.3.5 Distance travelled on last recreational sea angling trip

On average, anglers in this study travelled 63 miles on the outward journey of their last recreational sea angling session (that took place in either England or Wales). Travel distances ranges from less than a mile to 650. Travel in this study was used as a proxy indicator of behavioural commitment to recreational sea angling. This is novel data in relation to the recreational sea angling community in England and Wales. Comparable data for parts of continental Europe suggests that travel among the sample of angles in this study is higher than expected. For example, Arlinghaus et al. (2008) reported that one-way travel to fishing locations among freshwater and marine anglers in Germany was 29 miles among rural residents and 40 miles among those living in rural locations.

⁹ Anglers were asked to report spend on equipment such as rods, reels, landing nets, and tackle such as hooks, weights, and lures. They were asked to exclude any costs associated with boat ownership.

¹⁰ Outliers removed from the sample.

4.3.6 Income

The data in Table 8 shows that the most common category representing anglers' total personal annual income before deductions is £20,001-£40,000 (36.9% of respondents). The second most common annual income category was less than £20,000 (21.8%). Very few anglers earned above £100,000 per year before deductions (3%).

Table 8: Annual personal income before deductions

| Category | Count | % |
|---------------------|-------|-------|
| < £20,000 | 103 | 21.8 |
| £20,001 to £40,000 | 174 | 36.9 |
| £40,001 to £60,000 | 68 | 14.4 |
| £60,001 to £100,000 | 44 | 9.3 |
| £100,001> | 14 | 3.0 |
| Prefer not to say | 69 | 14.6 |
| Total | 472 | 100.0 |

4.3.7 Disability

Just over a quarter of the anglers in this study reported that had a physical/mental disability or illness expected to last 12 months or longer (26.3% of respondents). Very few anglers reported having both a physical and mental disability/illness (6.8%), and fewer still reported having just a mental disability/illness (3.8%). The sample therefore primarily consisted of anglers that have no known disability or illness at all (59.3%). This figure is slightly lower than that reported in other studies on recreational sea angler demographics in the UK: no disability, 65.8%; disability present, 18.7%; no answer, 15.5% (Hargreaves, 2013).

4.3.8 Ethnicity

Nearly all anglers completing the online survey for this study described their ethnic origin/background as white or white British (97.6% of respondents). The predominance of white or white British ethnic backgrounds in angling research samples is not uncommon: 96% of UK recreational sea anglers (Hargreaves, 2013).

4.3.9 Region of domicile

The majority of anglers in this study resided in the South West and South East of England (23.3% and 22.2% of respondents respectively). The third largest proportion of anglers resided in Wales (10.4%). As shown in Table 9, the region of domicile data reflects patterns in the WPS survey data and *Diarists*, with the South East, South West, and Wales also being the most common regions where recreational sea anglers reside. The only variation of note is that anglers in the South West of England had a slightly higher representation in the current sample compared to both the WPS and *Diarist* data (23.3% compared to 16.7% and 11.5% respectively). In addition, there was a slightly higher proportion of anglers from the East of England in the current sample compared to the WPS (9.7% compared to 3.7% respectively). Expectedly, the least amount of anglers in the sample resided in London, replicating data found in the *Diarists* group and WPS sample.

Table 9: Region of domicile

| Region | Count | % Sample | % <i>Diarists</i> | % WPS |
|--------------------|-------|----------|-------------------|-------|
| East Midlands | 21 | 4.4 | 3.8 | 5.8 |
| East of England | 46 | 9.7 | 10.5 | 3.7 |
| London | 12 | 2.5 | 2.7 | 2.6 |
| North East | 29 | 6.1 | 5.7 | 4.7 |
| North West | 39 | 8.3 | 13.5 | 4.3 |
| South East | 105 | 22.2 | 19 | 24.4 |
| South West | 110 | 23.3 | 16.7 | 11.5 |
| West Midlands | 29 | 6.1 | 4.3 | 5.4 |
| Yorkshire & Humber | 30 | 6.4 | 6.1 | 5.5 |
| Wales | 49 | 10.4 | 9.6 | 11.7 |
| Prefer not to say | 2 | 0.4 | n/a | n/a |
| Northern Ireland | n/a | n/a | 2.3 | 13.4 |
| Scotland | n/a | n/a | 5.9 | 7.1 |
| Total | 472 | 100.0 | 100 | 100 |

Note: Scotland and Northern Ireland are not included in the calculation of data associated with this study in; they are included in the calculation of percentages for the *Diarists* and WPS, so have been left in the Table for purposes of data transparency. This does not affect general assumptions based on the data.

4.3.10 Summary

Compared to known characteristics of the recreational sea angling community in the UK, the sample in this current study is biased towards older anglers, with a higher degree of

avidity and propensity to travel further to fishing destinations (compared to trends in selected European countries). It is of note that the avidity data reported in the current sample is lower as a result of the COVID-19 pandemic, meaning that in 'normal' times the data reported in the current study may have been even more skewed towards even higher levels of avidity compared to other national survey data conducted pre-pandemic. Aside from this, the sample was reflective of the wider recreational sea angling population in terms of region of domicile and settings in which anglers fished (mainly shore locations).

4.4 FACTOR ANALYSIS - IDENTIFYING STRATEGIC VARIABLES AND LATENT CONSTRUCTS

As seen in Chapter Two, attempting to understand heterogeneity among anglers involves a wide-ranging multidimensional lens that incorporates the cognitive, attitudinal and behavioural characteristics of the angler's psychological profile and/or choices-actions they carry out before, during or even after they fish. As a result, data collection via the angler survey included a relatively high number of variables. Because data parsimony is a fundamental building block of multivariate analysis, it was fundamental to fully understand the structural relationship (overlap, correlation, and variance) between these variables, taking opportunities to reduce the number of variables into a more manageable structure for developing the typology (Hair et al. 2014).

Explanatory factor analysis (R-type) was used to identify these highly interrelated variables and condense their number, categorising them into subsets (factors) that reflect distinct latent constructs, while retaining as much information about the dataset's characteristics. The section firstly describes the process involved with preparing the data, including variable selection, outlier identification and an assessment of factorability. The section then describes the process of factor extraction and defines the identified latent constructs (strategic variables) intended for subsequent cluster analysis. The factor analysis process is summaries in Figure 17.

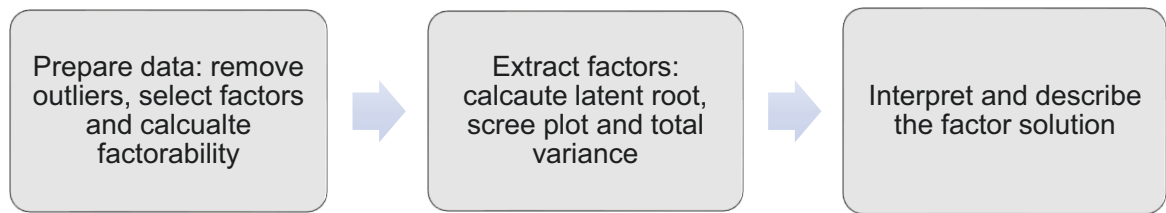


Figure 17: Factor analysis process

4.4.1 Factor analysis data preparation

This section describes the selection of variables, the process for identifying outliers and how factorability was assessed.

1) Initial selection of variables

Variables initially identified for factor analysis reflected potential predictors of angler behaviour or management preference and those used in previous angler categorisation theories (discussed in Chapter Two and Three). These variables are likely to form the most useful typology to inform the future management of recreational sea angling. Other data (descriptive variables) collected in the survey were not considered in the factor analysis but were used to profile the typology clusters (process outline by Hair et al. 2014). As a precursory measure, descriptive frequencies were generated to identify questions and statements where anglers may have been heavily grouped at one point in the corresponding response scale (90%+ of respondents). All variables intended for the factor analysis showed some degree response spread, with no dominant single response category. Variables selected for the factor analysis are described in Table 10, with reference to either their conceptual and/or theoretical basis (ordered according to the sequence of questions in the survey):

Table 10: Variables selected for factor analysis

| Label | Description (survey statement) | Conceptual basis | Theoretical basis |
|-----------------|--|---------------------------------------|------------------------------|
| FV1_Days | On how many DAYS in the LAST 12 MONTHS have you gone recreational sea angling? | Behavioural commitment | Specialisation |
| FV2_Spend | Approximately how much money in total have you spent in the past 12 months on equipment and tackle for recreational sea angling? | | |
| FV3_Distance | How far did you travel when you last went recreational sea angling? | | |
| FV4_Organised | "I find that a lot of my life is organized around recreational sea angling" | Centrality - Psychological commitment | Specialisation / Involvement |
| FV5_Central | "Recreational sea angling occupies a central role in my life" | | |
| FV6_Preference | "To change my preference from recreational sea angling to another recreation activity would require major rethinking" | | |
| FV7_Friends | "Most of my friends are in some way connected with recreational sea angling" | Social bonding | |
| FV8_Discuss | "I enjoy discussing recreational sea angling with my friends" | | |
| FV9_Opportunity | "Participating in recreational sea angling provides me with an opportunity to be with my friends" | | |
| FV10_Enjoy | "Recreational sea angling is the most enjoyable thing I can do" | Attraction | |
| FV11_Important | "Recreational sea angling is very important to me" | | |
| FV12_Satisfying | "Recreational sea angling is one of the most satisfying things I can do" | | |
| FV13_Myself | "When I participate in recreational sea angling, I can really be myself" | Identity (affirmative) | Involvement |
| FV14_Image | "I identify with the people and image associated with recreational sea angling" | | |
| FV15_Look | "When I'm sea angling for recreation I don't have to be concerned about the way I look" | | |
| FV16_Seeing | "You can tell a lot about a person by seeing them take part in recreational sea angling" | Identity (expressive) | |
| FV17_Says | "Participating in recreational sea angling says a lot about who I am" | | |
| FV18_Want | "When I participate in recreational sea angling people see me the way I want them to see me" | | |
| FV19_Skill | "How would you rate your overall sea angling skills in comparison to other anglers you know?" | Cognition | Specialisation |

| | | | | |
|------------------|--|-----------------------------|--------------------|--|
| FV20_No-fish | "A fishing session can be successful even if no fish are caught" | Catch 'something' | Attitudes to catch | |
| FV21_Any-fish | "If I thought I wouldn't catch any fish, I wouldn't go fishing" | | | |
| FV22_Some-fish | "When I go fishing, I'm not satisfied unless I catch at least something" | | | |
| FV23_More-fish | "The more fish I catch, the happier I am" | Catch 'Numbers' | | |
| FV24_Many-fish | "A successful fishing session is one in which many fish are caught" | | | |
| FV25_Others | "I'm happiest with a fishing session if I catch more than other anglers around me" | | | |
| FV26_Rather | "I would rather catch 1 or 2 big fish than 10 smaller fish" | Catch 'Trophy' | | |
| FV27_Challenge | "I'm happiest with a fishing session if I hook a fish that is challenging to catch" | | | |
| FV28_Chance | "I like to fish where I know I have a chance to catch a trophy fish" | | | |
| FV29_Eat | "I usually eat the fish I catch" | Catch: 'Retain' | | |
| FV30_Keep | "I want to keep the fish I catch" | | | |
| FV31_Release | "I'm just as happy if I release the fish I catch instead of keeping them" | | | |
| FV32_Rights | "Fish have as much right to exist as humans" | Biocentric | | Environment views as an antecedent of behaviour /cognitive hierarchy |
| FV33_Needs | "Humans have a right to change the natural world to suit their needs" | Anthropocentric | | |
| FV34_Value | "Fish are valuable in their own right, regardless of people" | Biocentric | | |
| FV35_Rule | "Humans were meant to rule over the rest of nature" | Anthropocentric | | |
| FV36_Nature | "Humans are not more important than other parts of nature" | Biocentric | | |
| FV37_Managed | "Fish should primarily be managed for human benefit" | Anthropocentric | | |
| FV38_Interfere | "When humans interfere with nature it often produces disastrous consequences" | Awareness of consequence | | |
| FV39_Abusing | "Humans are severely abusing the environment" | Awareness of consequence | | |
| FV40_Catastrophe | "If things continue on their present course, we will soon experience an ecological catastrophe" | Awareness of consequence | | |
| FV41_Protect | "We anglers do not do enough to protect aquatic ecosystems" | Awareness of Responsibility | | |
| FV42_Qualified | "We anglers are well qualified to manage and protect aquatic ecosystems" | Awareness of Responsibility | | |
| FV43_Ecosystems | "We anglers should be willing to change our present angling behaviour to protect aquatic ecosystems" | Awareness of Responsibility | | |

All statement-based variables were measured using a five-point Likert scale: (1) very strongly disagree; (2) disagree; (3) neither disagree or agree (neutral); agree (4); or strongly agree (5). Continuous data were collected for variables FV1_Days, FV2_spend and FV3_Dist. In order to replicate categorical (ordinal) data type as per, continuous data were subsequently stratified into ordinal segmentations. Quartiles were initially used to segment the continuous data, however in some cases the data required adjustment to ensure adequate numbers in each category. For this reason, quartile segmentation was only used for FV2_Spend. Variable FV1_Days was segmented as follows: less than 10; 11-20; 21-30; and, 31 and greater. Variable FV3_Dist (miles) was segmented as follows: less than 10; 11-40; 41-80; and, 81 and greater.¹¹

Although the total number of variables in Table 10 is rather large (n=43), there should be at least five times the number of cases (respondents) compared to observable variables. This reduces the chance of overfitting the data (i.e. revealing latent constructs that are sample-specific) and suggests suitability for factor analysis. The sample met this criteria: $472/43=10.97$, meaning there is sufficient number of required cases (respondents).

2) *Multivariate outliers*

As with most data preparation, it is important to identify combinations of responses across variables at a case level that represent truly aberrant patterns compared to generalisations in the wider sample (i.e. multivariate outliers). Including outliers in the sample risks skewing findings. However, omitting outliers reduces the generalizability of findings: judgements based on individual case characteristics are required when outliers are identified (Tabachnick and Fidell 2014). Hair et al. (2014) suggested that the Mahalanobis D^2 measure is the most suitable statistical approach to identify for multivariate outliers in preparation for factor analysis. The method calculates each case's responses against the mean centre of all cases (general distribution). The larger the D^2 , the further away that case is from the mean of all

¹¹ Subsequent factor analysis showed no impact in changing the structure of post-stratified continuous data.

cases. D^2 values are divided by the number of variables selected factor analysis (in this study, $n=43$) to represent an approximate t -value. Hair et al. (2014) suggests that for larger samples, t -values larger than 3 or 4 (with a level of significance at 0.001) are considered multivariate outliers. In this sample, the largest t -value was calculated at 2.8, indicating that there were no multivariate outliers that required consideration for exclusion from the sample. The sample therefore remained at $n=472$, which is far greater than the minimum number needed for conducting factor analysis ($n=100$) (Hair et al. 2014).

3) *Calculating input data (factorability)*

The variables were initially selected ($n=43$) and the sample size (cases or number of observations) was confirmed ($n=472$). This met the initial (preferable) criteria for conducting factor analysis (Hair et al. 2014). Factor analysis is inherently a test of co-variance, therefore there must be a good degree of multicollinearity among variables with the sample to begin with, i.e. evidence of correlation between several independent variables (Hair et al. 2014). While it is understood from previous literature that there is a degree of underlying structure (relationships) within the variables selected, testing for multicollinearity ensures that the critical amount of intercorrelations exists to perform a reliable factor analysis (Hair et al. 2014). Four techniques were used to assess the degree of multicollinearity and intercorrelations in the sample:

Visual inspection of the correlation matrix: factorability of the data is appropriate if visual inspection of the correlation matrix reveals an adequate number of correlations; these can be both positive and negative: ± 0.30 (Urquhart 2009; Hair et al. 2014). Excessive multicollinearity may also occur where two or more variables correlate exactly; again, these can be negative and positive: ± 0.90 (Urquhart 2009; Hair et al. 2014). The correlation ranges required are therefore: -0.9 to -0.3 and 0.3 to 0.9. Inspection of the correlation matrix revealed no variables with correlation values above ± 0.90 . However, two variables showed no correlation with any other variable, and were therefore removed from the dataset: FV3_Distnace and FV42_Qualified. The dataset set now included 41 variables.

Partial correlations: factorability of the data is also dependant on low levels of partial correlations. A partial correlation is a relationship between variables that is unexplained when the other variables are considered. When 'true' factors exist in the data, the number of partial correlations should be small, less than .70 per variable (Hair et al. 2014). Visual inspection of the data did not reveal partial correlations in the refined dataset of 41 variables (at either 0.70 or -0.70).

Sphericity and Adequacy: The significance of overall correlation among the variables (n=41) was adequate, with Bartlett test of sphericity measuring 7700.447 (Chi-square at <0.001). It must be noted, however, that high sphericity scores are expected with large sample such as this (Hair et al. 2014). In order to overcome this flaw, a measure of sampling adequacy (MSA) was also used to assess overall intercorrelations among the dataset in its entirety. The MSA scores the data from 0 to 1, with 1 meaning that there is perfect prediction between variables without error. MSA scores at a dataset level must exceed 0.50 (Hair et al. 2014). The overall Kaiser-Meyer-MSA value (n=43) was 0.850. This value is subject to change as a result of the sample size or number of variables increasing and/or factor extracted reduced, therefore it was also important that individual variables met eligibility of 0.50 throughout the analytical process. The lowest score among individual variables was 0.669 (n=41).

Communalities: these values show the percentage of variance in a variable explained by all factors at a given stage. Low communalities (<0.50) should be removed from the variable set (Urquhart 2009; Hair et al. 2014). Of the 41 variables, four variables were identified with communality coefficients of <0.50. They were subsequently removed in order (lowest first) until all variables were >0.50. As a result of the sequential removal, a further four variables were omitted from the dataset: FV2_Spend; FV19_Skill; FV33_Needs; and, FV36_Nature.

4.4.2 Factor extraction

The above processes left 37 variables in the dataset. At this stage, the dataset was suitable for factor analysis: the KM-MSA remained at a very good level (.846);

sphericity measured at 7090.587 (sig. <0.001); the lowest individual MSA was 6.60; there were no partial correlations; all variables in the correlation matrix had at least one correlation at ± 0.30 ; and all variable communalities were also above 0.50.

Principal component analysis was used to extract the factors. Although there are varying extraction methods, Hair et al. (2014) suggested that the principal component technique is the most appropriate when the primary aim is to reduce the number of variables into the smallest number of factors (based on 30+ variables). Choosing how many factors to extract is a key question in factor analysis and involves understanding the statistical definition of a 'factor'. Factors are hierarchical representations of the best linear combination of variables that account for more variation among the dataset than any other linear combination (based on a line of regression). The first factor is the best linear fit, the second factor is the second-best linear combination, after the first combination is extracted. The factoring process will continue to explain the remaining variance in order until the amount of variance get smaller and smaller. In this process, the first few factors will account for maximum variance. The point of 'factoring' is to draw a stop line where the maximum amount of variance across the dataset is explained with fewest factors.

The decision on how many factors are relevant for extraction is based on bespoke tests (discussed below) and prior knowledge of the theoretical underpinnings and expected number of plausible relationships. In relation to the latter, Table 10 demonstrated that there are at least four theoretical bases where the variables used in the survey derive: specialisation; involvement; attitudes to catch; and environmental views. Each of the areas have a cumulative total of thirteen sub dimensions (e.g. biocentrism). Therefore, prior to discussing the statistical process for identifying how many factors to extract, it was safe to assume that there should be no more than 13 and above 4.

Latent root: this method (relevant for studies with variables numbering between 30-50, Hair et al. 2014) stipulates that identified factors should account for the variance of at least one variable for its inclusion in factors solution. Each variable is given a value which reflects the variables association with identified factors (an *eigenvalue* or latent root). An eigenvalue of 1 is deemed an appropriate point for retaining a

variable in the factor solution; factors having latent roots below 1, are removed. The extraction identified 11 factors with eigenvalues at 1 or above, accounting for 67.9% of variance in the sample. This level of total variance is acceptable: at least 60% in the social sciences (Hair et al. 2014).

Scree plot: this test plots latent roots against number of factors, on a shaped curve. Where the curve flatten indicates the maximum number of factors suitable for extraction from the data. The visual analysis of the scree plot was consistent with the latent root values, indicating the suitability of extracting 11 factors.

Extracting factors is dependent on the degree each factor can explain variance. The extent to which each variable loads onto a factor (the coefficient value) is dependent on the number of variables in the factor analysis ($n=37$). Hair et al. (2014) suggests that for samples larger than 350 (in this case the sample is $n=472$), factor loadings of 0.30 are adequate, although 0.55 is desirable. A more specific calculation of the coefficient threshold is suggested by McKeown and Thomas (1988): this calculates the loading cut off (significance level) at 2.5 times the standard error ($1/\sqrt{N}$ (where N = number of variables), which was ± 0.41 for this study. Based on this, the factors were extracted using an orthogonal rotation method (VARIMAX in SPSS¹²). Unrotated factor loadings firstly establishes best fit linear relationship (maximum variance) as the first factor, meaning that the first factor often is too broad and conceptually difficult to define (because of the large number loading variables). The remaining factors present the residual variance from the first factor. Orthogonal rotation (preferred to oblique methods) is most suitable where the primary goal is data/variable reduction because it redistributes the variance from previous factors onto subsequent factors, therefore producing a more meaningful and easier-to-define set of latent constructs (Hair et al. 2014).

¹² VARIMAX is considered the most successful method of orthogonal rotation (compared to QUARTIMAX and EQUIMAX) because it focuses on ranging the values on the column section of the output (i.e. the component or factor). Therefore, each factor has a range of associations with 1 meaning an association between variable and factor. Because of this, the chance of a factor having more than one loading variable is reduced. Other methods use the same logic but on the rows of the output (the variable), but this means there is a chance that the variable loads onto multiple factors or components, which as discussed above, is problematic in terms of or structure and factor definition. VARIMAX therefore produces a more simplified factor structure.

Hair et al. (2014) suggests that at this stage, an initial review of rotated factor loadings should take place to identify cross-loading variables (i.e. those that statistically load onto two or more factors) and/or variables that do not load onto any factor according to the coefficient threshold. Because each variable must be incorporated into the definition of the factor, cross loading blurs the conceptual structure of the factor solution (i.e. reduced set of variables that account for maximum variance). It is therefore appropriate to decide whether to remove the variable from the dataset. In this study, at this point, one variable (FV14_Identity) cross-loaded onto two factors, in an otherwise conceptually and structurally strong factor solution. Hair et al. (2014) suggests removing the cross loaded variable and re-running the factor extraction in this scenario to assess the impact of removal. After the removal of FV_14, leaving 36 variables, one variable (FV15_Look) then failed to meet the loading threshold on any of the factors and was subsequently removed (coefficient threshold of ± 0.42 at both stages), leaving 35 variables. This revealed a further cross loading (variable FV13_Myself), which was removed, and analysis re-run based on 34 variables (threshold now at ± 0.43). At this stage, there were no cross loadings, all variables then loaded onto 10 factors explaining 67.5% of total variance. All variable communalities were above 0.50.

At this point, a judgement was made regarding the factor extraction based on 34 variables because one factor (10) only had two loading variables (see below). It has been recommended that factors have at least three loading variables (Hair et al. 2014). However, this recommendation is directed at scenarios where the identification of a factor structure within the data is primary end goal. In this study, the factor analysis is a precursor to the ultimate goal of clustering cases (i.e. respondents) in the sample based on the factor scores (essentially using these scores as new variables). Because the clustering process is focused on cases, not variables, and as long as there is more than one loading variable, a component with two loading variables can be used to form a factor as long as it is conceptually appropriate. Relatedly, there is another more important reason to retain a factor solution involving components with only two loading variables. Because the research aimed at assessing the best way to measure heterogeneity among anglers, the survey covered a wide range of metrics, ranging from attitudes (e.g. towards the environmental protection) through to measured behaviours such as

avidity. Every effort was made to ensure the survey was accessible and to reduce the likelihood of user drop out each conceptual area could only be addressed very briefly: for example, environmental protection could only be measured through three Likert based statements. In this scenario, while a factor analysis may identify only two of these statement as loading onto the biocentrism factor suggesting its omission from the component solution, in practical terms, the two statements represent (an acceptable) two-thirds of those presented in the survey that logically relate to this concept.

The factor solution included 34 variables reflecting 67.5% of total variance (eigenvalue of 1.0 for all factors, see Table 11). Variable communalities remained at +.50, the KM-MSA was very good (0.832), Bartlett test was sufficient (6450.350; sig. <0.001), all variables showed at least one correlation coefficient at ± 0.30 , the lowest individual MSA was +6.74, and there were no partial correlations. The 10 factor solution also showed a string conceptual fit to assumptions made about the data based on previous studies (discussed subsequently).¹³ Total variance for the factor solution is shown in Table 11.

Table 11: Total variance explained for the 10 factors (Eigenvalues)

| Component | Total | % of Variance | Cumulative % |
|-----------|-------|---------------|--------------|
| 1 | 6.472 | 19.034 | 19.034 |
| 2 | 3.657 | 10.756 | 29.790 |
| 3 | 2.970 | 8.736 | 38.526 |
| 4 | 1.945 | 5.720 | 44.246 |
| 5 | 1.674 | 4.922 | 49.168 |
| 6 | 1.521 | 4.475 | 53.643 |
| 7 | 1.349 | 3.968 | 57.611 |
| 8 | 1.224 | 3.601 | 61.212 |
| 9 | 1.097 | 3.228 | 64.439 |
| 10 | 1.047 | 3.079 | 67.519 |

It is important to highlight the variables that were omitted from the described process where previous assumptions about the data may have indicated inclusion. Most of

¹³ The factor lost in the component limitation process was awareness of environmental responsibility (only two loading variables).

variables omitted from the original set of 43 span across the dimensions outlined in Table 11. However, they also included FV2_Spend, FV3_Distance and FV19_Skill. The former two variables were subject to post stratification to convert the continuous data into ordinal categories. To test whether the post stratification of this data (discussed earlier) had an impact on the factor analysis, different categorisation strategies were employed (e.g. quartiles and adjusted groupings were tested in various renditions of the factor analysis). The alternate grouping strategies did not make a difference to the outcomes, and the significance testing techniques described above (e.g. communality values) still omitted these variables from the factor solution.

4.4.3 The factor solution

10 factors, involving 34 variables, explained 67.1% of total variance among the sample in this study, providing the best description of the interrelationships between the data. A summary of variables loading onto the 10 factors is given in Table 12 (the factor solution):

Table 12: Factor solution including 34 variables

| Variable label | Description (survey question / statement) | Factor loading |
|-----------------------------------|---|----------------|
| Factor 1: Central to life | | |
| FV1_Days | On how many days in the last 12 months have you gone recreational sea angling? | 0.708 |
| FV4_Organised | "I find that a lot of my life is organized around recreational sea angling" | 0.784 |
| FV5_Central | "Recreational sea angling occupies a central role in my life" | 0.840 |
| FV6_Preference | "To change my preference from recreational sea angling to another recreation activity would require major rethinking" | 0.727 |
| FV10_Enjoy | "Recreational sea angling is the most enjoyable thing I can do" | 0.711 |
| FV11_Important | "Recreational sea angling is very important to me" | 0.714 |
| FV12_Satisfying | "Recreational sea angling is one of the most satisfying things I can do" | 0.702 |
| Factor 2: Keep and consume | | |
| FV29_Eat | "I usually eat the fish I catch" | 0.889 |
| FV30_Keep | "I want to keep the fish I catch" | 0.897 |
| FV31_Thinking | "I'm just as happy if I release the fish I catch instead of keeping them" | -0.746 |

| Factor 3: Identity | | |
|--|---|--------|
| FV16_ Seeing | "You can tell a lot about a person by seeing them take part in recreational sea angling" | 0.793 |
| FV17_ Says | "Participating in recreational sea angling says a lot about who I am" | 0.784 |
| FV18_ Want | "When I participate in recreational sea angling people see me the way I want them to see me" | 0.750 |
| Factor 4: Biocentrism | | |
| FV32_ Rights | "Fish have as much right to exist as humans" | 0.726 |
| FV34_ Value | "Fish are valuable in their own right, regardless of people" | 0.702 |
| FV35_ Humans | "Humans were meant to rule over the rest of nature" | -0.716 |
| FV37_ Managed | "Fish should primarily be managed for human benefit" | -0.666 |
| Factor 5: Awareness of environmental impact | | |
| FV38_ Interfere | "When humans interfere with nature it often produces disastrous consequences" | 0.767 |
| FV39_ Abusing | "Humans are severely abusing the environment" | 0.845 |
| FV40_ Catastrophe | "If things continue on their present course, we will soon experience an ecological catastrophe" | 0.818 |
| Factor 6: A 'catch' orientation | | |
| FV20_ No-fish | "A fishing session can be successful even if no fish are caught" | -0.803 |
| FV21_ Any-fish | "If I thought I wouldn't catch any fish, I wouldn't go fishing" | 0.736 |
| FV22_ Some-fish | "When I go fishing, I'm not satisfied unless I catch at least something" | 0.749 |
| Factor 7: Friendship | | |
| FV7_ Friends | "Most of my friends are in some way connected with recreational sea angling" | 0.720 |
| FV8_ Discuss | "I enjoy discussing recreational sea angling with my friends" | 0.784 |
| FV9_ Opportunity | "Participating in recreational sea angling provides me with an opportunity to be with my friends" | 0.824 |
| Factor 8: Catch Numbers | | |
| FV23_ More-fish | "The more fish I catch, the happier I am" | 0.785 |
| FV24_ Many-fish | "A successful fishing session is one in which many fish are caught" | 0.779 |
| FV25_ Others | "I'm happiest with a fishing session if I catch more than other anglers around me" | 0.673 |
| Factor 9: Catch characteristics | | |
| FV26_ Rather | "I would rather catch 1 or 2 big fish than 10 smaller fish" | 0.800 |
| FV27_ Challenge | "I'm happiest with a fishing session if I hook a fish that is challenging to catch" | 0.755 |
| FV28_ Chance | "I like to fish where I know I have a chance to catch a trophy fish" | 0.685 |
| Factor 10: Environmental protection | | |

| | | |
|-----------------|---|-------|
| FV41_Protect | "We anglers do not do enough to protect aquatic ecosystems" | 0.786 |
| FV43_Ecosystems | We anglers should be willing to change our present angling behaviour to protect aquatic ecosystems" | 0.662 |

The interpretation of each factor is described below.

Factor One: Central importance to life: This factor accounted for 19.0% of the variance. The factor is strongly characterised by the 'central' role that recreational sea angling plays in anglers' lives. This is further reflected in the high levels of importance, satisfaction and enjoyment associated with RSA, and an increased level of behavioural commitment measured through the number of days fished over 12 months.

Factor 2: Keep and consume: This factor accounted for 10.8% of the variance. The factor is characterised by anglers that are highly likely to keep and eat the fish they catch. Supporting this inclination, the negative loading for FV31_Thinking indicates that such anglers disagree with idea that happiness results from releasing fish.

Factor 3: Biocentrism: Factor 3 accounted for 8.7% of the variance, with anglers placing high value and importance on non-human life within the natural environment. Supporting this sentiment, the negative loadings for FV35_Human and FV37_Managed, suggested that such anglers disagree with statements supporting human supremacy over other parts of nature.

Factor 4: Identity: This factor accounted for 5.7% the variance. The factor is characterised by those who associate their RSA involvement with expression their self-identity. Expression of identity suggests that anglers used the activity as a vehicle to convey their image of 'self' to other around them. The activity therefore reflects something the angler deems of great importance as it reflects a state of being, or self, with which they want to associate closely.

Factor 5: Awareness of environmental impact: This factor accounted for 4.9% the variance. High loading statements on this factor were associated with anglers who clearly recognised the impacts humans are having on the natural environment.

Factor 6: A 'catch' orientation: This factor, accounting for 4.5% of the variance, placed emphasis on the role of catching fish when angling. As showed in Chapter Two, there are many reasons why anglers fish and many aspects of the experience that anglers prioritise, including those related to 'catching' and those related to 'non-catch' benefits such as relaxation. This factor specifically highlights anglers that prioritise the experience of simply 'catching' a fish (regardless of quantity or quality). Supporting this, the negative loading on FV20_No-fish indicates that such anglers disagree with the premise that success can be obtained without catching fish.

Factor 7: Friendship: This factor accounted for 4% of the variance. The factor is associated with those who form and maintain friendships (or social bonds) as a result from participating in recreational sea angling.

Factor 8: Catch numbers: This factor accounted for 3.6% of the variance in the sample. High loading scores on this factor were associated with anglers who place importance on catching greater quantities of fish (often compared to peers).

Factor 9: Catch characteristics: This factor accounted for 3.2% of the variance. Anglers scoring highly on this factor place value on the quality or characteristics of the fish they catch, whether this is regarded as large fish, fish than provide a sporting challenge to catch, or specimen sizes depending on the species caught.

Factor 10: Environmental protection: This factor accounted for 3.1% of the variance. High loadings on this factor were associated with the view that anglers should do more to protect the natural environment.

To develop the typology of anglers using the condensed variables set, the factor scores were subject to cluster analysis, discussed in the next section.

4.5 CLUSTER ANALYSIS

Factor analysis grouped variables into 10 latent constructs. The purpose of the cluster analysis is to use these constructs (factors) to group cases (respondents) into the most appropriate solution (typology) that describes heterogeneity among anglers through identifying homogenous subgroups in the sample, representing 'inter-object' similarity (Hair et al. 2014). As a formal precursor to all work involving cluster analysis, Hair et al. (2014) recommends the careful formulation of precursor questions. For this process, the questions were: is there heterogeneity among angler in the sample? If so, how many distinct segmentations or clusters of anglers are there, and, how is each cluster defined (in order to present a 'real world' typology of anglers)?

It is worth highlighting here that clustering factors is an established technique (Hair et al. 2014). The method used in this study involves clustering the factors using a regressed score. Clustering techniques are not suitable for use with raw Likert scale responses (as used in the survey) because individuals may have interpreted the scales slightly differently, meaning the distance between responses across variables used to form the factors cannot be quantified by (such) absolute values. Factor variables limits these inconsistencies and standardises the combined measures into a singular (regressed) score with 0 representing the line of best fit for respective factors, and individual case values representing deviation from the centre point.

This section presents the results of the stages involved in performing the cluster analysis. The stages involved in the cluster analysis process is presented in Figure 18.

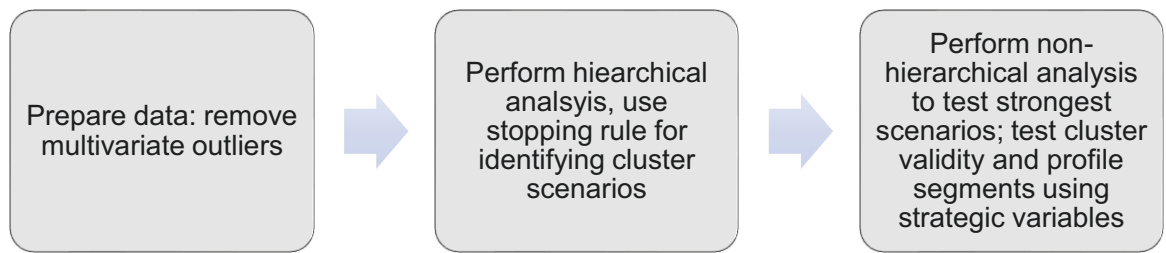


Figure 18: Cluster analysis process

4.5.1 Cluster analysis data preparation

Multivariate outliers across the 10 factor scores were identified using Mahalanobis D^2 . Because the number of cases in the sample exceeded 80, a cut off t-value of 4 was used to identify outliers, based on the D^2 score divided by the number of variables (in this case, 10 factors). One case exceeded the cut off (value: 6.4), and was omitted from the sample, leaving 471 cases at this point for cluster analysis. Factor scores at ± 3.0 were also deemed as outliers and omitted from the study ($n=18$). This left 453 cases for cluster analysis. The final stage in data preparation involved checking that there was no correlation (above 0.8) between the factor score variables, as this would skew the cluster analysis. A Pearson's correlation matrix was processed and revealed no values higher than 0.8.

4.5.2 The clustering approach

The purpose of clustering it to partition the data (cases/respondents) into the most suitable number of segmentations (two or more) to establish inter-object similarity. The most suitable typology must satisfy the balance between enough homogeneity within segments or clusters to enable easy definition, but enough difference (heterogeneity) between segments to warrant separation from other clusters. Added to this complexity is the need to develop a typology with enough segments to explain differences in the sample, but not too few segments through which variation in the sample is lost. Conversely, a typology with too many segments would likely lead to

problems in easily defining the distinguishing features of each cluster. For these reasons, the clustering process involves considering different cluster scenarios and alternate methods of working out how many clusters represent the most suitable for typology purposes.

The first things to consider, however, is how to measure 'similarity'. There are a number of ways to measure the similarity between objects. Less frequently used is the correlational measure, which focuses on the pattern of correlation values between cases. However, this does not account for the magnitude of correlation, which is the primary purpose of this cluster analysis. Distance measures, however, take into account similarity magnitude and measures the proximity of observations in the cluster variate (Hair et al, 2014). Several distance measures of proximity are used in cluster analysis. The 'Euclidean distance' measures the distance between coordinates (reflecting cases and multiple variables) in a geometric space reflecting the landscape of factors dimensions; it measures the hypotenuse of a right triangle (Hair et al. 2014). The squared Euclidean distance (sum of squared differences excluding the squared root - SED) is used in this study because it speeds up computation and is the recommended measure in multiple algorithms used to defined cluster similarities in SPSS, including Ward's method (see below). The SED is applied to factor scores (standardised) for each case (respondent).

The final stage in the clustering approach involved processes and decisions regarding the selection, numbering, and definition of clusters (partitioning). This is achieved through both hierarchical and non-hierarchical techniques (Hair et al. 2014). Hierarchical clustering (algorithmic) initially places each case into an individual cluster and then sequentially merges (through the process of nesting) all cases into one large cluster. Partitioning is then applied to select the most appropriate number of clusters that provide the best description of heterogeneity among the wider sample, with the most homogeneity among individual clusters (Hair et al. 2014). Hierarchical clustering is a reductive process; therefore, it can be seen as an exploratory technique to establish how many clusters provide the solution for explaining heterogeneity and homogeneity with a sample of cases (respondents). The number of clusters chosen, however, is dependent on several factors, including user interpretation of the results. The number of hierarchical clusters is then tested

in non-hierarchical analysis. Non-hierarchical techniques formulate the cluster solution with the researcher specifying the desired number of clusters beforehand; by testing a number of different solutions specified by the researcher, the technique finds the best clustering solution for responses to the specified variables (Hair et al, 2014). In this study, hierarchical methods were used to identify the preliminary cluster solution (number of clusters); this was then used in non-hierarchical clustering (employing seeds points) to finalise the cluster solution. More details on each of these methods is presented in respective subsections.

4.5.3 Hierarchical clustering

This method was used to explore likely numbers of clusters that provided the best solution for describing heterogeneity and homogeneity in the sample. This was achieved by analysing the cluster coefficients and dendrogram produced for the 10 factors.

A key part of the hierarchical clustering technique is choosing the most appropriate algorithmic similarity measure to use when interpreting how the clusters have been formed (Hair et al. 2014). Three of the most appropriate measure used in this scenario are the: single linkage method (which defined clusters by the shortest distance from any case in one cluster to any other case in any other cluster; average linkage (the average similarity of all cases in one cluster compared to another); and the ward method (based on the sum of squares with a cluster). The latter is useful when seeking to produce a cluster solution with equal numbers across groupings (Hair et al. 2014).

All three methods were processed on the sample and the greatest coefficient percentage change was analysed as the number of clusters started to reduce lower than 10.¹⁴ The coefficient measures the degree of difference between segments at each merger stage. The stopping rule suggests that the most appropriate number

¹⁴ The coefficients measure the degree of distinctiveness between clusters, therefore as each staged merger takes place, the percentage change between each stages' coefficient reflects the degree to which distinctiveness between clusters increases. Therefore, bigger the percentage change, the more likelihood that the cluster number after the step has taken place will show better distinction between segments.

of clusters in a solution is where the coefficient percentage change is highest (or uncharacteristically high in the trend of changes) as the cluster number is reduced in the hierarchical order; the number of clusters given after the high percentage change is the recommended number of segments in the final solution; high percentage increases in the coefficient at the point of cluster merging suggests that the solution, and the merging of the two clusters in question, are stronger as a result of being merged (Hair et al. 2014). In regards to the three linkage methods, Ward's was deemed the least suitable regarding the stopping technique in this scenario as the percentage changes were consistent and small at intervals at <10 solutions. As shown in Table 13, the most apparent percentage changes were visible using the average linkage (between groups) method. Note: this interpretation excludes the notion of a solution based on two clusters, as this would not show sufficient variation in the data for taxonomy purposes (Hair et al. 2014).

Table 13: Stopping rule for hierarchical cluster analysis (average link method)

| Stage | Number of clusters before joining | Number of clusters after joining | Coefficient value | % Increase to the next stage |
|-------|-----------------------------------|----------------------------------|-------------------|------------------------------|
| 444 | 10 | 9 | 23.36764 | 2.557422 |
| 445 | 9 | 8 | 23.96524 | 2.203885 |
| 446 | 8 | 7 | 24.49341 | 6.346976 |
| 447 | 7 | 6 | 26.048 | 2.288654 |
| 448 | 6 | 5 | 26.64415 | 7.705979 |
| 449 | 5 | 4 | 28.69734 | 2.801841 |
| 450 | 4 | 3 | 29.5014 | 22.17348 |
| 451 | 3 | 2 | 36.04288 | 12.0618 |
| 452 | 2 | 1 | 40.39031 | |

Note: red text highlights key data

Table 13 indicated that the stopping rule in this scenario suggests a 6, 4 and 2 segment cluster solution, percentage changes of 6.3%, 7.7% and 22% retrospectively. The single linkage method also revealed a recommended four cluster solution, in addition to a three-cluster solution (with a strong percentage change of 24.3%). The stopping rule, included all linkage methods, therefore suggested that cluster solutions of 6, 4, 3 and 2 may be appropriate for describing variance among cases in the sample according to the 10 factors. At this point, the

data was checked to ensure that adequate number of anglers were spread across each cluster; this is key for subsequent analysis, where the clusters are profiled. Ward's linkage method was used for this process as it produces more even clusters compared to average or single link methods. Table 14 shows that most clusters have adequate numbers. The lowest number of anglers in a cluster is 36, followed by 53 (n=2).

Table 14: Cluster scenario numbers (Ward method)

| Cluster number | 6 clusters | 4 clusters | 3 clusters | 2 clusters |
|----------------|------------|------------|------------|------------|
| 1 | 74 | 215 | 215 | 359 |
| 2 | 105 | 53 | 144 | 94 |
| 3 | 53 | 94 | 94 | |
| 4 | 94 | 91 | | |
| 5 | 36 | | | |
| 6 | 91 | | | |
| Total | 453 | 453 | 453 | 453 |

The next stage involved identifying which cluster solution (6, 4 or 3) offered the best description of diversity among the sample. While defining the clusters is saved for detail later in the section, the comparisons between solutions is the principal aim at stage. The comparison benchmarks each cluster scenario against each other in identifying the solution (or cluster number) that best represents a set of easily definable cluster segmentations, just small enough in number to ensure a taxonomy where variation is not lost in the conceptual areas for each factor, but large enough in number to ensure that variation between segments is easily defined without lengthy intricacy in respective descriptions. To achieve this, ANOVAs were generated across the cluster solutions focusing on the means of the factor scores, which represents the cluster centroids (process followed by Hair et al. 2014). Please note that the factors (see previous section) are expressed as regressed scores in which each case (respondent) is assigned a value that represents their deviation from the line of best fit (point '0') for that respective factor. The means below (essentially, cluster centroids) are based on means of these scores. The greater the distance from 0, the more that cluster (or group of anglers) is distinguished from the mean score of all anglers in all clusters across the sample for that factor. The data,

(presented in Tables 15, 16, 17, 18 and Figures 19, 20, 21, 22) show where variation is lost as the cluster number changes. Additionally, the ANOVA scores highlighted where there was statistically significant differences across clusters for each factor.

Table 15: Two-cluster solution by cluster (factor) variable means

| Cluster variable | Factor score means (F and Sig) | | | |
|---------------------------|--------------------------------|-------|-------|------|
| | 1 | 2 | F | Sig |
| F1: Central to life | -0.09 | 0.33 | 13.80 | 0.00 |
| F2: Keep and consume | 0.04 | -0.12 | 2.22 | 0.14 |
| F3: Identity | 0.08 | -0.38 | 17.92 | 0.00 |
| F4: Biocentrism | 0.12 | -0.32 | 16.67 | 0.00 |
| F5: Env. impact | -0.01 | 0.32 | 10.18 | 0.00 |
| F6: A catch orientation | 0.10 | -0.45 | 26.01 | 0.00 |
| F7: Friendship | 0.08 | -0.28 | 9.63 | 0.00 |
| F8: Catch numbers | -0.12 | 0.50 | 31.61 | 0.00 |
| F9: Catch characteristics | 0.11 | -0.35 | 17.62 | 0.00 |
| F10: Env. protection | 0.14 | -0.58 | 45.64 | 0.00 |
| Cases | 359 | 94 | n/a | n/a |

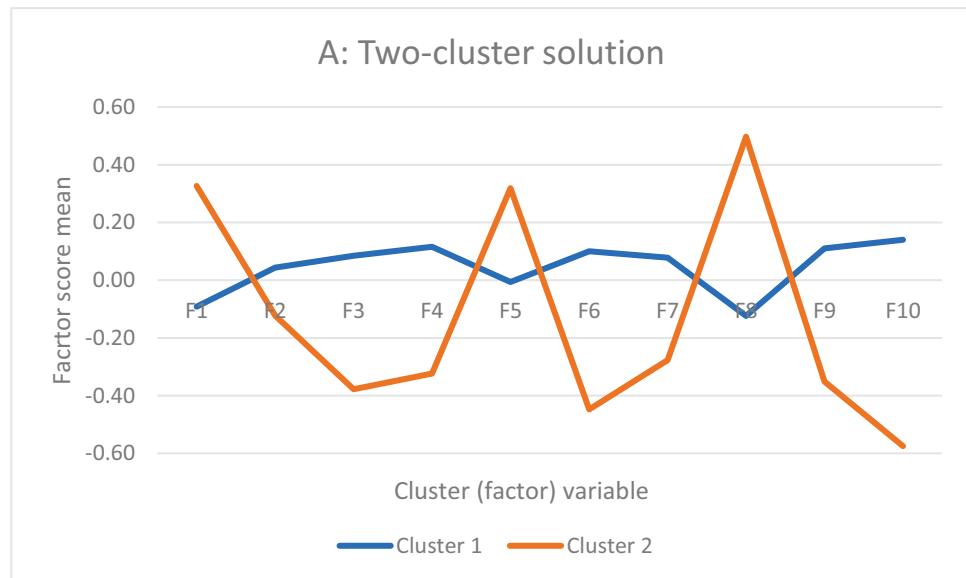


Figure 19: Two-cluster solution trend across cluster (factor) variables. Note: F1: Central to life; F2: Keep and consume; F3: Identity; F4: Biocentrism; F5: Env. impact; F6: A catch orientation; F7: Friendship; F8: Catch numbers; F9: Catch characteristics; F10: Env. protection

Table 16: Three-cluster solution by cluster (factor) variable means

| Cluster Variable | Factor score means (F and Sig) | | | | |
|---------------------------|--------------------------------|-------|-------|-------|------|
| | 1 | 2 | 3 | F | Sig |
| F1: Central to life | -0.24 | 0.12 | 0.33 | 13.13 | 0.00 |
| F2: Keep and consume | 0.27 | -0.29 | -0.12 | 16.52 | 0.00 |
| F3: Identity | -0.06 | 0.31 | -0.38 | 16.01 | 0.00 |
| F4: Biocentrism | 0.22 | -0.04 | -0.32 | 11.93 | 0.00 |
| F5: Env. impact | -0.09 | 0.12 | 0.32 | 7.49 | 0.00 |
| F6: A catch orientation | 0.22 | -0.07 | -0.45 | 17.45 | 0.00 |
| F7: Friendship | -0.21 | 0.51 | -0.28 | 30.67 | 0.00 |
| F8: Catch numbers | -0.32 | 0.17 | 0.50 | 28.71 | 0.00 |
| F9: Catch characteristics | -0.09 | 0.41 | -0.35 | 21.93 | 0.00 |
| F10: Env. protection | 0.02 | 0.32 | -0.58 | 27.84 | 0.00 |
| Cases | 215 | 144 | 94 | n/a | n/a |

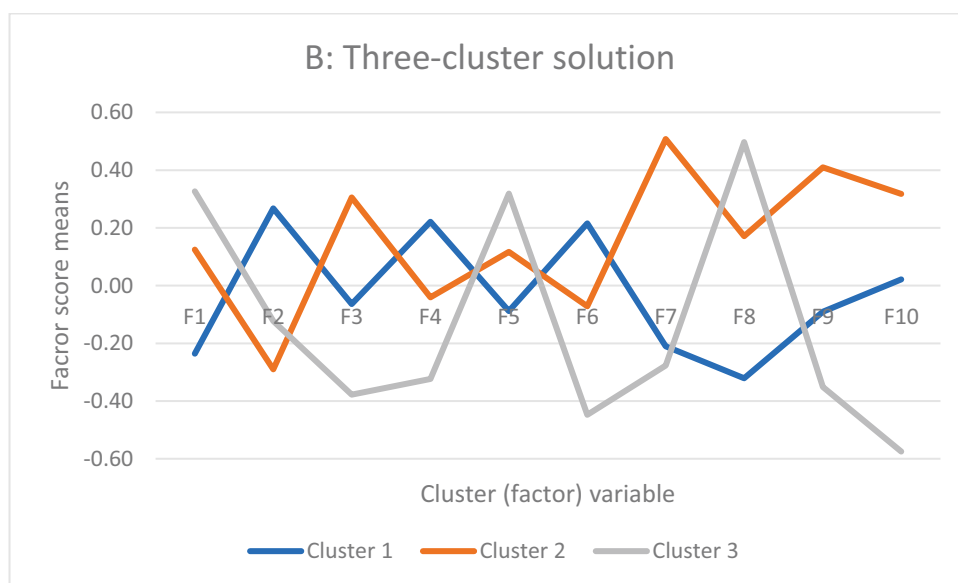


Figure 20: Three-cluster solution trend across cluster (factor) variables. Note: F1: Central to life; F2: Keep and consume; F3: Identity; F4: Biocentrism; F5: Env. impact; F6: A catch orientation; F7: Friendship; F8: Catch numbers; F9: Catch characteristics; F10: Env. protection

Table 17: Four-cluster solution by cluster (factor) variable means

| Cluster variable | Factor score means (F and Sig) | | | | | |
|---------------------------|--------------------------------|-------|-------|-------|-------|------|
| | 1 | 2 | 3 | 4 | F | Sig |
| F1: Central to life | -0.24 | 0.26 | 0.33 | 0.05 | 9.30 | 0.00 |
| F2: Keep and consume | 0.27 | 0.19 | -0.12 | -0.57 | 19.20 | 0.00 |
| F3: Identity | -0.06 | 1.15 | -0.38 | -0.19 | 40.05 | 0.00 |
| F4: Biocentrism | 0.22 | -0.51 | -0.32 | 0.23 | 15.83 | 0.00 |
| F5: Env. impact | -0.09 | 0.25 | 0.32 | 0.04 | 5.68 | 0.00 |
| F6: A catch orientation | 0.22 | -0.27 | -0.45 | 0.04 | 13.03 | 0.00 |
| F7: Friendship | -0.21 | 0.05 | -0.28 | 0.77 | 28.23 | 0.00 |
| F8: Catch numbers | -0.32 | 0.25 | 0.50 | 0.12 | 19.35 | 0.00 |
| F9: Catch characteristics | -0.09 | 0.14 | -0.35 | 0.57 | 17.23 | 0.00 |
| F10: Env. protection | 0.02 | 0.86 | -0.58 | 0.00 | 30.48 | 0.00 |
| Cases | 215 | 53 | 94 | 91 | n/a | n/a |

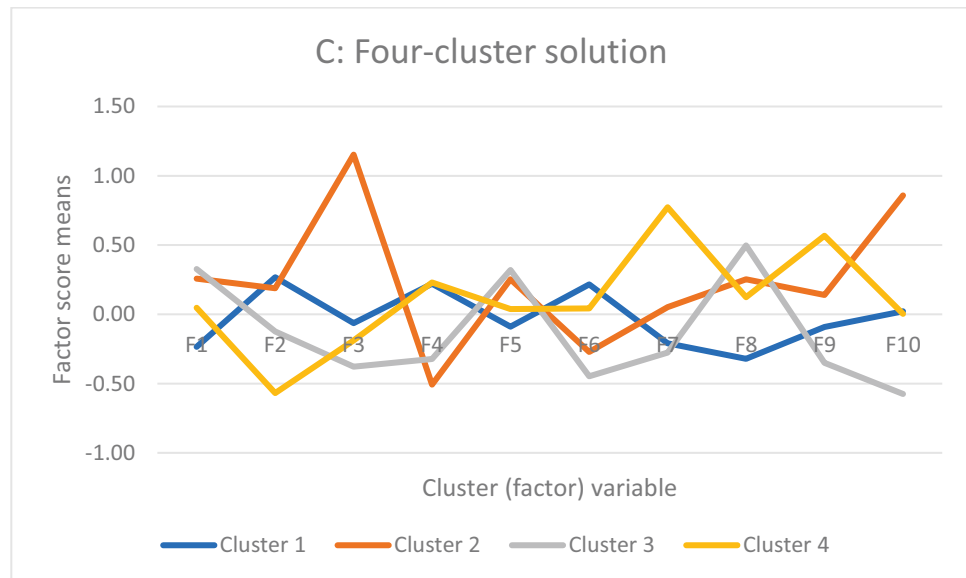


Figure 21: Four-cluster solution trend across cluster (factor) variables. Note: F1: Central to life; F2: Keep and consume; F3: Identity; F4: Biocentrism; F5: Env. impact; F6: A catch orientation; F7: Friendship; F8: Catch numbers; F9: Catch characteristics; F10: Env. protection

Table 18: Six-cluster solution means across cluster (factor) variables

| Cluster Variable* | Factor score means (F and Sig) | | | | | | | |
|-------------------|--------------------------------|-------|-------|-------|-------|-------|-------|------|
| | 1 | 2 | 3 | 4 | 5 | 6 | F | Sig |
| F1 | -0.55 | -0.05 | 0.26 | 0.33 | -0.13 | 0.05 | 8.20 | 0.00 |
| F2 | 0.45 | -0.10 | 0.19 | -0.12 | 0.98 | -0.57 | 21.93 | 0.00 |
| F3 | -0.11 | 0.02 | 1.15 | -0.38 | -0.20 | -0.19 | 24.48 | 0.00 |
| F4 | 0.27 | 0.22 | -0.51 | -0.32 | 0.12 | 0.23 | 9.61 | 0.00 |
| F5 | 0.25 | -0.38 | 0.25 | 0.32 | 0.06 | 0.04 | 8.59 | 0.00 |
| F6 | -0.35 | 0.13 | -0.27 | -0.45 | 1.61 | 0.04 | 40.09 | 0.00 |
| F7 | 0.32 | -0.77 | 0.05 | -0.28 | 0.34 | 0.77 | 39.00 | 0.00 |
| F8 | -0.76 | -0.25 | 0.25 | 0.50 | 0.38 | 0.12 | 20.72 | 0.00 |
| F9 | -0.53 | 0.26 | 0.14 | -0.35 | -0.21 | 0.57 | 18.10 | 0.00 |
| F10 | -0.04 | 0.03 | 0.86 | -0.58 | 0.14 | 0.00 | 18.46 | 0.00 |
| Cases | 74 | 105 | 53 | 94 | 36 | 91 | n/a | n/a |

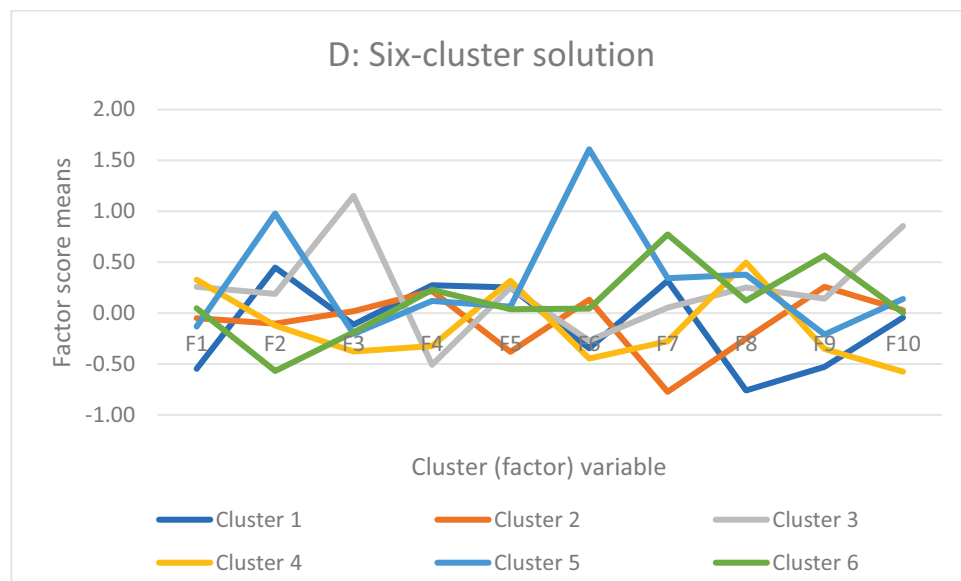


Figure 22: Six-cluster solution trend across cluster (factor) variables. Note: F1: Central to life; F2: Keep and consume; F3: Identity; F4: Biocentrism; F5: Env. impact; F6: A catch orientation; F7: Friendship; F8: Catch numbers; F9: Catch characteristics; F10: Env. protection

Moving from six clusters to four clusters involved combining cluster 1, 2 and 5. In the six-cluster solution, segments 1 and 5 show similar values for 8 of the 10 factors (F1, 2, 3, 4, 5, 6, 9 and 10); cluster two in this solution also shows similar value patterns compared to segments 1 and 5 (or both) for F1, F3, F4, F5, F6, F9 and F10. This suggests that a low level of variation is lost when moving from a six to four-cluster solution. The six-cluster solution was therefore discarded at this point because the variation exists in the four-cluster model. The six-cluster solution also had the lowest percentage difference in the average link clustering coefficients.

The four-cluster solution shows variation across segments for most factors (excluding F5, where the most similarity occurs). Moving from four to three clusters involved merging segments 4 and 2 into cluster 2 (of the three-cluster solution). However, clusters 2 and 4 show differences in values for variables F2, F3, F4, F7 and F10. Therefore, variation may be lost in this process. It is also of note that variation in solution four is only at its strongest for a few factors (e.g. F3). It is worth discussing the value of the two-cluster solution before concluding on the value of three clusters.

The two-cluster solution showed marked differences in the mean trends for each segment across the factor variables. However, the solution consisted of one large cluster of more than three-quarter of the sample. This solution therefore may not be the best way to capture the differences on a lesser scale in angler responses across variables, or the best solution to achieve the research goal of developing a typology reflecting multiple conceptual areas as demonstrated in the factor constructs. The two-cluster solution was disregarded at this point.

Moving from a two-cluster to three-cluster solution involved the separation of the former cluster one into two segments (clusters 1 and 2 respectively), therefore removing the large segmentation apparent in the two-cluster solution. These two newly formed clusters show marked differences across variables (suggesting that the split increases variation). It must be noted that while the three cluster solution shows variation across segments/variables and is supported by a strong percentage change in the clustering coefficient (discussed above), the overall range from the

mean is reduced compared to the other solutions. None-the-less, solution three shows the most marked differences between clusters out of all the solutions.

In summary, the visual presentation of cluster scenarios suggests that a three-factor solution is a likely candidate for developing a strong typology of anglers within the sample, and that a four-cluster solution may also provide explanatory value. Non-hierarchical clustering using K-mean centroids will further determine the strength of both the three and four cluster solutions for developing a taxonomy of angler in the sample.

4.5.4 Non-hierarchical clustering

The hierarchical cluster analysis resulted in two cluster solutions (3 and 4 segmentations) based on the premise that observations (cases/respondents) are not horizontally assigned to different clusters, instead they are only merged in a nested fashion the cluster number was reduced. This initial process revealed likely cluster solutions that best represented inter-group heterogeneity in the sample. Non-hierarchical clustering maximises heterogeneity between groups by allowing observations to be reallocated between clusters until maximum homogeneity is achieved within clusters. Non-hierarchical clustering 'fine tunes' the hierarchical clustering process (Hair et al. 2014).

Cluster centroids were used in a K-means analysis of both three and four-cluster solutions.¹⁵ As with the hierarchical process, the K-means were based on the regressed factor scores. The K-means process involves the arbitrary assignment of a cluster centre point which is then moved to achieve best-centre-fit to the cluster, followed by repeated mean calculations and centre point adjustments until the cluster presents optimum homogeneity. This resulted in more evenly spread segmentations when compared to cluster numbers in the respective hierarchical analysis. Similar to the process outline for the hierarchical clustering, the centre points (K-means, centroids) for each cluster in the 3 and 4 segment models were

¹⁵ Measures based on squared Euclidean distance. ANOVA F and Sig. also presented.

used to assess the potential loss of variation when moving between cluster scenarios. The is presented in Tables 19, 20 and Figures 23, 24.

Table 19: Non-hierarchical three-cluster solution centroids across factor variables

| Cluster variable | Cluster centroids for three-cluster solution | | | F | Sig |
|---------------------------|--|-------|-------|---------|-------|
| | 1 | 2 | 3 | | |
| F1: Central to life | -0.52 | 0.30 | 0.22 | 36.715 | 0.000 |
| F2: Keep and consume | 0.60 | -0.61 | -0.03 | 76.079 | 0.000 |
| F3: Identity | 0.31 | -0.26 | -0.10 | 14.680 | 0.000 |
| F4: Biocentrism | 0.51 | 0.41 | -0.76 | 143.401 | 0.000 |
| F5: Env. impact | 0.05 | 0.09 | 0.05 | 0.078 | 0.925 |
| F6: A catch orientation | 0.22 | 0.01 | -0.26 | 10.500 | 0.000 |
| F7: Friendship | 0.03 | 0.32 | -0.29 | 15.234 | 0.000 |
| F8: Catch numbers | -0.26 | 0.59 | -0.24 | 41.427 | 0.000 |
| F9: Catch characteristics | 0.00 | -0.21 | 0.22 | 7.438 | 0.001 |
| F10: Env. protection | -0.13 | -0.21 | 0.28 | 12.185 | 0.000 |
| Cases | 154 | 137 | 162 | n/a | n/a |

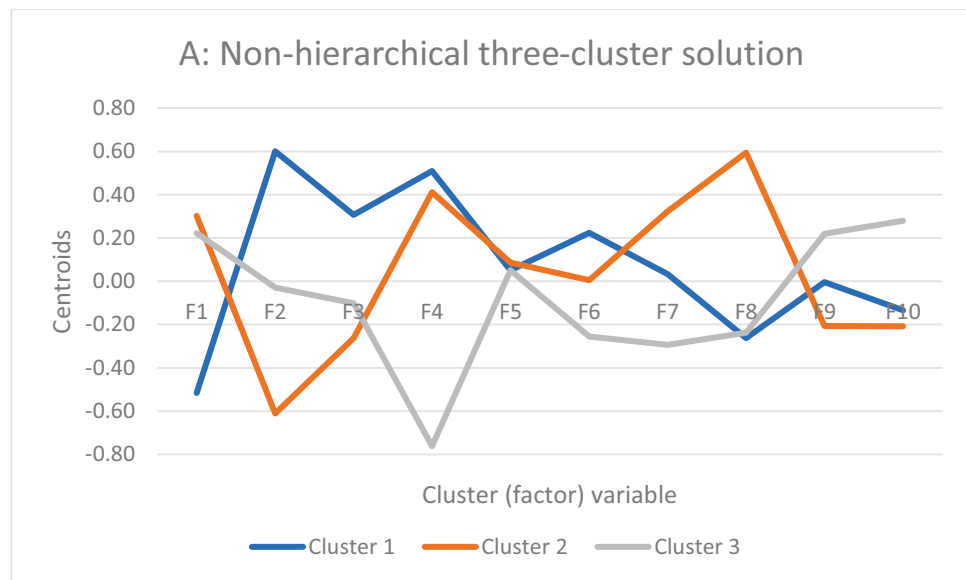


Figure 23: Non-hierarchical three-cluster solution trend (centroids) across (factor) variables. Note: F1: Central to life; F2: Keep and consume; F3: Identity; F4: Biocentrism; F5: Env. impact; F6: A catch orientation; F7: Friendship; F8: Catch numbers; F9: Catch characteristics; F10: Env. protection

Table 20: Non-hierarchical four-cluster solution centroids across factor variables

| Cluster variable | Cluster centroids for three-cluster solution | | | | F | Sig |
|---------------------------|--|-------|-------|-------|---------|-------|
| | 1 | 2 | 3 | 4 | | |
| F1: Central to life | -0.31 | 0.29 | 0.28 | -0.12 | 9.889 | 0.000 |
| F2: Keep and consume | 1.10 | -0.38 | -0.03 | -0.53 | 124.086 | 0.000 |
| F3: Identity | 0.05 | -0.06 | 0.55 | -0.38 | 22.128 | 0.000 |
| F4: Biocentrism | 0.17 | 0.50 | -0.35 | -0.09 | 15.115 | 0.000 |
| F5: Env. impact | 0.03 | 0.25 | 0.07 | -0.01 | 1.653 | 0.176 |
| F6: A catch orientation | 0.40 | 0.32 | -0.49 | -0.18 | 22.836 | 0.000 |
| F7: Friendship | 0.28 | -1.04 | -0.37 | 0.58 | 87.301 | 0.000 |
| F8: Catch numbers | -0.05 | -0.22 | -0.13 | 0.25 | 5.557 | 0.001 |
| F9: Catch characteristics | 0.01 | 0.69 | -0.82 | 0.19 | 53.075 | 0.000 |
| F10: Env. protection | -0.28 | 0.04 | 0.39 | -0.09 | 9.483 | 0.000 |
| Cases | 112 | 82 | 99 | 160 | n/a | n/a |

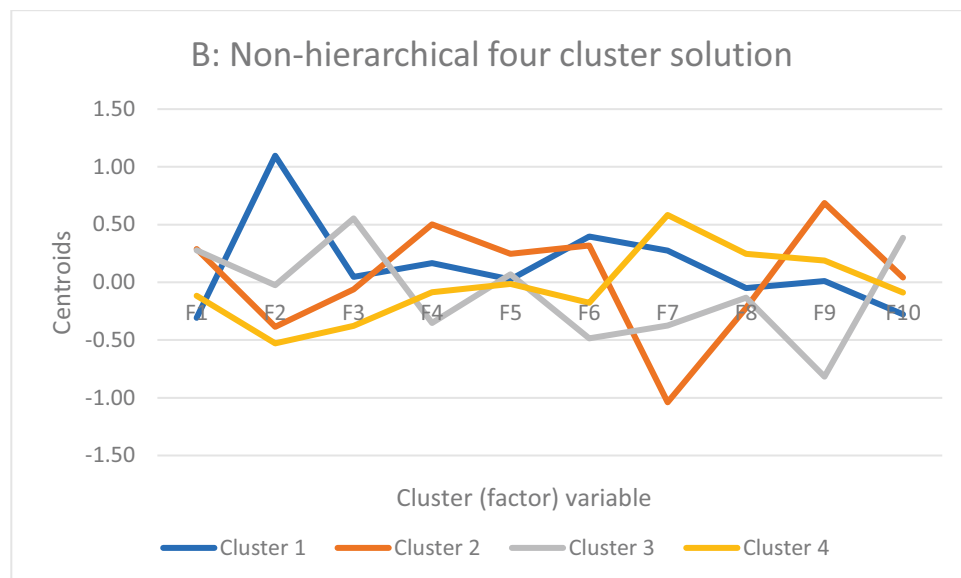


Figure 24: Non-hierarchical four-cluster solution trend (centroids) across cluster (factor) variables. Note: F1: Central to life; F2: Keep and consume; F3: Identity; F4: Biocentrism; F5: Env. impact; F6: A catch orientation; F7: Friendship; F8: Catch numbers; F9: Catch characteristics; F10: Env. protection

Cases can be reassigned in non-hierarchical clustering; therefore, it remains difficult to interpret the impact of cluster reduction (mergers) as was done in the hierarchical testing stages. What is apparent, however, is that the three-cluster

solution continues to demonstrate a greater degree of difference in the centroids across the majority of variables (excluding F5) compared to the four-cluster solution. F5 shows slightly more variation across segments in the four-cluster solution, with cluster 2 separated from the other 3 clusters, but its ANOVA score suggests these differences are not statistically significant.

The full extent to which both solutions offer optimal description of heterogeneity in the sample is explored further in the interpretation section below.

4.5.5 Cluster validity

Before interpreting and describing the profiles of the selected clusters, the validity of each cluster solution was tested to further establish the suitability of each cluster scenario. As described in this section, this involved assessing the criterion validity, which tests the predictive ability of the cluster solutions. Predictive ability confirms whether the clusters are distinct when expressed by variance in other attitudes and behaviours captured in the survey (Hair et al. 2014). Significant differences between clusters in other non-factoring variables means that the segments have predictive validity and the cluster solution is stable.

Hair et. al (2014) recommends that the selected variables for assessing criterion validity must theoretically be linked to expected differences between clusters. In practice, it remained difficult to select a variable not used in the factor/cluster analysis that held weight within previous literature and research as a predictor of any other conceptual area covered in the survey questionnaire. However, as the factors and associated variables often addressed behaviours or attitudes related to the release of, and respect towards, fish, it was assumed that this may have bearing on behaviours among anglers when handling or caring for fish taken from the water before they are released. For this reason, the criterion validity variable selected for testing the predictive validity of the cluster solutions was Q19, which asked how frequent anglers engaged in four specific behaviours when returning fish back to the water after being caught over the last 12 months (see Appendix One). In line with the approach taken by Hair et al. (2014), analysis of variance between means (of

scale responses to Q19)¹⁶ was performed using the clusters as the independent factor. The results are shown in Tables 21 and 22.

Table 21: Four-cluster solution predictive validity on catch and release behaviours

| Variable (angler behaviour) | Cluster | N | Mean | F | Sig. |
|---|---------|-----|------|-------|-------|
| Returned fish that are intended to be released back to the water as quickly as possible | 1 | 105 | 4.85 | 0.924 | 0.429 |
| | 2 | 82 | 4.79 | | |
| | 3 | 98 | 4.88 | | |
| | 4 | 158 | 4.87 | | |
| Cradled fish in water to ensure they can swim before being released | 1 | 105 | 3.78 | 3.620 | 0.013 |
| | 2 | 82 | 3.99 | | |
| | 3 | 98 | 4.09 | | |
| | 4 | 158 | 4.18 | | |
| Kept fish to be released in water while being unhooked | 1 | 105 | 2.91 | 2.667 | 0.047 |
| | 2 | 82 | 3.11 | | |
| | 3 | 98 | 3.35 | | |
| | 4 | 158 | 3.23 | | |
| Used barbless hooks | 1 | 105 | 2.61 | 5.909 | 0.001 |
| | 2 | 82 | 2.84 | | |
| | 3 | 98 | 3.11 | | |
| | 4 | 158 | 3.28 | | |

Table 22: Three-cluster solution predictive validity

| Variable | Cluster | N | Mean | F | Sig. |
|---|---------|-----|------|-------|-------|
| Returned fish that are intended to be released back to the water as quickly as possible | 1 | 147 | 4.84 | 1.112 | 0.330 |
| | 2 | 137 | 4.89 | | |
| | 3 | 159 | 4.83 | | |
| Cradled fish in water to ensure they can swim before being released | 1 | 147 | 3.95 | 0.951 | 0.387 |
| | 2 | 137 | 4.12 | | |
| | 3 | 159 | 4.03 | | |
| Kept fish to be released in water while being unhooked | 1 | 147 | 3.12 | 0.145 | 0.865 |
| | 2 | 137 | 3.20 | | |
| | 3 | 159 | 3.16 | | |
| Used barbless hooks | 1 | 147 | 2.85 | 1.403 | 0.247 |
| | 2 | 137 | 3.09 | | |
| | 3 | 159 | 3.06 | | |

As demonstrated, the three-cluster solution offered poor predictive validity. The lack of any significant (<0.05%) *F* values show that the variance expressed within

¹⁶ Scale responses included: 1: never, 2: rarely, 3: sometimes, 4: often, 5: always

clusters based on the factor variables used in the non-hierarchical testing does not transfer to other conceptually related areas. The four-cluster solution, however, shows a greater ability to predict variance in angler catch and release behaviour (reflected in three of the four variables in Table 21 having significant ANOVA values). Based on this analysis, the three-cluster solution was omitted from further analysis.

4.5.6 Describing the clusters using strategic variables

The four-cluster solution described above showed the best predictive ability after several cluster scenarios were considered through both hierarchical and non-hierarchical testing. This section describes each of the four clusters (segmentations). Their profiles are described using two methods. Firstly, by considering the performance of each cluster in regard to other descriptive data (independent variables) gathered in the survey that have not been used in the analysis techniques thus far. This process further identified characteristics that statistically defined the clusters (segments). And secondly, by reanalysing the respective means of the factor variable scores.

In regard to the former, Chi square was performed to test the association between cluster membership and eleven independent variables drawn from the survey questionnaire. As shown in Tale 23, four independent variables (highlighted in red) were significantly linked to the clusters, including: anglers reporting in the survey that they fish from shore; anglers who fished from privately owned boats; motivation and whether it derives from catch-related experiences and/or non-catch experiences; and, the frequency of releasing fish back to the water over the last 12 months (response categories including: never, occasionally, more often than not, and always). These variables therefore present are the most useful (and statistically strongest) in helping to define the clusters (segments) in addition to the factor-based variables.

Table 23: Independent variables chi squares

| Variables | Chi Square | p |
|---------------------------------|---------------------|-------|
| IV_Setting_Fished from shore | 22.045 ^a | 0.000 |
| IV_Setting_Privately owned boat | 9.194 ^a | 0.027 |
| IV_Setting_Figureer boat | 2.659 ^a | 0.447 |
| IV_Setting_Kayak | 3.320 ^a | 0.345 |
| IV_Spend | 12.951 ^a | 0.165 |
| IV_Distance | 6.598 ^a | 0.679 |
| IV_Motivation | 13.884 ^a | 0.031 |
| IV_Frequency of releasing fish | 52.196 ^a | 0.000 |
| IV_Age | 9.338 ^a | 0.407 |
| IV_Income | 23.809 ^a | 0.068 |
| IV_Domicile by region | 23.059 ^a | 0.813 |

Regarding the second approach, Table 24, presents an ANOVA of the four cluster solutions means from the non-hierarchical clustering. The higher values (highlighted in red) imply that the factor is one of the defining characteristics of the cluster, and that there is a likelihood that respective anglers strongly agree for the associated loading variables. Negative values (blue) indicate that the cluster is likely to place lower importance (or disagree) on respective factors variables. These factors are therefore the most useful in defining the clusters.

Table 24: Non-hierarchical four-cluster solution centroids across factor variables

| Cluster variable | Cluster centroids for three-cluster solution | | | | F | Sig |
|-------------------------------|--|-------|-------|-------|---------|-------|
| | 1 | 2 | 3 | 4 | | |
| F1: central to life | -0.31 | 0.29 | 0.28 | -0.12 | 9.889 | 0.000 |
| F2: keep and consume | 1.10 | -0.38 | -0.03 | -0.53 | 124.086 | 0.000 |
| F3: identity | 0.05 | -0.06 | 0.55 | -0.38 | 22.128 | 0.000 |
| F4: biocentrism | 0.17 | 0.50 | -0.35 | -0.09 | 15.115 | 0.000 |
| F5: environmental impact | 0.03 | 0.25 | 0.07 | -0.01 | 1.653 | 0.176 |
| F6: a catch orientation | 0.40 | 0.32 | -0.49 | -0.18 | 22.836 | 0.000 |
| F7: friendship | 0.28 | -1.04 | -0.37 | 0.58 | 87.301 | 0.000 |
| F8: catch numbers | -0.05 | -0.22 | -0.13 | 0.25 | 5.557 | 0.001 |
| F9: catch characteristic | 0.01 | 0.69 | -0.82 | 0.19 | 53.075 | 0.000 |
| F10: environmental protection | -0.28 | 0.04 | 0.39 | -0.09 | 9.483 | 0.000 |
| Cases | 112 | 82 | 99 | 160 | n/a | n/a |

Drawing on the two methods of analysis, descriptions of each cluster are provided below. The data used to inform chi square tests on the independent variables are shown in Appendix Seven. Appendix Eight provides a sensibility check of assumptions made in the descriptions by cross tabbing the cluster responses to the highest loading variables for each factor.

Cluster One: the consumer

Representing the second largest group in the sample (n=112), the consumer angler takes part in recreational sea angling to catch, retain and eat the fish they catch. Seventeen percent of the cluster are motivated purely by the experiences related to catching fish, the highest proportion of any cluster, and they are the most likely to keep all fish caught (over the last 12 months). While such anglers are driven by catching at least something when they fish, they also associate angling with an opportunity to be with friends. However, they are one of the least likely clusters to view angling as a centrally important part of their life. This cluster are also unlikely to associate anglers with a responsibility to protect the environment in the future. See Figure 25.

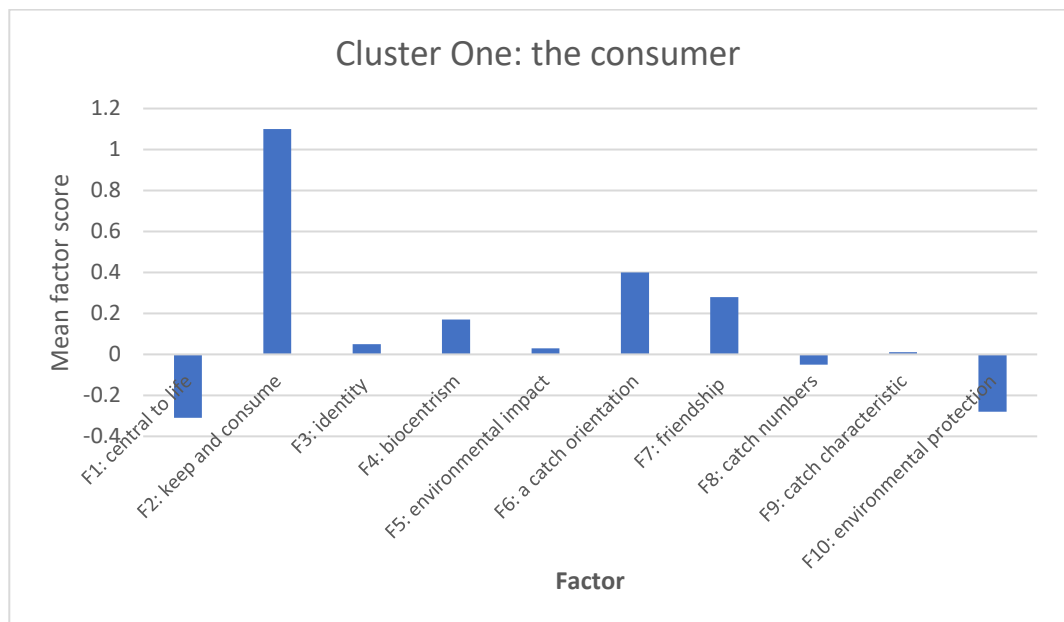


Figure 25: Mean factor scores for the consumer

Cluster Two: the trophy angler

Representing the smallest cluster in the sample (n=82), the trophy angler places high importance on the characteristics of the fish being caught, preferring to catch larger and challenging fish, or fish that represent a 'trophy' catch (this may not mean large or challenging, but fish of a high standard in relation to desired aspects of the respective species). Of all clusters, they are the least likely to fish from a boat and are motivated by both catch and non-catch experiences related to angling. Another key characteristic of the trophy angler is that they express biocentric viewpoints, valuing the parity of rights between humans and animals/fish. This aligns with the importance they place on the characteristics of trophy fish, suggesting that these anglers respect qualities (such as growth, speed or guile) that are part of the physical make-up of species caught. Again, in line with this, the trophy angler is least likely to retain fish they catch, and the second most likely to have returned all fish caught (over the last 12 months). While the trophy angler places recreational fishing as central to life, there is a dissociation between angling and friendship or socialisation (this supports the presumption that these anglers are likely to fish for specific species at specific/optimal times, and perhaps for these reasons may fish alone).

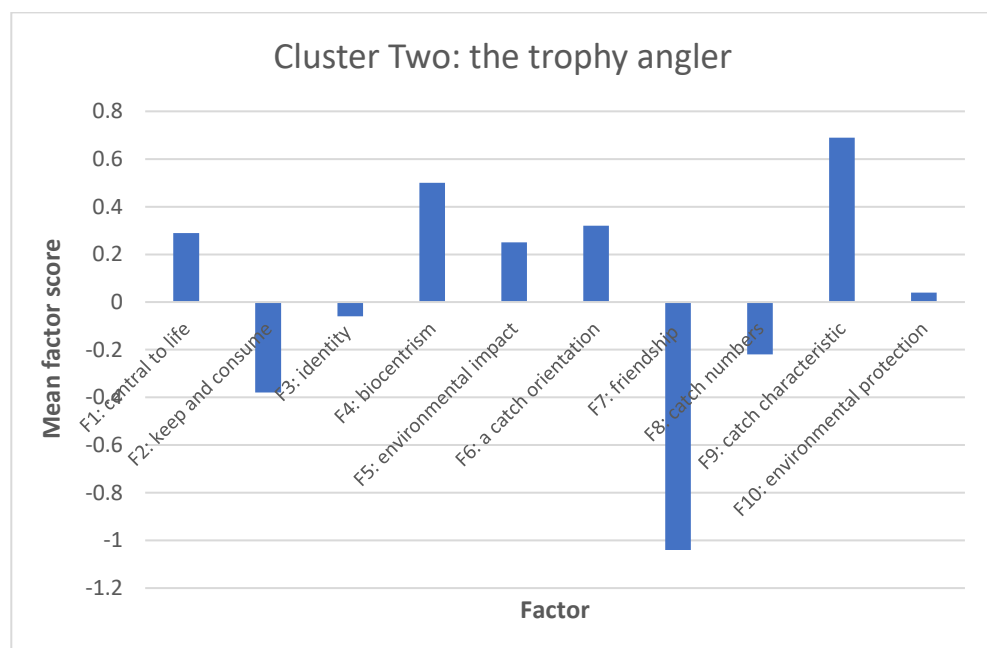


Figure 26: Mean factor scores for the trophy angler

Cluster Three: the leisure-identity angler

Leisure-identity anglers represent the second smallest group in the sample (n=99). These anglers place lower importance on catching fish and the characteristics or numbers of fish caught. Of all clusters, they are the least motivated by experiences related to catching fish, and the second most likely group motivated by non-catch experiences. This suggests that fishing is perhaps more for outdoor leisure. More importantly, this cluster consists of anglers who link recreational sea angling to their personal identity, suggesting that the nature and characteristics of fishing reflects how they see themselves and how they want to be viewed by others. In this respect, recreational sea angling plays a central role in their life and they see anglers as key in the future protection of the environment.

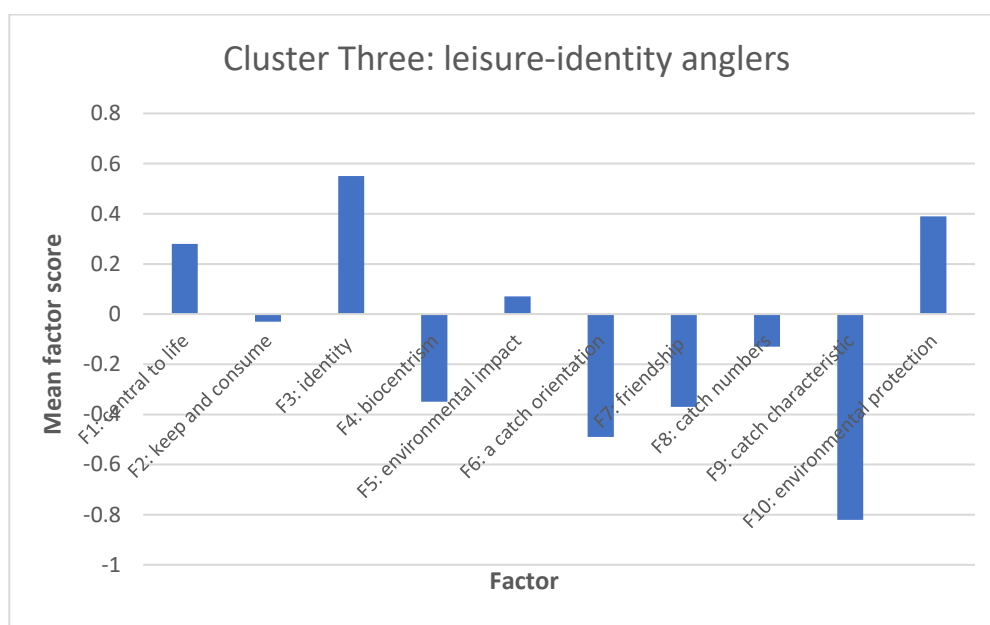


Figure 27: Mean factor scores for leisure-identity anglers

Cluster Four: the social angler

The social angler is the largest cluster in the sample (n=160) and the most likely to fish from shore. For these anglers, the most defining feature is that recreational sea angling provides an opportunity to be with friends, with most of their friendship circles connected to fishing in some way. Social anglers place lower importance on

keeping and consuming their catch and do not necessarily think fishing sessions are fruitless if no fish are caught; in line with this, they are the most likely cluster to have released all fish caught over the past 12 months of fishing. They do, however, place some importance on catching higher numbers of fish and trophy fish. Supporting this dichotomy, of all clusters, the social angler is most likely to be motivated equally by experiences related to catch and non-catch aspects of recreational sea angling. Cluster four shows lesser propensity to associate angling with identity expression and/or centrality to life.

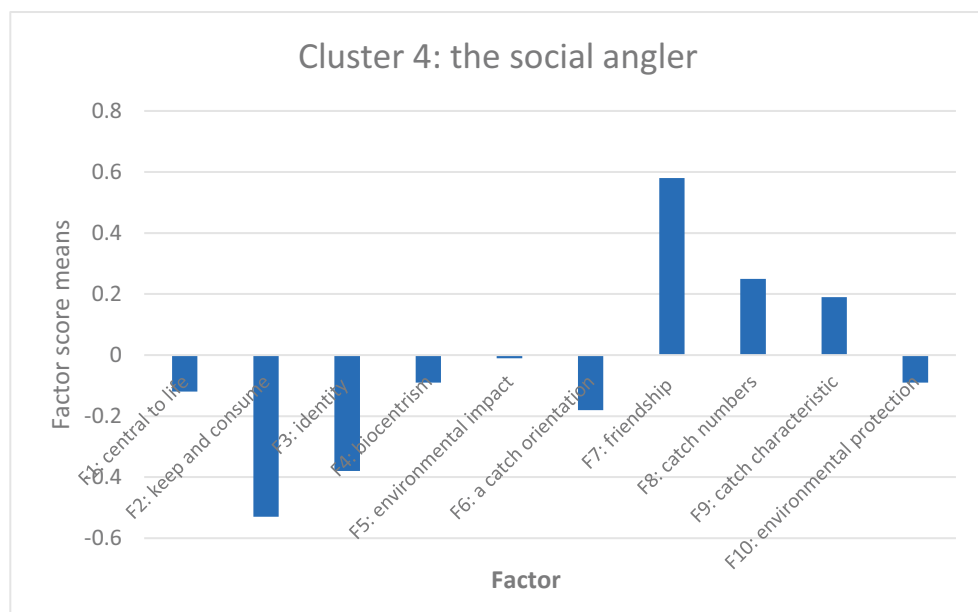


Figure 28: Mean factor scores for social anglers

4.6 SEGMENT CHARACTERISTICS

This section moves beyond the definition of angler types as described by variables used in the factor analysis and those employed in the predictive validity testing of cluster membership and analyses similarities/differences between each segmentation according to the following data captured in the angler survey: demographics (age, region of domicile, income); level fishing activity/investment (days fished, spend and distance travelled); catch and release behaviour (including motivation for releasing fish); personal stewardship norms; stewardship behaviours; and, satisfaction. This analysis helps to further understand the degree to which the

clusters/segmentations are useful for describing differences in the angler sample regarding variables (attitudes or behaviours) that may sit outside those used in identifying/defining the angler types. The analysis also helps to identify areas where the angler segments differ most. Please data used in the previous section is statistically stronger for defining the segments as per reasons listed; the data used in this section to support previous interpretations, hence only descriptive data is used.

4.6.1 Demographics (age and income)

The average age of anglers in each segmentation were as follows: consumer, 63 years; trophy angler = 60 years; leisure-identity angler = 64 years; and, social angler 61 years. Consumer and leisure-identity anglers were slightly older than the average age in the wider sample (62 years old). Anglers in the trophy and social segmentations were slightly younger on average. These figures suggest minimal variation in angler age across segments.

Figure 29a shows the domicile of survey respondents, specifically the proportion of segments in comparison to each other as per regions across England and Wales. Presenting the data in this way helps to reduce the effect of different sample sizes in both the segments and regions and provides an accurate picture of which segment are more dominant in each region. As shown, the domicile of anglers across each segmentation follows a similar pattern and reflects the wider sample which includes all anglers combined. This means that anglers across segmentations were more likely to live in the South West and South East of England and less likely to live in London or the East of England. However, there is a higher proportion of social anglers in the South West (27%) compared to all other segments and the overall sample; consumer anglers were more likely to live in the South East and Yorkshire and Humber when compared to other groups (34% and 9% respectively); similarly, trophy anglers were more common than other segments in the East of England and Wales (15% and 13% respectively).

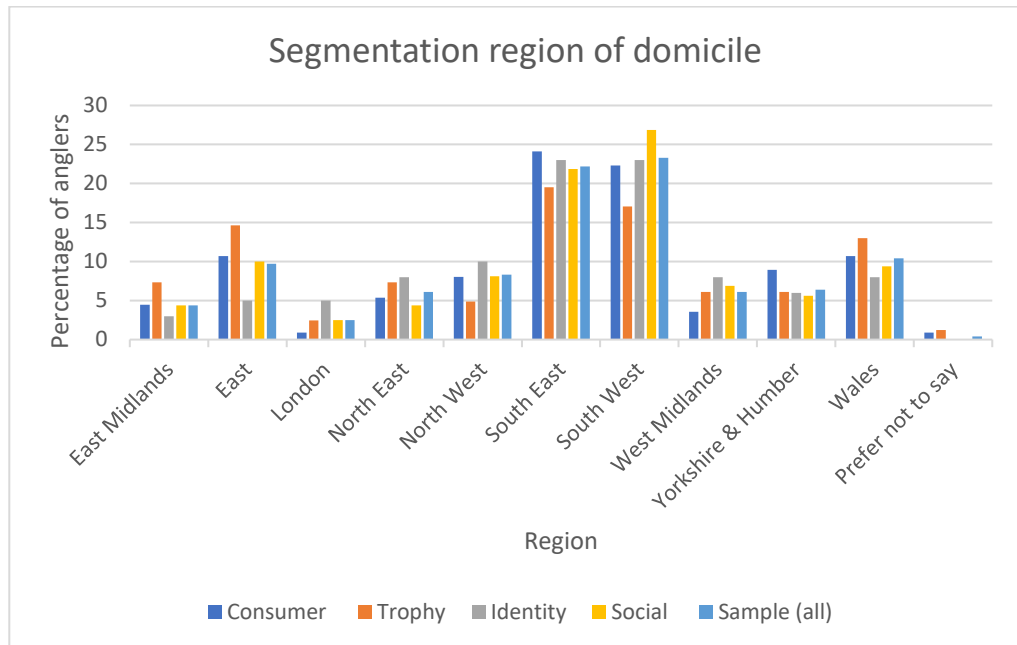


Figure 29a: Domicile of angler segmentations. Note: identity = leisure-identity. This abbreviation is used in relevant figures and tables hereafter.

Figure 29b shows the domicile of angler segments simply by their frequency (proportions) across regions. Caution is advised when interpreting this data as it is likely to reflect trends in the overall survey response rate (i.e. higher proportions of respondents in the South East and South West of England). Figure 29a and 30 provides more accurate descriptions of the segmentation profile at a regional level.

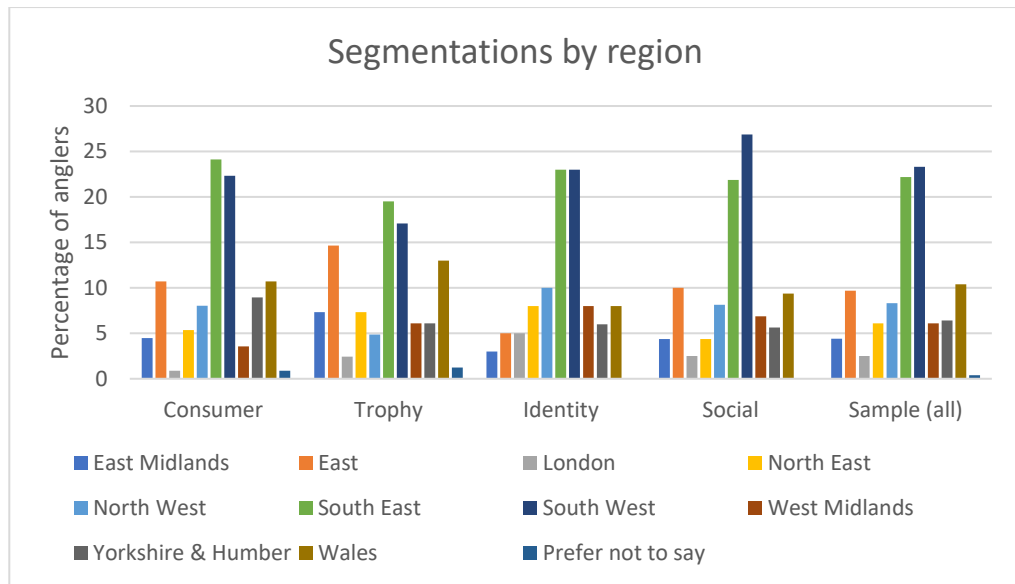


Figure 29b: Segmentations by region.

Figure 30 shows the angler population (proportions) in each region according to their segmentations. Social anglers account for the highest proportion of anglers in seven of the ten regions included in the study. Regions with the highest proportion of social anglers include the South West (41% of anglers in the region); west midlands (39%) and North West (36%). The highest proportion of consumer anglers can be seen in Yorkshire and Humber (33%), where they account for the largest segmentation in that region. Consumers usually feature as the second most common segmentation at a regional level. The highest proportion of trophy anglers can be seen in the East Midlands (29% of anglers in the region), the East (27%) and Wales (24%); however, they do not feature as the largest proportional segment in any of these regions. Leisure-identity anglers feature as the largest proportional segmentation in only one region (London, 42% of angler in that region).

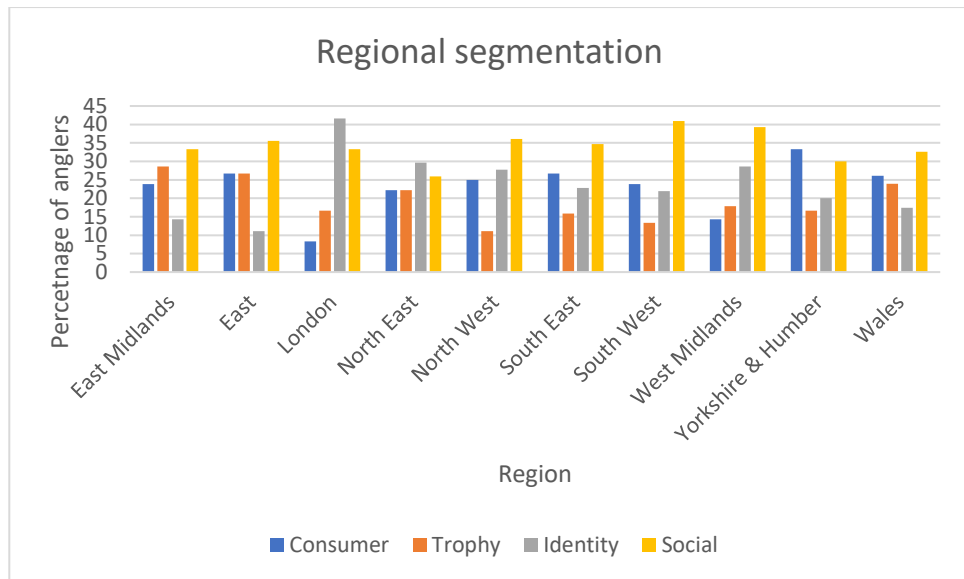


Figure 30: Regional segmentation

Figure 31 shows the personal annual income of anglers in each of the four segmentation and the wider sample. The most common personal annual income category across all segmentations was £20-£40,000. Leisure-identity anglers, however, were more likely to earn between £0-£20,000 per annum compared to the other segments, with the proportion of anglers in this group equalling their counterparts in the £20-£40,000 category (34% and 34% respectively). Anglers across all segmentations were less likely to yield a personal annual income above £40,000 compared to below £40,000 per year. Very few anglers belonged to the highest tier of annual income (>£100,000).

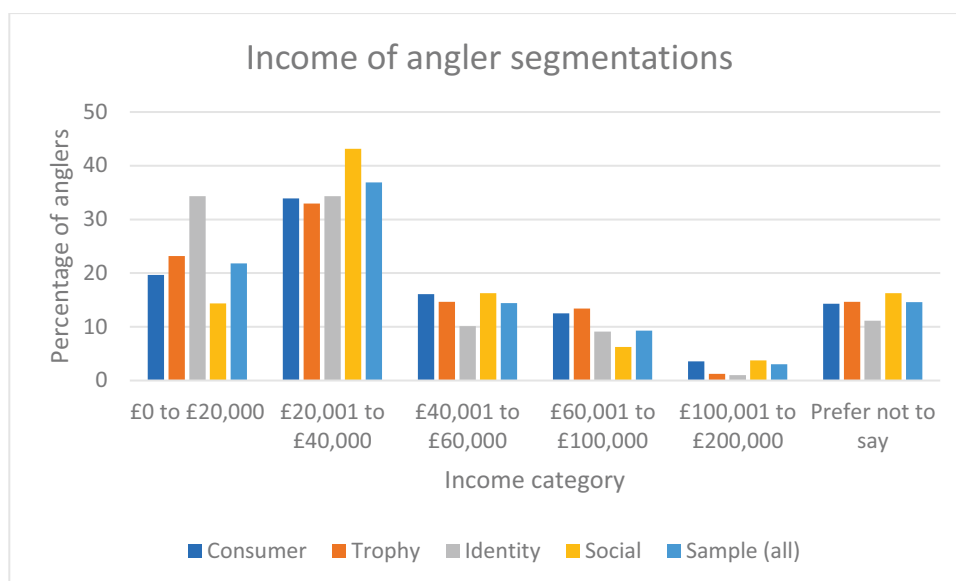


Figure 31: Income of angler segmentations

4.6.2 Angling activity (days, spend and travel)

On average, the number of days fished by consumer anglers over the 12-month period prior to completing the survey was 16 (ranging from 1-160 days). This is considerably lower than the average number of days fished by anglers in the wider sample (n=27) and is the lowest average number of days fished across all four angler segmentation. This may be consistent with the fact that such anglers may only fish when there is a need to meet appetite or dietary requirement (rather than fishing for social or leisure reasons). Trophy anglers fished the most compared to other segments, 38 days in the 12 months prior to completing the survey questionnaire (ranging from 1-300 days). Leisure identity and social anglers fished, on average, also fished more than consumers (and wider sample combined) but not as much as trophy anglers: 31 days (ranging from 1-223 days), and 24 days (ranging from 1-138 days) respectively.

Anglers in the consumer group spent on average £302.22 on fishing tackle and equipment in the 12 months prior to completing the survey questionnaire (ranging from £0 spent to £3,000), which is less than the average spend in the wider sample (£365.18) and the lowest average across all segmentations. Anglers in the leisure identity group also spent less compared to other groups and the wider sample (£328.87, ranging from £0-£4,700). Anglers in the leisure-identity segment spent on

average £425.03 on fishing tackle and equipment in the 12 months prior to completing the survey questionnaire (ranging from £0-£3,500), which is considerably higher than the average spend in the wider sample (£365.18) and is the largest average across all four segmentations. Anglers in the social group also spent slightly more than the average spend in the wider sample (£380.53, ranging from £0-3,000).

Consumer anglers travelled, on average, 58 miles on the outward journey of their last fishing trip (ranging from <1 to 320 miles), which is less than the 63-mile average for the wider sample, and is the least distance travelled of all segmentations. All other segments travelled slightly more than the sample average: trophy anglers (66 miles, ranging from 1-500 miles); leisure-identity anglers (64 miles, ranging from <1-285 miles); and social anglers (66 miles, ranging from <1-650 miles).

4.6.3 Catch and release behaviour

Anglers were asked to nominate one species of fish that they had caught over the 12 months prior to completing the survey questionnaire, with additional questions collecting further detail on the characteristics of their catch. Drawing on this data, Table 25 firstly shows the species selected by anglers against which they reported data. Columns in blue report the number (and percentage) of anglers in each segment reporting data on respective species. Columns in pink show how many fish anglers reported to have caught in the 12 months prior to completing the survey questionnaire, presented by species and angler segment. Columns in peach shows the percentage of each angler segment that released corresponding species 'more often than not' or 'always'.¹⁷

Across all species and all segments, a total of 16,222 fish were reported to have been caught in the 12 months prior to completing the survey. Seventy-seven percent of anglers across all segments reported to have released fish more often than not

¹⁷ Most anglers chose to report on species common across segments, with few anglers reporting data on a wide range of other species. While the wide range of species are important to report, they skew the corresponding release rates because of potential inflation that occurs when calculating percentages based on low numbers. For this reason, species with low angler returns and therefore problems in assessing release percentage rates, are presented in faded text within the Table.

or always. Of all segments, trophy anglers released fish most frequently (93%); consumers were least likely to release fish (62% of the segment). These trends are not surprising considering the primary motivation and respective intention of both these angler types. Both identity and social anglers have fairly similar release rates (80% and 81% releasing fish more often than not or always).

Whiting was released most frequently across all segments (91%), closely followed by sea bass (89%). The least frequently returned species was mackerel (47%). The patterns in species order regarding release frequency are evident across three of the four segments; for social anglers, sea bass was released more frequently compared to whiting (95% and 89% respectively). Cod represented the species least caught in number, followed by pollack (1,314 and 1,497). Both species have similar rates of return (67% and 73% respectively).

As discussed, trophy anglers released fish most frequently. All anglers in this segment released pollack and whiting more often than not or always, and nearly all (97%) did the same for sea bass. Only 57% of trophy anglers released mackerel more often than not or always. These are the highest release rates for these species across the segments. Social anglers also had a high level of release for sea bass (95%), however had considerably lower release rates for pollack and whiting (87% and 67%). Social anglers had the highest return rate across all segmentations for cod (89%). Leisure-Identity anglers had the third highest return rate for sea bass (92%), and second highest for whiting (92%). Most return rates for the identity group fail to be either markedly high or low across species and in comparison with other segments. The consumer segment had the lowest return rate across all species in comparison to other segments, the lowest being for mackerel (38%), and the highest for whiting at 86%.

Table 25: Catch and release by angler segment

| Species | Number of anglers (%) | | | | | Number of fish caught | | | | | Percentage of segment releasing fish 'more often than not' or 'always' | | | | |
|--------------|-----------------------|-----------|-----------|------------|------------|-----------------------|--------------|--------------|--------------|---------------|--|-----------|-----------|-----------|-----------|
| | Consumer | Trophy | Identity | Social | All | Consumer | Trophy | Identity | Social | All | Consumer | Trophy | Identity | Social | All |
| Sea bass | 40 (36) | 35 (43) | 24 (24) | 62 (39) | 161 | 883 | 873 | 713 | 2,605 | 5,074 | 73 | 97 | 92 | 95 | 89 |
| Mackerel | 21 (19) | 7 (9) | 19 (19) | 36 (23) | 83 | 708 | 125 | 248 | 1,387 | 2,468 | 38 | 57 | 53 | 47 | 47 |
| Whiting | 14 (13) | 17 (21) | 26 (26) | 23 (14) | 80 | 730 | 669 | 1,203 | 1,899 | 4,501 | 86 | 100 | 92 | 87 | 91 |
| Cod | 9 (8) | 5 (6) | 10 (10) | 9 (6) | 33 | 401 | 76 | 213 | 624 | 1,314 | 44 | 80 | 60 | 89 | 67 |
| Pollack | 6 (5) | 6 (7) | 6 (6) | 9 (6) | 27 | 605 | 177 | 407 | 308 | 1,497 | 50 | 100 | 67 | 67 | 73 |
| Dogfish (LS) | 2 (2) | 3 (4) | 1 (1) | 6 (4) | 12 | 22 | 39 | 75 | 58 | 194 | 0 | 100 | 100 | 100 | 83 |
| Mullet (TL) | 1 (1) | 2 (2) | 3 (3) | 1 (1) | 7 | 20 | 15 | 34 | 45 | 114 | 0 | 100 | 100 | 100 | 86 |
| Wrasse* | 2 (2) | 2 (2) | 1 (1) | 1 (1) | 6 | 7 | 6 | 1 | 7 | 21 | 100 | 100 | 100 | 100 | 100 |
| Shark (blue) | n/a | 1 | n/a | 4 (3) | 5 | n/a | n/a | n/a | 204 | 204 | n/a | n/a | n/a | 100 | 100 |
| Tope | 1 (1) | 1 (1) | n/a | 2 (1) | 4 | 40 | 3 | n/a | 20 | 63 | 100 | 100 | n/a | 100 | 100 |
| Flounder | 2 (2) | n/a | 1 (1) | 1 (1) | 4 | 126 | n/a | 200 | 2 | 328 | 100 | n/a | 100 | 100 | 100 |
| Ray* | 2 (2) | n/a | n/a | 2 (1) | 4 | 35 | n/a | n/a | 29 | 64 | 50 | n/a | n/a | 100 | 75 |
| Dab | n/a | n/a | 2 (2) | 1 (1) | 3 | n/a | n/a | 18 | 50 | 68 | n/a | n/a | 100 | 100 | 100 |
| Plaice | 3 (3) | n/a | n/a | n/a | 3 | 28 | n/a | n/a | n/a | 28 | 67 | n/a | n/a | n/a | 67 |
| Conger eel | 1 | n/a | n/a | 1 (1) | 2 | 1 | n/a | n/a | 1 | 2 | 100 | n/a | n/a | 100 | 50 |
| Sea scorpion | 1 (1) | n/a | 1 (1) | n/a | 2 | 3 | n/a | n/a | n/a | 3 | 100 | 100 | 100 | n/a | 100 |
| Black bream | n/a | 1 (1) | 1 (1) | n/a | 2 | n/a | 30 | 20 | n/a | 50 | n/a | n/a | 100 | n/a | 100 |
| Sea trout | n/a | 1 (1) | n/a | n/a | 1 | n/a | 1 | n/a | n/a | 1 | n/a | 100 | n/a | n/a | 100 |
| Sole | 1 (1) | n/a | n/a | n/a | 1 | 2 | n/a | n/a | n/a | 2 | 100 | n/a | n/a | n/a | 100 |
| Smoothhound | 1 (1) | n/a | n/a | n/a | 1 | 1 | n/a | n/a | n/a | 1 | 0 | n/a | n/a | n/a | 0 |
| Pouting | n/a | n/a | n/a | 1 (1) | 1 | n/a | n/a | n/a | 100 | 100 | n/a | n/a | n/a | 100 | 100 |
| Gilht.bream | n/a | n/a | 1 (1) | n/a | 1 | n/a | n/a | 1 | n/a | 1 | n/a | n/a | 100 | n/a | 100 |
| Monkfish | 1 (1) | n/a | n/a | n/a | 1 | 2 | n/a | n/a | n/a | 2 | 100 | n/a | n/a | n/a | 100 |
| Unspecified | 1 (1) | n/a | 2 (2) | n/a | 3 | 2 | n/a | 120 | n/a | 122 | 0 | n/a | n/a | n/a | n/a |
| Zero catch | 3 (3) | 1(1) | 1 (1) | 1 (1) | 6 | n/a | n/a | n/a | n/a | 0 | n/a | n/a | n/a | n/a | n/a |
| Total | 112 | 82 | 99 | 160 | 453 | 3,616 | 2,014 | 3,253 | 7,339 | 16,222 | 62 | 93 | 80 | 81 | 77 |

* Unspecified by anglers

Anglers stating that they had returned fish back to the water over the last 12 months were prompted to give reasons why they released fish, shown in Figure 32. The most common reason for releasing fish across all segments was to conserve future fish stocks (64% of respondents), closely followed by their size, meaning fish were too small (60%). The latter was the most common factor influencing the decision to release fish among consumer anglers (74%). The second most common reason was to conserve future fish stocks (49%); however, this proportion of consumers was considerably lower compared to other segmentations (73%, 64% and 70% respectively). The third most common reason for consumers was the desire to continue fishing even though they had caught what was needed for their personal use (47%); for this factor, consumer anglers scored highest across all segments (47% compared to 33%, 37% and 34% respectively). Consumers also scored highest regarding conforming to regulations (45%). Consumers were the least likely segment to be release fish because they thought it was the ethical or moral thing to do (31% compared to 65%, 45% and 54%).

Trophy anglers mainly released fish in order to conserve future fish stocks (73%), and because they thought it as the ethical or moral thing to do (65%). For both of these categories, trophy anglers scored highest across all segments. While the latter may actually reflect the size of the fish, or may even reflect a conservation agenda, the key point with this reasoning is that it reflects the anglers innate personal morality rather than being influenced by an external pressure such as regulation (e.g. size, which also accounted for 60% of trophy angler responses). Regulations were one of the least motivating factors influencing decisions to release fish among trophy anglers (35%), alongside having caught enough but wanting to continue fishing (33%).

Leisure-identity anglers did not feature as the highest scoring group for any of the reasons for release presented in the Figure 32. The most common reasons among leisure-identity anglers was because they felt the fish were too small (66%) and to conserve future fish stocks (64%). Lower proportions in this group were influenced by regulation and personal morality (34% and 45% respectively). Social anglers also failed to score highest for any of the reasons for release in comparison to the other segments. The most common reason for release among social anglers was to

conserve future fish stocks (70%) and ethical or moral reasons (54%), with these figures only being surpassed by trophy anglers (73% and 65% respectively). Of all segments, decision to release fish among social anglers were the least likely to be influenced by regulations and size (too small), 33% and 46% respectively. Of note, very few anglers across all segments were influenced by seeing others around them release fish.

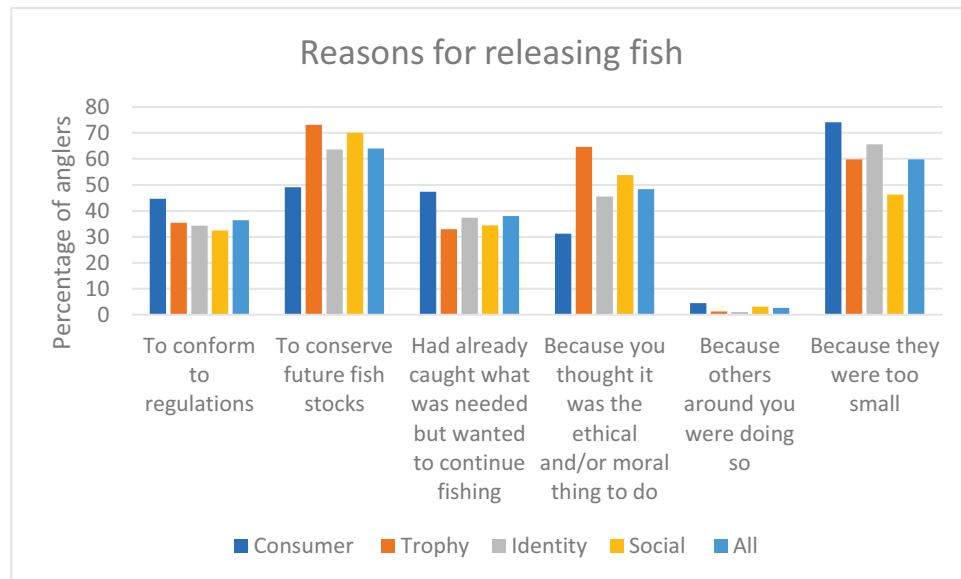


Figure 32: Reasons for releasing fish across segments. Note: multiple response

4.6.4 Personal stewardship norms

Anglers responding to the survey were asked how much they disagreed/agreed with three statements reflecting personal norms based on the principles of environmental stewardship (statements tailored to suit recreational sea angling). Figure 33 shows the pro environmental stewardship responses for each statement (agree or strongly agree for two of the statements, and disagree or strongly disagree for one stated, as marked in the figure). Across the sample (all) 84% of anglers felt a moral obligation to conserve fishery resources, 85% reported that they would feel guilty if they did not do their part to protect aquatic ecosystems and 93% felt that other anglers should do whatever they can to protect the environment. In relation to the latter, there was only +/- 1% difference at a segment level. A moral obligation to protect the environment showed slightly more varied results with trophy anglers presenting slightly higher proportions compared to the other segments (90%,

compared to 85%, 82%, 82% and 84% respectively). Most variation can be seen in relation to guilt felt for not protecting the environment: consumer anglers scored lowest (76%), and trophy anglers the highest (91%).

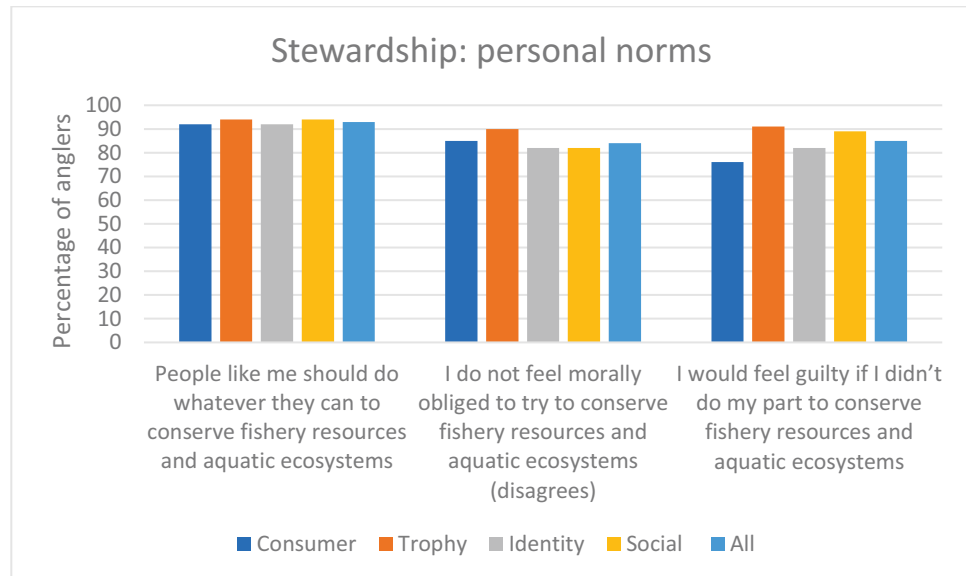


Figure 33: Personal stewardship norms across segments

An analysis of variance in means highlighted how membership to angler segmentation (independent variable) impacted on the three levels of norm (dependant variable), as shown by significance levels presented in Table 26. This means there were significant difference in the variation of means when comparing across the four groups.

Table 26: Stewardship norms analysis of variance

| Norm | Segment | N | Mean | F | Sig. |
|---|----------|-----|------|--------|--------|
| People like me should do whatever they can to conserve fishery resources and aquatic ecosystems | Consumer | 112 | 4.13 | 3.438* | 0.018* |
| | Trophy | 82 | 4.44 | | |
| | Identity | 99 | 4.30 | | |
| | Social | 160 | 4.25 | | |
| I do not feel morally obliged to try and conserve fishery resources and aquatic ecosystems | Consumer | 112 | 1.89 | 3.422 | 0.017 |
| | Trophy | 82 | 1.61 | | |
| | Identity | 99 | 1.99 | | |
| | Social | 160 | 2.01 | | |
| I would feel guilty if I didn't do my part to conserve fishery resources and aquatic ecosystems | Consumer | 112 | 3.91 | 5.411 | 0.001 |
| | Trophy | 82 | 4.33 | | |
| | Identity | 99 | 4.11 | | |
| | Social | 160 | 4.19 | | |

*Homogeneity of variance violated (proved statistically significant for this variable), which was subject to correction using Welch ANOVA. All other variables tested not statistically significant regarding homogeneity, which is expected for using standard ANOVA f values.

Figure 33 does not indicate where the differences or between what groups the difference in normative views lies. As shown in Table 27 (in combination with Figure 33), Sheffe post hoc testing (used because the samples are not similar in size) reveals that there is a significant difference in variance of means between trophy anglers and consumers regarding the statement 'people like me should do whatever they can to conserve fishery resources'. In Figure 33 trophy anglers are slightly more in agreement with this statement, and the post hoc testing suggests the difference between the groups is significant. In relation to the statement focused on a moral obligation to conserve fishery resources, Table 27 shows a significant difference between trophy and social anglers. Again, in reference to Figure 33, this difference is manifested in a stronger pro-environment normative attitude amongst trophy anglers compared to social anglers. Feelings of guilt over responsibility for environmental protection is where most differences are apparent: a statistical difference occurs between consumers and trophy anglers (with the latter feeling more guilt) and consumers and social anglers (again, with social anglers feeling more guilt). In summary, the post hoc testing reveals that when comparing pairs of segmentations, most difference in normative attitudes are apparent between trophy anglers and consumers, followed by consumers and social anglers. In regards to Tables 26 and 27, this means that consumer anglers, while generally holding positive stewardship norms, are comparatively less favourable to trophy and social anglers.

Table 27: Stewardship norms post hoc testing

| Norm statement | Segment | Comparison | Mean diff. | S.E | Sig. |
|---|----------|------------|---------------|--------------|--------------|
| People like me should do whatever they can to conserve fishery resources and aquatic ecosystems | Consumer | Trophy | -.305* | 0.091 | 0.011 |
| | | Identity | -0.1691 | 0.086 | 0.277 |
| | | Social | -0.11607 | 0.077 | 0.515 |
| | Trophy | Consumer | .305* | 0.091 | 0.011 |
| | | Identity | 0.135994 | 0.093 | 0.545 |
| | | Social | 0.189024 | 0.085 | 0.174 |
| | Identity | Consumer | 0.169102 | 0.086 | 0.277 |
| | | Trophy | -0.13599 | 0.093 | 0.545 |
| | | Social | 0.05303 | 0.080 | 0.931 |
| | Social | Consumer | 0.116071 | 0.077 | 0.515 |
| | | Trophy | -0.18902 | 0.085 | 0.174 |
| | | Identity | -0.05303 | 0.080 | 0.931 |
| I do not feel morally obliged to try to conserve fishery resources and aquatic ecosystems | Consumer | Trophy | 0.283101 | 0.140 | 0.253 |
| | | Identity | -0.09704 | 0.133 | 0.911 |
| | | Social | -0.11339 | 0.119 | 0.822 |
| | Trophy | Consumer | -0.2831 | 0.140 | 0.253 |
| | | Identity | -0.38014 | 0.144 | 0.074 |
| | | Social | -.396* | 0.131 | 0.028 |
| | Identity | Consumer | 0.097042 | 0.133 | 0.911 |
| | | Trophy | 0.380143 | 0.144 | 0.074 |
| | | Social | -0.01635 | 0.123 | 0.999 |
| | Social | Consumer | 0.113393 | 0.119 | 0.822 |
| | | Trophy | .396* | 0.131 | 0.028 |
| | | Identity | 0.016351 | 0.123 | 0.999 |
| I would feel guilty if I didn't do my part to conserve fishery resources and aquatic ecosystems | Consumer | Trophy | -.419* | 0.110 | 0.003 |
| | | Identity | -0.2004 | 0.105 | 0.300 |
| | | Social | -.283* | 0.093 | 0.028 |
| | Trophy | Consumer | .419* | 0.110 | 0.003 |
| | | Identity | 0.218157 | 0.113 | 0.295 |
| | | Social | 0.135518 | 0.103 | 0.630 |
| | Identity | Consumer | 0.200397 | 0.105 | 0.300 |
| | | Trophy | -0.21816 | 0.113 | 0.295 |
| | | Social | -0.08264 | 0.097 | 0.867 |
| | Social | Consumer | .283* | 0.093 | 0.028 |
| | | Trophy | -0.13552 | 0.103 | 0.630 |
| | | Identity | 0.082639 | 0.097 | 0.867 |

Sheffe testing used due to unequal sample sizes for each segmentation.

4.6.5 Stewardship behaviours (private, public and social)

Each domain of stewardship behaviour is discussed in turn.

4.6.5.1 *Private stewardship*

Stewardship norms are associated with positive stewardship behaviours. Stewardship behaviours have been conceptualised in previous literature to encompass three distinct areas: private; public; and social.

In line with this, anglers responding to the survey were firstly asked how often they carried out behaviours in line with the private sphere of stewardship.¹⁸ These behaviours represent actions that the anglers are directly responsible for when taking part in recreational sea angling, and were chosen to reflect behaviours directly related to preserving the longevity of fish stocks by minimizing harm and maximizing likelihood of fish survival when returning fish back to the water. Figure 34 shows each behaviour and the percentage of responding anglers that carry out such action either 'often' or 'always'. Across the sample (all) 99% of anglers returned fish intended to be release back to the water as soon as possible; 74% of anglers in the sample cradled fish in water to ensure thy were able to swim before being released. Considerably lower proportions of anglers kept fish in water while being unhooked (43%) or used barbless hooks (37%) either often or always.

Returning fish back to the water as quickly as possible was carried out either often or always by nearly all anglers in each segment (100% of both identity and social anglers, 99% of trophy anglers and 98% of consumers). This type of private stewardship behaviour was the most common of all types. Social anglers were the most likely to cradle fish before returning them back to the water, scoring higher than the sample average (83% compared to 74% respectively); this was their second highest scoring behaviour. Trophy and leisure-identity anglers scored similarly in relation to cradling fish (72% and 70% respectively), again representing the second

¹⁸ Please note that stewardship behaviours were only asked to those angler reporting that they had returned fish back to the water in the 12 months previous to completing the survey questionnaire: N=105

most common type of private stewardship behaviour for these segmentations. Consumers were the least likely to cradle fish in comparison to all other segments and the sample (65% compared to 72%, 70%, 83% and 74% respectively). Leisure-identity anglers were the most likely segment to keep fish in the water while being unhooked either often or always compared to the other segments and the sample (49% compared to 43%). Social anglers were the second most likely, and again above the sample average (45% compared to 43% respectively). Both consumer and trophy anglers fell below the sample score for this type of behaviour (35% and 39% respectively). Social anglers were the most likely segment to use barbless hooks (44%), followed by leisure-identity anglers (40%); both of these segments scored higher than the sample (37%). Both consumers and trophy anglers were less likely than the wider sample to use barbless hooks either often or always (25% and 33% respectively). All segments show the same pattern in the order of behaviours carried out either often or always: most common is returning fish as quickly as possible, followed by cradling fish, followed by keeping fish in water, with the least common is the use of barbless hooks. In addition, higher proportions of social and leisure-identity anglers demonstrate these behaviours compared to consumer and trophy anglers.

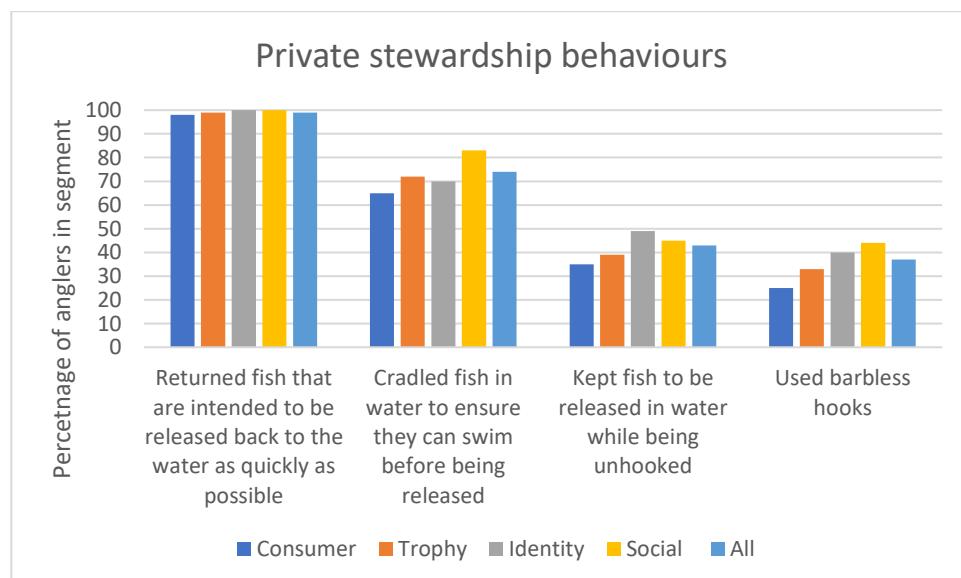


Figure 34: Private stewardship behaviours across segments

An analysis of variance in means highlighted how membership to angler segment (independent variable) impacted on the three of the four types of private stewardship

behaviour (dependant variable), including: cradling fish in water to ensure they can swim before being release; keeping fish in water while being unhooked; and using barbless hooks (Table 28).

Table 28: Stewardship private behaviours analysis of variance

| Private behaviour | Segment | N | Mean | F | Sig. |
|---|----------|-----|------|--------|--------|
| Returned fish that are intended to be released back to the water as quickly as possible | Consumer | 105 | 4.85 | 0.778* | 0.507* |
| | Trophy | 82 | 4.79 | | |
| | Identity | 98 | 4.88 | | |
| | Social | 158 | 4.87 | | |
| Cradled fish in water to ensure they can swim before being released | Consumer | 105 | 3.78 | 3.248* | 0.023* |
| | Trophy | 82 | 3.99 | | |
| | Identity | 98 | 4.09 | | |
| | Social | 158 | 4.18 | | |
| Kept fish to be released in water while being unhooked | Consumer | 105 | 2.91 | 2.667 | 0.047 |
| | Trophy | 82 | 3.11 | | |
| | Identity | 98 | 3.35 | | |
| | Social | 158 | 3.23 | | |
| Used barbless hooks | Consumer | 105 | 2.61 | 5.909 | 0.001 |
| | Trophy | 82 | 2.84 | | |
| | Identity | 98 | 3.11 | | |
| | Social | 158 | 3.28 | | |

*Homogeneity of variance violated (proved statistically significant for this variable), which was subject to correction using Welch ANOVA. All other variables tested not statistically significant regarding homogeneity, which is expected for using standard ANOVA f values.

As shown in Table 29 (in combination with Table 28), Sheffe post hoc testing reveals that there is a significant difference in variance of means between consumers and social anglers in relation to cradling fish in water to ensure they can swim before being returned. In Figure 34 social anglers were considerably more likely to carry out this behaviour compared to consumers, and this is proven to be a statistically significant difference (sig. <0.05). Consumers and social anglers also differed (sig. <.001) in relation to the use of barbless hooks. Viewing this in combination with Figure 34 means that social anglers were far more likely to use barbless hooks often or always when compared to consumer anglers.

Table 29: Private stewardship behaviours post hoc testing

| Private stewardship behaviour | Segment | Comparison | Mean diff. | S.E | Sig. |
|---|----------|------------|----------------|--------------|--------------|
| Returned fish that are intended to be released back to the water as quickly as possible | Consumer | Trophy | 0.055 | 0.055 | 0.804 |
| | | Identity | -0.030 | 0.053 | 0.956 |
| | | Social | -0.019 | 0.047 | 0.982 |
| | Trophy | Consumer | -0.055 | 0.055 | 0.804 |
| | | Identity | -0.085 | 0.056 | 0.516 |
| | | Social | -0.074 | 0.051 | 0.548 |
| | Identity | Consumer | 0.030 | 0.053 | 0.956 |
| | | Trophy | 0.085 | 0.056 | 0.516 |
| | | Social | 0.010 | 0.048 | 0.997 |
| | Social | Consumer | 0.019 | 0.047 | 0.982 |
| | | Trophy | 0.074 | 0.051 | 0.548 |
| | | Identity | -0.010 | 0.048 | 0.997 |
| Cradled fish in water to ensure they can swim before being released | Consumer | Trophy | -0.207 | 0.147 | 0.575 |
| | | Identity | -0.311 | 0.140 | 0.177 |
| | | Social | -0.403* | 0.125 | 0.017 |
| | Trophy | Consumer | 0.207 | 0.147 | 0.575 |
| | | Identity | -0.104 | 0.149 | 0.921 |
| | | Social | -0.196 | 0.135 | 0.555 |
| | Identity | Consumer | 0.311 | 0.140 | 0.177 |
| | | Trophy | 0.104 | 0.149 | 0.921 |
| | | Social | -0.092 | 0.128 | 0.916 |
| | Social | Consumer | 0.403* | 0.125 | 0.017 |
| | | Trophy | 0.196 | 0.135 | 0.555 |
| | | Identity | 0.092 | 0.128 | 0.916 |
| Kept fish to be released in water while being unhooked | Consumer | Trophy | -0.195 | 0.172 | 0.730 |
| | | Identity | -0.433 | 0.163 | 0.073 |
| | | Social | -0.320 | 0.147 | 0.192 |
| | Trophy | Consumer | 0.195 | 0.172 | 0.730 |
| | | Identity | -0.237 | 0.174 | 0.604 |
| | | Social | -0.124 | 0.158 | 0.893 |
| | Identity | Consumer | 0.433 | 0.163 | 0.073 |
| | | Trophy | 0.237 | 0.174 | 0.604 |
| | | Social | 0.113 | 0.150 | 0.904 |
| | Social | Consumer | 0.320 | 0.147 | 0.192 |
| | | Trophy | 0.124 | 0.158 | 0.893 |
| | | Identity | -0.113 | 0.150 | 0.904 |
| Used barbless hooks | Consumer | Trophy | -0.232 | 0.197 | 0.708 |
| | | Identity | -0.503 | 0.187 | 0.067 |
| | | Social | -0.669* | 0.168 | 0.001 |
| | Trophy | Consumer | 0.232 | 0.197 | 0.708 |

| | | | | | |
|--|----------|----------|--------|-------|-------|
| | | Identity | -0.271 | 0.200 | 0.607 |
| | | Social | -0.437 | 0.182 | 0.124 |
| | Identity | Consumer | 0.503 | 0.187 | 0.067 |
| | | Trophy | 0.271 | 0.200 | 0.607 |
| | | Social | -0.166 | 0.172 | 0.816 |
| | Social | Consumer | 0.669* | 0.168 | 0.001 |
| | | Trophy | 0.437 | 0.182 | 0.124 |
| | | Identity | 0.166 | 0.172 | 0.816 |

Sheffe testing used due to unequal sample sizes for each segmentation.

4.6.5.2 *Public stewardship*

Anglers were asked about behaviours they have carried out in the previous 12 months in a public context (actions involving representatives or groups associated with local or national governance and the financial support of conservation activities). Because it was anticipated that public (and social) involvement among anglers would be less common among anglers, frequency of participation in this type of behaviour was not captured. Data for these two variables (political and social stewardship behaviour) was therefore captured in a nominal format with anglers simply marking their involvement over the 12 months prior to completing the survey questionnaire with either yes/no. As a result, frequencies across angler segmentations are not supported with analysis of variance. ANOVA is only possible when the dependant variable is either ordinal or ratio.

Figure 35 shows that across all segments, a lower proportion of anglers engaged with public stewardship compared to social stewardship discussed above: only 30% of the sample had contacted a political representative about a fishery-related conservation issue over the 12 months prior to completing the questionnaire and only 46% had donated money to a conservation organisation. Of note, however, a considerably higher proportion of trophy anglers had contacted a political representative about fishery conservation (55%) compared to the other segments and sample (32%). Consumers were the least likely to carry out this type of behaviour (29% of the segmentation). Trophy anglers, however, were least likely to donate money to fishery conservation organisations (32%) compared to the other segments and wider sample (46%). Social anglers were the most likely to donate money in this respect (48%) closely followed by leisure-identity anglers (46%).

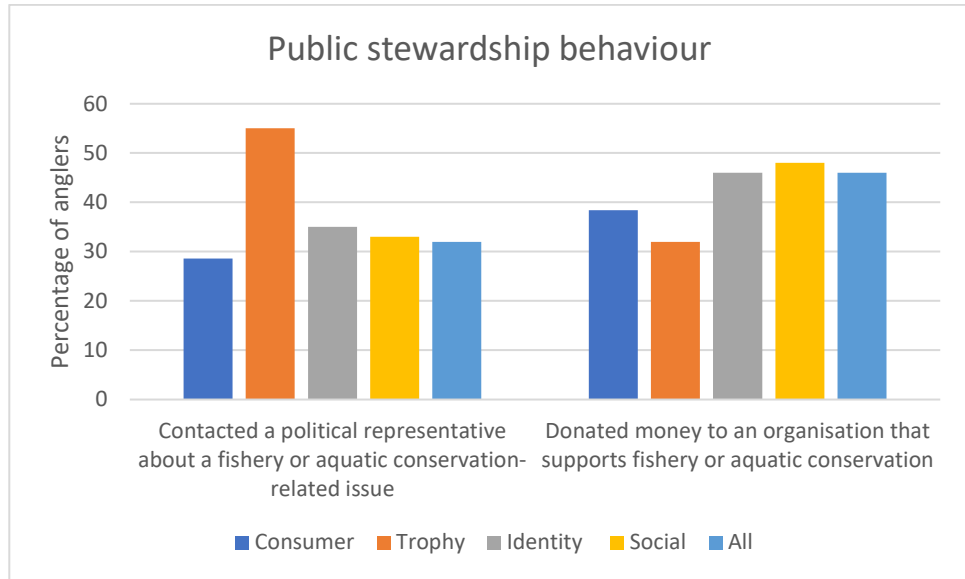


Figure 35: Public stewardship behaviour across segments

4.6.5.3 Social stewardship

Social stewardship behaviours varied in the types presented in Figure 36. Very few anglers (proportionally) across the segments participated as active members in fishery or aquatic conservation organisations. Trophy anglers were the most likely (31% of anglers in the segment), followed by consumers (26%). More anglers across the sample engaged in social stewardship in form of talking to other in the angling community about conservation (57%). This is perhaps due to the ease of carrying out such behaviour in comparison to donating money or contacting political representatives. Social anglers were most likely to engage in conservation conversations (66% of the segment), followed by leisure-identity anglers (58%). Trophy anglers were least likely to carry out this type of social stewardship (54% of the segment).

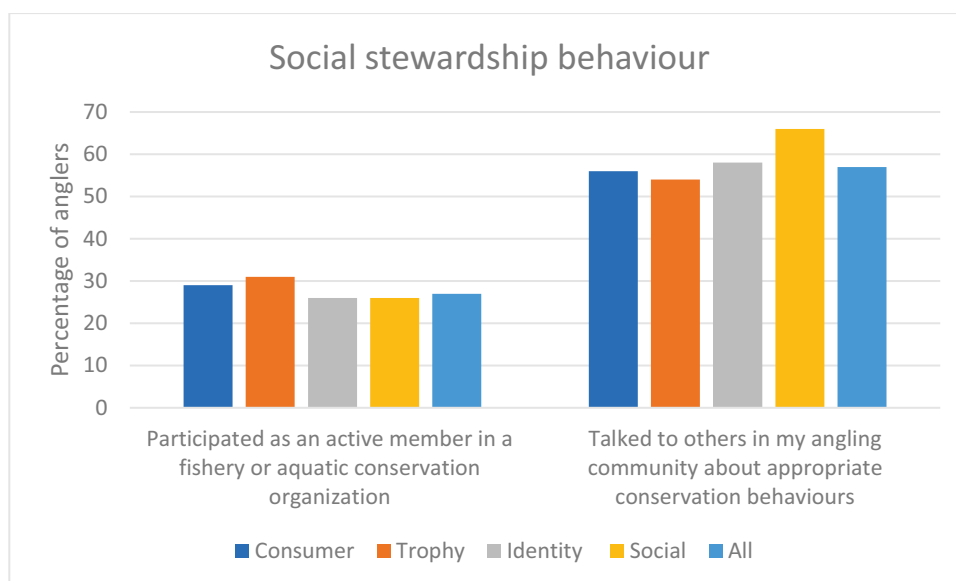


Figure 36: Social stewardship behaviour across segments

4.7 CONCLUSION

This Chapter has presented the results and analysis of the angler survey. The techniques employed have concluded that the angler sample is heterogeneous when considering co-variance based on several latent constructs captured by the survey variables. The resulting angler typology consists of four distinct angler types. The angler types (clusters/segments) are summarised as follows, primarily based on the strategic variables, independent variables where chi square was significant, and to a lesser degree, other variables reflecting demographic data and attitudinal/behavioural characteristics based on ANOVA.

4.7.1 The consumer

The consumer angler takes part in recreational sea angling to catch, retain and eat the fish they catch, motivated mainly by the experiences related to catching fish. While such anglers are driven by catching at least something when they fish, they also associate angling with an opportunity to be with friends. Consumers do not view angling as a centrally important part of their life, tend to fish less compared to other segments, and are unlikely to associate anglers with a responsibility to protect the environment. They are slightly older compared to other anglers in the sample, are

represented more so than the other segments in the South East of England and Yorkshire and Humber. Consumers are the least likely segment to return fish back to the water and when doing so are influenced by the small size of the fish, the desire to conserve future fish stocks and conformity to regulation. They demonstrate low levels of stewardship norms compared to other segments in form of guilt felt towards not protecting the environment, particularly the trophy angler. Consumers are also the less likely than other segments to carry out personal stewardship behaviours in form of cradling fish before return and the use of barbless hooks. In this respect, consumers are most different from social anglers.

4.7.2 The trophy angler

The trophy angler places high importance on the characteristics of the fish being caught, favouring catching larger and challenging fish, or fish that represent a 'trophy' catch (this may not mean large or challenging, but fish of a high standard in relation to desired aspects of the respective species). Of all clusters, they are the least likely to fish from a boat and are motivated by both catch and non-catch experiences related to angling. They express biocentric viewpoints, valuing the parity of rights between humans and animals/fish. The trophy angler is least likely to retain fish they catch, and the second most likely segment return fish back to the water. When returning fish, trophy anglers are mainly influenced by the conservation of future fish stocks, reflecting a sense of personal morality. While the trophy angler places recreational fishing as central to life, there is a dissociation between angling and friendship or socialisation. They also tend to fish less compared to other segments and are most common in the East of England. Trophy anglers hold a high level of stewardship norms with feelings of guilt towards protecting the environment. In this respect, and in comparison to other segments, they are most different from consumer anglers. Similarly, trophy anglers are the most likely segment to engage in public stewardship, mainly involving contacting political representatives in relation to conservation issues.

4.7.3 The leisure-identity angler

Leisure-identity anglers place lower importance on catching fish and the characteristics or numbers of fish caught. Of all clusters, they are the least motivated by experiences related to catching fish, and the second most likely group motivated by non-catch experiences. They link recreational sea angling to their personal identity, suggesting that the nature and characteristics of fishing reflects how they see themselves and how they want to be viewed by others. In this respect, recreational sea angling plays a central role in their life and they see anglers as key in the future protection of the environment. While leisure-identity anglers fish slightly more often, they do not feature strongly in any other form of angling behaviours or attitudes when compared to the other segments (e.g. stewardship or demographic data). The definition of this angler type is discussed further in Chapter Five.

4.7.4 The social angler

For the social angler, recreational sea angling provides an opportunity to be with friends. Social anglers place lower importance on keeping and consuming their catch and do not necessarily think fishing sessions are fruitless if no fish are caught. In line with this, they are the most likely cluster to release fish, and fish mostly from the shore and fish more often compared to other segments. They do, however, place some importance on catching higher numbers of fish and trophy fish. Supporting this dichotomy, of all clusters the social angler is most likely to be motivated equally by experiences related to catch and non-catch aspects of recreational sea angling. They show lesser propensity to associate angling with their identity expression and do not necessarily see it as central to their life. Social anglers are more likely to engage in private stewardship behaviours (using barbless hooks and cradling fish before return), particularly in relation to the consumer segment. As expected, social anglers are also the most likely segment to engage in forms of social stewardship (talking to others about fishery conservation).

CHAPTER FIVE

ANALYSIS AND RESULTS – INTERVIEWS

5.1 INTRODUCTION

The angler survey identified a number of key themes that required further exploration, investigating intricacies of the relationship between certain latent constructs and associated variables. Concepts such as identity emerged as strong factors that divided anglers in the sample, however detail was lacking in terms of how ‘identity’ featured in respective anglers’ experiences, or how anglers themselves interpreted such concepts. In addition, other areas of potential division between angler attitudes and behaviour (such as regulation and compliance) required more flexible approaches to data collection. This necessitated in-depth discussions with anglers to help not only clarify relationships between data in the survey, but also to explore other potential ways that the segments differed. The interviews with anglers were also used to verify the angler typology.

Twenty-four semi-structured interviews were conducted with anglers representing the typology segments (Table 30). Interviews were subject to thematic content analysis in Nvivo (see Appendix Nine for a summary of the coding frame).

Table 30: Segment membership of those taking part in follow-up angler interviews

| Segment | Count |
|----------|-------|
| Consumer | 5 |
| Trophy | 5 |
| Identity | 7 |
| Social | 7 |
| Total | 24 |

Each interview lasted for approximately 30 minutes (see Chapter Three for full methodology). The section presents the key findings of the interviews, beginning with a qualitative exploration of latent constructs, then detailing the angler typology verification process. The Chapter then explores perceptions of sustainability in

recreational sea angling before concluding with a discussion of regulation and compliance.

5.2 EXPLORING LATENT CONSTRUCTS

Both factor and cluster analysis revealed a close relationship between recreational sea angling and personal identity for a distinct group of anglers within the sample. Based on the survey analysis it was unclear as to what aspects of personal identity resonated with such anglers and vice versa. This topic formed the first basis of conversation with anglers during the interviews who were assigned both within and outside the 'leisure-identity angler' segment (section 5.2.1). The second topic discussed was motivation for angling, exploring levels of importance between catch and non-catch factors and whether motivation changes over time (5.2.2).

5.2.1 Identity

"I am an outdoors person" (Leisure-identity angler).

Anglers taking part in the interviews were asked how important angling was to their identity. Just under half of the anglers interviewed (11 of 24) felt that angling was very important to their identity as a whole, while an additional four anglers felt that angling was important but only in terms of their leisure identity (15 of 24 combined). Four of these anglers belonged to leisure-identity segment based on the survey analysis. The remaining 11 were evenly split across the other segmentations. In these contexts, recreational sea angling was seen as factor that both constructed and reflected personal identity (n=5).

Where a positive relationship between identity and angling existed (n=15), aspects of the interviewee's identity and how it related to angling were explored. The majority of anglers (n=10) reported that angling allowed them to engage in their enthusiasm for the outdoors and/or nature, helping to construct and reflect their identity in these terms. As one interviewee stated: *"I love the countryside and being outdoors, it's part of my personality, the joy is arriving at a venue and looking at it, interpreting the*

landscape, the water and how it moves, I've thought about what I'm doing, look at the tides and thinking this is a place I can catch wrasse and use this method, then I catch wrasse, I feel as if I've communicated with that environment. It's a symbiosis with the place I'm in" (Social angler). Similarly, another interviewee stated: *"Putting yourself against the challenges of not just fish but the environment... I'm into the environment anyway, being out there in the environment, lots of watery stuff, surfing and kayaking"* (Leisure-identity angler).

The latter is particularly interesting because it draws attention to the fact anglers who associate identity with angling often engage in other sports that act as a means to situate or position themselves with nature or the environment, such as shooting, walking or amateur forestry. As expected, the link between angling and personal identity as an outdoor person was expressed mainly by those assigned to the leisure-identity segmentation through the survey analysis (6 of the 10). Interestingly, however, trophy anglers did not feature in this grouping, with the remaining four of 10 anglers being equally divided between the consumer and social segmentations.

5.2.2 Motivation

Engaging with the outdoors and environment not only featured in relation to angler identity, but also in relation to motivation for participation in recreational sea angling. While catch and non-catch related motivation data was captured in the survey, the opportunity was taken in the angler interviews to discuss motivating factors in more detail, particularly to re-assess the divide in the importance of catching and not catching fish, but also to explore the potential of motivations changing over time. Fifteen of the 24 anglers interviewed were primarily motivated by the opportunity recreational sea angling offers to engage with the outdoors and natural environment. The majority of these anglers were assigned to the identity and trophy angler segmentations (5 each), as demonstrated in the following statements: *"My main motivation is going out, being in fresh air, a wonderful environment, clean sea, a joy to be out there"* (Leisure-identity angler)... *"getting out there into the wild, connecting with places"* (Trophy angler).

Only two anglers of the initial 15 gave equal parity between non-catch motivations and motivations related to catching fish. Six of the fifteen noted that their motivations had changed over time, compared to periods when they were younger and the motivation to catch fish was of greater importance to non-catch aspects of angling. Five anglers gave higher importance to catching fish as the primary motivation, of which three were assigned to the consumer segmentation. Consumption, challenge and thrill featured as subdimensions of catch the related motives discussed with anglers, as demonstrated in the following angler statements: *“Primarily, it’s about catching fish, the thrill of the fight.”* (Consumer angler). Another stated: *“For sea angling, I do enjoy eating the fish, sea angling is more of challenge”* (Consumer angler).

5.3 VERIFICATION OF THE ANGLER TYPOLOGY

Anglers were read definitions of the four angler segmentations drawn from the descriptions of key characteristics presented in Chapter Four. Following the definitions, anglers were asked to name the segmentation that they felt most closely reflected them in a recreational sea angling context (single fit scenario). Anglers were then asked to score themselves against each of the segmentations in terms of how much they identified with the defining criteria given in the previous descriptions (multiple fit scenario). Anglers were asked to score using the following scale: 1 = completely identify; 2 = strongly identify but not completely; 3 = partially identify; 4 = not related at all.

Table 31 shows that in the single fit scenario 67% (n=16) of anglers positioned themselves in the segmentation they were assigned to as a result of the survey analysis. This proportion increases to 83% (n=20) by incorporating scores of 2 in the multi-fit scenario. Based on single fit positioning, the leisure-identity segment shows the strongest verification with 86% (n=6 of 7) of anglers interviewed positioning themselves in the same grouping as their survey allocation. The consumer segment also performed well with 80% (n=4 of 5) of anglers self-positioning to the same group. Fifty-seven percent (n=4 of 7) of the social segment self-allocated to the same group as the survey analysis and only 2 of the five trophy

anglers (40%) did the same. The two respective anglers in the identity and consumer groups that allocated themselves to a different segment both felt completely aligned with the definition of the social angler. The trophy angler that did not feel they aligned with that particular segment, resonated completely with the leisure-identity segment. Those feeling mis-aligned within the social segment (n=3) chose to re-align themselves to either the identity or consumer groups (2 and 1 respectively).

Table 31: Angler fit against segments

| Segment | Single fit | Multiple fit: score | | | |
|----------|------------------|---------------------|--------|----------|--------|
| | Self-positioning | Consumer | Trophy | Identity | Social |
| Consumer | Consumer | 2 | 3 | 4 | 4 |
| Consumer | Consumer | 2 | 4 | 1 | 3 |
| Consumer | Consumer | 1 | 4 | 1 | 3 |
| Consumer | Social | 3 | 4 | 4 | 1 |
| Consumer | Consumer | 1 | 3 | 2 | 3 |
| Trophy | Identity | 2 | 3 | 2 | 4 |
| Trophy | Identity | 4 | 2 | 1 | 3 |
| Trophy | Trophy | 2 | 1 | 2 | 4 |
| Trophy | Identity | 2 | 4 | 1 | 3 |
| Trophy | Trophy | 4 | 2 | 1 | 3 |
| Identity | Identity | 3 | 2 | 1 | 2 |
| Identity | Identity | 3 | 4 | 1 | 3 |
| Identity | Identity | 3 | 4 | 1 | 4 |
| Identity | Identity | 2 | 4 | 1 | 2 |
| Identity | Social | 2 | 2 | 2 | 1 |
| Identity | Identity | 4 | 3 | 1 | 2 |
| Identity | Identity | 4 | 3 | 1 | 2 |
| Social | Consumer | 1 | 3 | 4 | 2 |
| Social | Identity | 4 | 2 | 1 | 3 |
| Social | Social | 3 | 4 | 2 | 1 |
| Social | Identity | 4 | 2 | 1 | 2 |
| Social | Social | 2 | 3 | 2 | 1 |
| Social | Social | 3 | 4 | 3 | 1 |
| Social | Social | 3 | 3 | 4 | 1 |

5.4 THE SUSTAINABILITY OF RECREATIONAL SEA ANGLING

Angler perceptions on the sustainability of recreational angling was explored in relation to threats, responsibility and trust. Each area is discussed in the following sections.

5.4.1 Threats to the sustainability of recreational sea angling

Sustainability in this context was defined as the long-term availability of a natural resource such as the sea and its fish stocks. Just over half of the anglers interviewed (n=14) felt that most threat to the fish stock originated with the commercial fishing sector, whether this was in form of overfishing, illegal fishing methods, or legal activity that may be condoned by policy but actually degrades the natural environment (such as dredging). Angler segmentation did not feature as a strong predictor of viewpoints towards environmental threats regarding commercial fishing. Of the 14 that highlighted commercial fishing, four were in the trophy segment, four in the leisure-identity segment, and three in the consumer and social segments.

A range of other threats to sustainability emerged in the interviews, although these were reported by fewer anglers (e.g. over-regulation and pollution). Of note, however, two anglers in the leisure-identity segment felt it important to highlight the apathy of recreational anglers as potential to endanger the future of recreational fishing, both in contexts of apathy towards the rules and a general apathy among young people taking up the activity. In relation to the latter, one angler stated: *“Apathy with youngsters coming in, there isn’t any feed in, there needs to be a pathway [into fishing], clubs and societies and coaching, stuff to help that second step”* (Leisure-identity angler).

5.4.2 Responsibility and trust

The majority of anglers interviewed (n=17) felt the government and relevant angling authorities were responsible for ensuring the sustainability of fish stocks for recreational sea angling. These views were apparent across all segmentations (3

anglers in the consumer and trophy segments respectively, and four in the social segment). These views were particularly strong, however, with leisure-identity anglers, with all those interviewed as part of this segmentation putting clear responsibility on the government. Additionally, four anglers felt the responsibility lay clearly on anglers themselves, with two of the four belonging to the trophy segment, as reflected in the following angler statements: *“There has to be a degree of self-regulation, people need to be more aware of what [effect] them taking immature bass effect that can have, but also I worry about Brexit and what will happen with the fishing laws, with some of the protection we had through EU law... mainly environmental protection...we’re going to end up with a free for all”* (Trophy angler)...*“Recreationally it has to be down to the angler, I’ve seen people on piers with buckets of undersized fish... you have a responsibility to know the rules and a lot of people don’t know the rules. I think freshwater fishing and flyfishing, it’s a different culture, self-regulation should be more understood, but that’s down to the individual”* (Trophy angler).

Co-responsibility between recreational and commercial sectors to ensure sustainability of the marine fish stock was also highlighted by a small number of anglers.

When probed on the level of trust held for those deemed responsible for sustainable fishing, the majority of those who named government also reported very low levels of trust in the ability of organisations (such as Defra) to protect fish species and the natural environment (n=10 of 17). There were no significant patterns in these responses, however, according to segment membership. A significant proportion of those mentioning government and authorities, however, did hold some trust in the ability of such organisations to protect the future of sea angling (n=5), again with no clear relationship to segment membership. Fewer anglers took opportunity to suggest ways to increase levels of trust with government/angling authorities. Those who did mainly targeted suggestions at actually implementing-enforcing policy in recreational fishing and commercial fishing (such as enforcing harsher rules on dredging which was previously referred to as a main threat to sustainability).

5.5 REGULATION AND COMPLIANCE

The majority of anglers interviewed felt they had a good degree of knowledge around recreational sea angling regulations (n=20). This core knowledge acted as a good starting point to explore some of the potential issues with existing regulations, although because of the sensitive topic (rules and regulation) some anglers were not as forthcoming in the discussions. Because of this, it was important to ensure enough experience was held by each interviewee to support viewpoints and that probing was kept at a minimal to avoid interviewees pulling out of the discussion. Firstly, each angler was asked to state the main type of regulation that they come across in their angling endeavours. Thirteen anglers mainly experienced regulation in relation to fishing for sea bass; 10 anglers stated they mainly encountered regulation through species minimum sizes (excluding sea bass sizes). These two sets of rules are explored individually subsequently.

5.5.1 Sea bass

The least represented groups that chose to discuss sea bass regulations were consumers and trophy anglers (n=2 respectively). Similar numbers of identity and social anglers chose to engage in debate on sea bass rules and regulations (n=5 and n=4 respectively). Three anglers (consumer, identity and social) felt that current sea bass regulations were appropriately protecting the species. Three more anglers (in the trophy, identity and social segments) felt that the current regulations were not doing enough, and that minimum size limits should be readdressed. A significant number of the thirteen anglers (n=11) reported that other anglers in the bass fishing community do not conform to existing regulations, and that many conduct this behaviour despite the fact that they are fully aware of the rules, as stated by one interviewee: *“I know there are anglers that don’t follow the rules around here... the people who are breaking them know the rules.”* (Leisure-identity angler). Another angler took the opportunity to expand on potential rule breaking as a result of comparison with the commercial sector: *[rule breaking is] “widespread, I know where to go if wanted to get examples of it, you either got not very informed anglers, or a few greedy ones who know they are doing wrong but carry on doing it. You see them*

doing it. On the small boats, you have anglers that don't respect the 2 fish a day limit, they don't think it's fair, 'why should commercial be able to catch 5 tonne a day and I'm only allowed to catch two.' (Leisure-identity angler).

5.5.2 Sizes

A similar proportion of anglers chose to discuss fish size regulations. A small number felt that current size limits were not sufficient to protect respective species (n=3 of 10). These anglers were located in the consumer, trophy and leisure-identity segments. Two anglers (consumer and trophy) felt the sizing regulations were adequate. Just over half of the anglers (n=6 of 10) in this group felt that other anglers in the community do not follow the stipulated minimum sizes for species set by government. Again, there is evidence to suggest that motivations behind community rule breaking may result from perception of other peoples' actions (normative) as demonstrated by the following angler statement: *"I have seen people do it, and they go out and catch 5, 6, 10 each because if I don't, somebody else will"* (Consumer). There is also evidence to suggest that community rule breaking is not a result of lack of information or knowledge among anglers: *"People generally understand the size and catch limits and they ignore them and do what they like really"* (Social angler).

5.5.3 Influences on compliance

The reasons behind why anglers may choose to ignore specific regulations for sea bass or species size limits in general related to a wider discussion held during the interviews on what factors may positively affect compliance with policy. Half of the anglers interviewed (n=12) felt that compliance was driven by a personal sense of morality and self-interest to prolong the resource that their leisure was dependant on (in essence therefore, a sense of sustainability), as one interviewee noted: *"I follow the rules because I want the fish to be sustainable, because I want to be able to come back tomorrow and catch fish, if I don't follow the rules then the sustainability isn't going to be there"* (Consumer).

Again, anglers with this viewpoint were positioned across all four segments: four in the identity group, three respectively in the consumer and trophy groups, and just two in the social segment. Peer pressure was also raised by five anglers, again cutting across segments, except the consumer group. Fear of being caught breaking the rules or risk of persecution was only raised by two anglers; conversely, six anglers specifically reported that risk of prosecution if caught was particularly unimportant mainly because of the lack of visible enforcement of such rules (and chance of being caught). Again, there is no pattern in terms of a significant proportion of these anglers being positioned in one or more segmentation developed from the survey.

In order to explore influences on compliance further, interviewees were asked about factors that may increase the likelihood of them adhering to a recreational sea angling licensing system if introduced in the UK. Contrary to previous observations, the majority of interviewees (n=14) indicated that uptake would be largely influenced by enforcement and fear of prosecution. Here, however, there was a clear pattern in angler segmentation: Fear and prosecution was raised by all anglers in the leisure-identity segmentation (n=7), and by only one angler in the trophy group. In addition, seven interviewees felt that uptake would be increased by demonstrating how the licensing system would benefit the angling community and protect the environment. Four anglers felt that the system would require a form of normative intervention to change the internal beliefs of the angler to 'want' to self-regulate, as one angler stated: *"You got to change the angler, the coastline is too big and you can't go to every charter boat and look in their bucket, it would be impossible"* (Trophy angler).

Less common factors mentioned by anglers included: incentivisation (n=3); and publicity (n=4), with three quarters of these angler belonging to the leisure-identity segment.

5.6 CONCLUSION

This Chapter has demonstrated that the typology based on latent constructs developed from the survey accurately reflects key characteristics of anglers that took part in the interviews. Over 82% of anglers interviewed felt that they either completely or strongly aligned with the definition of the segment they were assigned to as part of the survey analysis. There is some variation, however, with consumer and leisure-identity anglers performing strongest in this respect and fewer trophy anglers self-allocating to the same survey segment.

Importantly, the interviews revealed that the relationship between identity and recreational sea angling is fundamentally based on an enthusiasm for being outdoors and partaking in a leisure activity that is situated within the natural environment. For these reasons, the definition of the leisure-identity segment can be further refined by suggesting that anglers in this group identify with angling because it is a means through which they can express their passion for the outdoors and meet their desire to engage and benefit from being in the natural environment. The interviews also allow an expansion of the data regarding motivation, with the outdoors being closely associated with reasons for taking part in angling, particularly for leisure-identity anglers. The caveat here, however, is that motivation is perhaps changeable over time, and responses may be different at different points during an anglers' lifetime.

The ability of the angler typology to reflect perceptions and behaviours regarding sustainability, regulation and compliance is not clear. The typology did not feature as a divisive model for many of the actions, behaviours or perceptions expressed during the interviews. However, some observations do act as points that can aid further in defining the angler clusters. The data suggests that leisure-identity anglers are more inclined to place responsibility for the sustainability of recreational sea angling on government. In line with this, leisure-identity anglers were more inclined to respond to enforcement and risk/fear of prosecution in the hypothetical scenario whereby a UK licensing system is introduced. Furthermore, trophy anglers were least likely to raise this as a potential factor in the success of licensing.

Although not reflective of the typology division, the interviews also yielded important observations that can add to current debates on policy and management in recreational sea angling. Evidence presented in this Chapter suggests that informed rule breaking may be more embedded in the UK angling community than previously thought. However, more positively, compliance to existing rules and regulations is based on a degree of self-regulation among anglers deriving from feelings of personal morality and enforced through normative perceptions of peer pressure.

CHAPTER SIX

DISCUSSION AND CONCLUSION

6.1 INTRODUCTION

This Chapter presents a discussion of the study results in relation to the research objectives set out in Chapter One under the broad remit of increasing the understanding of heterogeneity among recreational sea anglers in England and Wales. The chapter provides a critical discussion of the typology (6.2). It then makes comparison to key literature in order to fully contextualise theoretical significance of the research (6.2.1). Section 6.2.2 continues this discussion by focusing on what the typology reveals about the values, attitudes and behaviours of angler segments in the study, specifically drawing on the scientific literature to demonstrate advancements in theory relating to measures of angler heterogeneity; this sub section provides a detailed discussion of the data collection framework and data reduction techniques as this is where relevant contributions to concepts used in measuring heterogeneity are made (e.g. components of specialisation and attitudes to catch). Section 6.2.3 critically discusses angler views on fishery management while 6.2.4 focuses on impact. Section 6.2.5 draws together insights from the angler survey, interviews and development of the angler typology to contribute toward current and future policy development in the UK fisheries framework. Section 6.3 provided a methodological discussion and recommendations on the future application of the typology developed in the study to aid future research on heterogeneity and catch reporting. The research objectives driving the research (Chapter One) are included at the outset of each chapter to guide discussion. The Chapter concludes with a summary of key findings and specific recommendation for UK fisheries policy.

6.2 CRITICAL DISCUSSION OF THE ANGLER TYPOLOGY AND ITS CONTRIBUTION TO FISHERY MANAGEMENT

The subchapter focuses on what the typology helps to reveal about the values, attitudes, and practices of recreational sea anglers and how these insights contribute to fishery policy and governance.

6.2.1 Describing heterogeneity among anglers in the study and critically comparing to existing typologies

Objective: produce a typology that best describes heterogeneity among recreational sea anglers in England and Wales. In relation to this: 1) define key characteristics of the constituent angler groups; 2) use appropriate and novel techniques to verify/validate the angler typology; and 3) compare angler groups to those produced in research outside the UK.

The survey analysis resulted in an angler typology consisting of four segments: the consumer; the trophy angler; the leisure-identity angler; and the social angler. Observing the structure of the typology in this study, it is apparent the suite of typology segments are consistent with other studies, notably the work of Magee et al. (2018), Beardmore et al. (2011) and, to an extent, Johnston et al. (2013). Table 32 shows comparison between the segments across studies. These similarities exist even though each study was underpinned by different approaches, methods and variables. The current study is based on exploratory factor analysis involving primarily survey methods supported with angler interviews; the exploratory nature encompassed a wide range of measures on which the analyses was formed. While both Beardmore et al. (2011) and Magee et al. (2018) used survey and questionnaire research in their research, both were primarily focused on motivation as the leading/defining characteristic of the typology. Johnston et al. (2013) is methodologically further afield than the current study, employing a utility modelling approach. The studies are also different in their environmental context: Johnston et al. (2013) focused solely on anglers targeting several freshwater species (pike, perch, brown/bull trout), Magee et al. (2018) and Beardmore et al. (2011) focused

on both fresh and saltwater anglers, encompassing a broader remit of targeted species.

Table 32: Typology comparison of the macro structure

| Angler type | Current study | Magee et al. (2018) | Beardmore et al. (2011) | Johnston et al. (2013) |
|--------------------------------------|----------------------|----------------------------|--------------------------------|-------------------------------|
| Consumer / hunter gatherer | ✓ | ✓ | ✓ | ✓ |
| Trophy | ✓ | ✓ | ✓ | ✓ |
| Identity (outdoor-nature enthusiast) | ✓ | ✓ | ✓ | × |
| Social | ✓ | ✓ | ✓ | × |
| Non-trophy anglers | × | × | ✓ | × |
| Generic | × | ✓ | × | ✓ |
| Challenge seeking | × | × | ✓ | × |

To further understand the similarities between the typology in this current study and previous research, it is necessary to compare the key defining characteristics of each angler segment, noting that concise comparison may be hindered due to the fact that the studies are slightly different (as discussed above). Before this, however, it is important to address the angler segments shown in Table 32 that did not emerge in the current study. Firstly, ‘non-trophy’ or ‘generic’ anglers did not feature the current study (Beardmore et al. 2011). While there is a simple explanation in that the analysis in the current study did not warrant the creation of such segments, a more considered reason is that there were no precise measures used in the survey questionnaire for this study that would have created groupings to this effect. The final angler group absent in this current study is the ‘challenge seeking angler’ (Beardmore et al. 2011). The current study did include a variable that would reflect this segment’s characteristic: FV27_Challenge: “I’m happiest with a fishing session if I hook a fish that is challenging to catch”. However, the factor analysis grouped this variable with others that focused more on the characteristics of the fish itself, for example, size over quantity (FV26_Rather: “I would rather catch 1 or 2 big fish than 10 smaller fish”) or its ability to represent a trophy fish (FV28_Chance: “I like to fish where I know I have a chance to catch a trophy fish”). For these reasons the ‘challenge’ variable was subsumed into the formation of the trophy angler segmentation in the current study.

Comparison of individual angler segments from across studies shown in Table 32 is provided below:

Consumer: Magee et al. (2018) conceptualised consumer anglers slightly differently to the current study, naming this group 'hunter gatherers', defined as having a high degree of consumptive orientation and scoring neutral on most other measures such as those associated with fish size, numbers caught and the importance of catching at least something when fishing (attitudes to catch from Anderson et al. 2007). While the current study agrees with the neutrality of measures (evident in factor scores) and of course the propensity of consumer anglers to retain fish they catch for eating, 'consumers' in this study also viewed angling as a means to socialise with friends. This makes for a slight difference in the definition of consumer anglers in this current study compared to the hunter gatherers in Magee et al. (2018). It becomes slightly more difficult to make comparisons with the work of Beardmore et al. (2011) due to their research primarily focusing on heterogeneity being measured through motivation. Their consumer equivalent ('meal sharing anglers') was based on a detailed measure of motivation that was not replicated in the current study. Johnston et al. (2013) is comparable, with anglers showing a predisposition to retain fish caught (i.e. the only comparable measure).

Trophy anglers: this segment was defined with a broader range of characteristics compared to consumer anglers, favouring to catch larger fish and challenging fish, expressing biocentric viewpoints, a dissociation between angling and friendship or socialisation, but holding a high level of stewardship norms. No other studies in Table 32 used such a range of diverse measures, so it is not possible to draw accurate comparisons. The segment is most comparable to trophy anglers in Magee et al. (2018): both place higher importance on catching challenging and larger fish. Size was also an important part of the conceptualisation of trophy anglers in Johnson et al. (2013). Beardmore et al. (2011), however, found that centrality and fish consumption played an important part in their definition of 'trophy' anglers, which is contrary to the defining characteristics in this study: trophy anglers did not score highly for these variables and showed increased likelihood of releasing fish as opposed to retaining for the table.

Leisure-Identity anglers: this group placed lower importance on catching fish and were least motivated by experiences related to catching fish. They linked recreational sea angling to their personal identity and as someone being in touch with nature and the outdoors. They also scored high in terms of centrality. This group is most comparable to the outdoor enthusiast group in Magee et al. (2018), although their definition is primarily based on a more detailed capture of non-catch motivations (of which escapism and relaxation featured strongly). This study and Magee et al. (2018) showed low scores in relation to the importance of fish size, numbers and socialisation. Beardmore et al. (2011) conceptualised the equivalent group as 'nature orientated anglers', again placing higher importance on being outdoors. However, this group scored low in terms of centrality and high regarding importance placed on challenge and size of fish caught, meaning that differ compared to leisure-identity anglers identified in this study.

Social anglers: for these anglers, recreational sea angling provided an opportunity to be with friends, with lower importance was placed on keeping and consuming their catch and centrality. Some importance was placed on catching higher numbers of fish and trophy fish. Similarly, Magee et al. (2018) defined social anglers by the motivation to be with friends, escapism propensity to release fish. Less importance was placed on catching fish, however, with higher percentages of the group claiming they are happy if they don't catch fish (Magee et al. 2018). In Beardmore et al. (2011) the social group proved the most difficult to define, although they did share the common characteristic of low retention rates apparent in Magee et al. (2018) and this study.

The similarity in the overarching structures of angler typologies discussed thus far must be contextualised by two important factors:

Firstly, the typology developed in this study was supported by a unique verification exercise. Eighty-three per cent of anglers completing the survey and taking part in the follow-up interviews self-allocated to the same group in which they were placed as a result of the survey analysis. This verification method is novel and has not been conducted in any other research focusing on angler typologies (in either freshwater environments or outside the UK). While it is difficult to draw comparisons on the

theoretical implications of this method, it is important to highlight what the verification actually verifies. At face value, one may assume that it verifies the existence of four angler types among the recreational sea angling community across England and Wales. This is only partly correct. There is a likelihood that these angler types are reflective of segments across the wider community outside of the sample used in this study, but representative sampling would be required to answer this definitively. The verification method actually verifies the strength and ability of the survey analysis (specifically the combination of factor-cluster techniques and use of validity variables) to accurately combine questionnaire responses and amalgamate them into a digestible format on which segment definitions can be formed; a definition against which members of the segment agree. This reflects the important fact that the typology is inherently linked to the framework of variables and questions asked. Asking a different set of questions may result in a different typology. But in the case of this research, the most appropriate questions were asked relative to previous research on heterogeneity and sustainability in angling, with theoretical justification presented in the literature review.

Secondly: while the typology developed in this study represents robust description of heterogeneity among recreational anglers in England and Wales and is comparable to other studies in the angling literature, an important consideration must be highlighted in reference to the male predominance in the survey sample. Research has demonstrated that there are certain gendered differences in the motivation of and ethics of anglers. For example, Schroeder et al. (2006) demonstrated that motivation to eat fish caught was higher among women than men, and that men were more likely to release fish caught than women. Men were more supportive of sustainability orientated regulations such as limitations on the numbers of fish caught or restrictions on the minimum sizes of endangered species. Such research implies that changes in the balance of gender (i.e. more women in the sample) could potentially change the outcome of the typology. In practice, these changes are not likely to affect the outcome of the factor analysis but could affect the proportion of the anglers in each segment: for example, based on Schroeder et al. (2006), more female anglers in the sample could increase the size of the consumer segment. Future research is needed based on a representative sample, or probabilistic sampling strategy where female anglers are represented

proportionally/accurately to the population in England and Wales. This approach can be integrated in the methodological recommendations for future research discussed in section 6.3. Additionally, future research would benefit from a full review of the gender differences in relation to each of the measures used in the survey for this study, which could inform appropriate weighting methods in future analysis. This is dependent on the existence of such research: for example, studies evidencing gender differences (or not) in the outcomes of the NEP, centrality, identity, or social bonding. This would represent a significant piece of additional work but would be extremely valuable in further progressing research on the human dimension of recreational angling.

6.2.2 What the typology reveals about angler attitudes, values and behaviours of recreational sea anglers in England and Wales

Objective: to review existing literature and theoretical approaches on recreational angler heterogeneity and produce a framework for collecting appropriate data that allows the capture of differences in values, attitudes and behaviours. As part of this: 1) describe factors (latent constructs) demonstrating high value in measuring heterogeneity; 2) review the strength of the latent constructs in context of existing theoretical/conceptually based frameworks.

The typology developed in the current study demonstrates a significant degree of heterogeneity among the values and attitudes of recreational sea anglers in England and Wales, behaviours (such as avidity) proved less useful in segregating anglers. This observation is key and can be refined further by understanding the development of the framework used to develop the typology and how the factors themselves were formed by reducing the sets of variables. Through this process, key contributions and critics of the literature are made with regards to the types of values and attitudes prevalent in the typology and therefore prevalent among recreational anglers in England and Wales.

The formation of the angler typology involved the collation of quantitative data ranging across several conceptual domains, using a cognitive hierarchy model of

behaviour as a theoretical schematic. This novel approach was exploratory by nature and for this reason required the inclusion of measures and concepts that showed credible legitimacy in describing differences among anglers. The data collection tool (survey questionnaire) was extensive and relatively time consuming for participants; its construction required careful consideration as the variables (questions) intended for use in the typology existed alongside other questions capturing additional areas of angler behaviour to enable wider inferences on the impact of heterogeneity.

Forty-three variables were initially selected from the data collection framework on which assessment of heterogeneity were made; the process of factor analysis reduced the number to 34. The implication of variables omitted in this process is discussed subsequently, however, in the first instance it is important to note that the while the number of variables were reduced, the number of factors or concepts were only reduced minimally. The initial 43 variables reflected thirteen known concepts drawn from the literature, with the final factor solution consisting of 10 factors (latent constructs). This suggests that in its entirety and in an unmanipulated form, the data collection framework successfully broached most topics where variance in angler values, attitudes and, to an extent, behaviours, were expected; further implying that the framework is appropriate for replication in future data collection exercises that aim to measure angler heterogeneity in an exploratory context. Future data collection, however, will need to minimise the amount of space given to the measure of angler heterogeneity to reduce participant burden. This is discussed in more detail later in the Chapter.

Returning back to the process of data reduction, discussing the theoretical importance is best achieved by grouping the omitted variables. Firstly, the statistical analysis required omission of FV2_Spend, FV3_Distance (travelled), and FV19_Skill (self-perception). The first two constituted key measures of behavioural commitment and the third reflected a measure of angler cognition. These two concepts represent two of the three segments of angler specialisation theory. This is significant. Their omission reflects a lack in co-variance with each other or with any other measure in the variable matrix, including the third component of angler specialisation theory, psychological commitment (centrality). The lack of statistical

relationship in the factor analysis process suggests that specialisation does not hold as a theoretical model to best explain heterogeneity among recreational sea anglers in England and Wales.

There are three potential reasons behind this outcome: the most credible and simple reason is that specialisation is a weak theoretical model for explaining the make-up of the recreational sea angler in the sample; secondly, specialisation was not born from a statistical process that had found significant co-variation/relationships among its constituent measures, rather, it had been developed on a logic model reflecting perceived core components involved in the angling experience, therefore it was never intended to hold strong in a factor-cluster analysis model; thirdly, this could be a product of sample bias, although in response to this, the sample demographic in this study was largely consistent with other samples drawn from the UK sea angler population (e.g. WPS).

The second set of variables omitted in the factor analysis also have notable theoretical implications. These include: FV13_Identity; FV14_Look; and FV15_Myself. These variables are what Kyle (2007) used to conceptualise and measure identity affirmation (discussed in Chapter Two). The statements reflect the degree to which angling is used to 'affirm' one's identity to oneself (as opposed to identity expression, in which angling is used to express one's identity to others). Kyle et al. (2007) confirmed the required inclusion of measures reflecting both affirmation and expression in determining the level of enduring involvement among anglers in South Carolina, USA, but recommend that further research was needed to test the cohesiveness of constituent components. The results of this study failed to find co-variance and correlation between the statements used to measure identity affirmation as per the aforementioned omitted variables, meaning it did not hold as measurable latent construct). This suggests that: firstly, if one were to use the data gathered in this study to form a hierarchical gradient reflecting the level of involvement among anglers in England and Wales, the definition of 'involvement' would require revision to exclude identity affirmation; secondly, future UK based research on involvement may consider removing measures of affirmation in data collection tools; and thirdly, moving away from the methodological and theoretical

considerations, identity for recreational anglers in England and Wales relates to the presentation of self-image to others, rather than introspective confirmation to self.

There are other observable differences in the factors developed in this study and the sub dimensions of involvement theory (Kyle et al. 2007). In this study, the centrality factor incorporated seven variables: FV1_Days; FV4_Organised; FV5_Central; FV6_Preference; FV10_Enjoy; FV11_Important; FV12_Satisfying. Three of the variables (FV10_Enjoy; FV11_Important; and FV12_Satisfying) are conceptualised to reflect 'attraction' in involvement theory. At no stage in the factoring process did the seven measures listed above de-group; measures of attraction consistently covaried in a combined state with measures of centrality. Kyle et al. (2007) did not focus greatly on the independent role of 'attraction' in conceptualizing enduring involvement; however, their research did highlight the fluid nature of sub-dimensions within the theory and justified the necessity to change the definitions of factors as long as there is plausible-logical reason to do so. Kyle et al. (2007) defined attraction as a measure of pleasure derived from a given leisure activity: the results of this study suggests that there is a significant overlap between this definition and that of centrality, defined as the degree that fishing is centralised as a core component of one's lifestyle. In an abstract view of these concepts, one can see how easily they relate to one another: an activity that provides a high degree of pleasure would play a pivotal (or central) role in one's life. Therefore, there is a data-driven and conceptual rationale to combine attraction with the concept of centrality for the purposes of understanding angler heterogeneity among this study sample.

The conceptualisation of centrality in this study has other significance in relation to the angling literature. Firstly, the analysis combined FV1_Days into the centrality factor. While this may seem slightly odd, considering that both are treated as separate components of specialisation theory, there is literature-based rationale behind this merger arising from the relationship between high degrees of avidity and the measures of centrality (see Kyle et al. 2007). Secondly, previous research on enduring involvement has suggested that the definition of centrality should be inclusive of measures of social bonding because the degree of personal relevance of a leisure activity (centrality) is usually tied to the derivation of rewards resulting

from social interaction (McKintrye and Pigram 1992). Kyle et al. (2007) disagreed, arguing that when separated as distinct constructs, they provide strong predictive power in explaining longevity of engagement with the leisure activities. The factor analysis presented in this study showed distinction between measures of social bonding ('friendship') and centrality, therefore supporting Kyle et al. (2007).

The discussion on 'involvement' reflects an important macro-level observation about the data and factors developed in this study. Just as specialisation is regarded as a weak theoretical underpinning for heterogeneity, the dimensions of enduring involvement is regarded as a strong framework for understanding heterogeneity among recreational sea anglers in England and Wales. Apart from the caveats surrounding the merger of attraction and centrality, and the deletion of identity affirmation, the domains of enduring involvement remain in the 10-factor solution: centrality; social bonding, and identity expression.

The problem with enduring involvement research, apart from the lack of research and data confirming its dimensions (Kyle et al. 2007), is that its primary focus to date has been to test the ability of each constituent measure to predict performance in the other measures employed in its definition (e.g. centrality used to predict attraction and vice versa). While it provides a multi-dimensional framework, there is a need to test the ability of enduring involvement in a gradient framework, where measures are combined to provide a single indexed score allowing the identification of 'least' to 'most' 'involved' (a unidimensional measure). The main reason why a sole focus on a unidimensional measure, such as involvement, was not employed in this current study is that they are too limited and exclude many other measures relevant to understanding angler heterogeneity. This was proven in the current study: the three measures of involvement were joined by seven other dimensional concepts that showed statistical significance in describing characteristics of each constituent segment in the typology. Understanding heterogeneity across the sample was therefore aided by a more inclusive (and wider reaching) set of variables and resulting factors.

The attitudes to catch framework was also evident in the factor solution, further supporting the notion that attitudinal measures are of most use in describing

heterogeneity. All four dimensions (catching something, catch numbers, catch large/trophy fish, and keep fish) played important parts in defining the angler segmentations within the typology. However, slightly different names were applied to two of the four dimensions originally developed by Anderson et al. (2007). Firstly, 'catch something' was renamed as to reflect a general 'a catch orientation' as it was felt that this more accurately reflected the nature of the three associated statements. Secondly, 'large/trophy' fish was renamed as 'catch characteristics', again the reason being that this title more appropriately reflected the three-loading statements. For example, only one of the three loading statements referred to 'trophy' fish, with the other two focusing on 'big' fish and 'challenging' fish. These aspects of a fish are more in-line with their biological characteristics rather than simply indicating their label as a trophy fish.

Anderson et al. (2007) largely focused on the ability of the four dimensions to reflect an overall consumptive orientation, or whether the single dimension 'catch something' is sufficient to reflect a consumptive orientation. Anderson et al. (2007) highlighted the need to replicate the framework in different contexts/cultures to further explore the strength of the individual sub-dimensions in angler attitudes (other than among licence paying anglers in Texas, USA, which represented very structured angling context). The research presented in this study validated framework developed by Anderson et al. (2007), importantly, demonstrating its applicability in an open access, multispecies, fishery.

The discussion thus far has clearly identified that heterogeneity among recreational sea anglers in England and Wales is best described by conceptual measures of identity, social bonding, involvement, centrality, environmental attitudes and the importance placed on difference values associated with catching fish (each representing factors and latent constructs in the data). This research has made important contributions to development of each of these conceptual areas in both their definition and measurement. These measures are integral to describing the differences among anglers in this study and are pivotal in considering the contribution of the angler typology to the development of recreational angling in future UK fisheries policy (discussed in section 6.5).

6.2.3 Perspectives on fishery management

Objective: use qualitative methods to explore views on fishery governance and management among angler groups identified in the typology.

The ability of the angler typology to explain differences in perceptions and behaviours regarding sustainability, regulation and compliance is not clear. Anglers across all segments of the typology felt that the government was responsible for safeguarding sustainability, with evidence suggesting that leisure-identity anglers are perhaps slightly more likely to express such views. Anglers across the segmentations also held low levels of trust in government. Furthermore, specific policies on sea bass and size guidelines in recreational angling also yielded mixed views from across angler segments. For example, regardless of segment membership, some felt sea bass are adequately protected under current legislation (limited size and catch limits) while some felt stricter measures were needed. Compliance with such regulation was influenced by a sense of personal morality in anglers across all segments, with fear and the risk of prosecution acting as the main deterrent against rule breaking. In this context, the first difference according to angler type is apparent, with leisure-identity anglers displaying this characteristic more than any other segment in the typology.

In previous research, there has been clearer linkage between angler type and views on angling regulation and policy. Several studies have highlighted that more specialised anglers are more supportive of increasingly restrictive harvest regulations (Ditton et al. 1992; Aas and Vitterso 2000; Sutton and Ditton 2001); however, these studies use a typology for angler segregation (specialisation) that has proven inappropriate for describing heterogeneity among anglers in this study sample. Johnston et al. (2013) demonstrated that trophy anglers showed more support for tighter harvest regulations and consumptive orientated anglers being the least supportive. Magee et al. (2018) also found consistency between certain motivational characteristics of anglers ('skills mastery' and 'challenge') and support for increased restriction on fish sizes and harvest regulations. These motivational characteristics are consistent with characteristics of the trophy angler this study.

Arlinghaus (2006b) showed that motivation, however, can mislead angling policy makers. While most anglers give high levels of importance for non-catch motivations, angling satisfaction is based on catch performance, and this should be favoured in relation to informing fish harvest policy. Logic then suggests that any policy change significantly affecting the ability of anglers with high harvest expectations (i.e. consumers) to fulfil their expectations, would likely be opposed. This logic is consistent with scenario-based willingness to pay studies carried out in the UK: much higher values were reported for catch and keep compared to catch and release regulations in regard to sea bass and cod (Andrews et al. 2021).

The discrepancy between the findings of this study and that of previous research described above suggests that further work is needed to fully explore the impact of the typology on perspectives towards management. This would benefit from a specific focus on certain regulations aimed at enhanced protection for selected fish species, such as sea bass, and the inclusion of more anglers if a qualitative methodology is applied. There is limited research on sea bass compliance and regulation among recreational anglers in the UK. Of relevance, however, is the work of Grilli et al. (2019) who surveyed recreational sea bass anglers in Northern Ireland. The work revealed that most anglers in the survey felt regulations protecting the species was 'just right', with smaller but similar proportions of anglers reporting rules to be too lenient or too strict.¹⁹ This is in line with the spread of views among anglers taking part in the interviews for this study. Although Grilli et al. (2019) did not focus on the segmentation of anglers, there are other broader similarities of their findings to the current study in terms of compliance: anglers reported ethical reasons as one of the main factors influencing decisions to follow legislation.

Fear of prosecution was not measured by Grilli et al. (2019) but featured as a characteristic of the leisure-identity segment identified in this study. There is a body of literature suggesting that deterrence is the more effective model of policy regulation regarding animal protection, otherwise known as the instrumental

¹⁹ At the time of the research, sea bass restriction were fairly similar to that in 2023, with a no fish season, minimum sizes of 40cm and a bag limit of two fish per day.

approach (Keane et al. 2008; Bova 2019). However, this study also showed that morality and influence of peers featured across segments as factors that influenced compliance behaviour, suggesting that psychological and normative factors also affect angler decision making. Several studies have recommended the importance and effectiveness of normative approaches to angling policy (Bova et al. 2017; Bergseth and Rocher, 2018; Mackay et al. 2018; Bova, 2019). The finding of this study implies that a mixed method of policy implementation involving normative approaches, as well as instrumental drivers, may be most effective in the UK context. The only potential drawback to this combined approach is that instrumental drivers are most effective when there is a good degree of trust and legitimacy placed on the policy and governing body in charge of its implementation, and as demonstrated among the sample in this study, trust in government was relatively low.

6.2.4 Impact on fish stock

The commonality in view towards government across segments is reflected in certain measures of angler behaviour related to the impact of anglers on fish stock. Survey data revealed that large proportions of anglers released the fish they catch across the typology: for example, for cod, the segment with the lowest return rate (i.e. consumers) was 86%. Considerable numbers of cod were caught by anglers across the segments over the 12 months prior to completing the survey (4,501), however, with such a high proportion of anglers returning fish, it suggests that the impact of recreational anglers on fish stock in this study is relatively low and contrasts to previous studies demonstrating the potential high detrimental impact of recreational angling on fish stock (see Brownescombe et al. 2019 for a review, or Cook and Cowx 2005; Lewin et al. 2006). Please note, however, that the numbers of anglers in this study is relatively low to warrant substantial claims outside the context of this study; further work would be required to extend the data captured in this study by extrapolation techniques that recognise the effect of non-probabilistic survey bias (an objective outside the initial remit of the current study).

The survey data implies a general intention among anglers to release fish caught; furthermore, anglers in the study generally hold attitudes or pursue behaviours that aim to protect fish as demonstrated in both the survey and follow up interviews. For example, a high percentage of anglers across segments agreed with personal stewardship norms around the conservation of fishery resources and engaged in stewardships behaviours involving fish being kept / cradled in water before being released. Landon et al. (2018) identified these traits as vitally important in the sustainability of fisheries. Based on this, the incorporation of recreational anglers in the UK into a policy framework geared towards sustainability may be met with more ease than previously thought. Policy may well preach to the already converted.

6.2.5 The future integration of recreational sea angling in the future UK policy framework

Objective: highlight implications arising from angler heterogeneity regarding the further inclusion of recreational sea angling in the future UK policy framework.

Management and policy literature has highlighted the importance of understanding diversity among anglers in developing effective governance of marine environments (Arlinghaus and Mehner 2005; Arlinghaus, 2006b; Beardmore et al. 2011; 2013; Arlinghaus et al. 2019a; 2019b). Brownescombe et al. (2019), specifically highlighted that describing and understanding angler values and behaviours is crucial for such governance systems to develop policies that will meet angler expectations and therefore result in policy compliance. Still, however, recreational angling is poorly described and understood in most national policy frameworks throughout the world (Potts et al. 2020). In the UK, the formal integration of recreational angling into the policy framework is significant step forward and is now coupled with a robust description of the diversity within the angling community as a result of this study, where features describing anglers rests on consumption, trophy fish, identity and social interaction. Future engagement and policy developments can use the definitions of segments to inform and shape the phrasing and messaging of key policies that are likely to affect recreational anglers, increasing

the likelihood of compliance and end user satisfaction. This is discussed in relation to the UK context in this section.

The Fisheries Act 2020 requires that recreational fishing be considered alongside commercial fishing in policy and management decisions relating to fish stocks. In line with this, recreational anglers are recognised and included as key stakeholder in the development of the FMPs alongside commercial fishers. Recreational anglers are required to conform to existing statutory instruments implemented by the MMO, including minimum conservation reference sizes and species-specific guidance such as that for sea bass and tope shark. There is a requirement to understand how recreational angler heterogeneity presented in this study can aid the future development of this policy context, both in terms of the integration of anglers and the policy itself.

The value of the data collection framework and typology of heterogeneity presented in this study lies in the context of potential future introduction of specific policies and regulations that reflect the latent constructs in the factor solution. This is because the factors, reflected in the observed and associated variables, are where most differences across the sample were apparent, and are essentially what has been most useful in defining the angler segments. Magee et al. (2018) suggested similar, highlighting that communication of angling policy, education and promotional campaigns would benefit from understanding different types of angler specifically based on motivational profile (i.e. their equivalent of factors used in this study): for example, they suggest that trophy anglers may respond best to messages on skills and challenge seeking as drivers for engagement, or that social fishers and generalists may respond well to campaigns promoting relaxation or the wellbeing benefits of social networks. Social marketing research has further demonstrated that understanding values and motives for action can improve the communication of environmental policy/campaigns and that information regarding environmental issues is received differently by different segments of the population (Leiserowitz et al. 2021; Bostrom et al. 2013).

There is a broad consensus that understanding market segmentation is a fundamental requisite of most social marketing and promotional campaigns,

comprising two stages: choosing an appropriate segmentation model (value or motivation based or social data); and tailoring the message (Bostrom et al. 2013). In this study, the segment characteristics will inform how to frame management or policy messages appropriately for different 'types' of angers, identified in the typology. The specific factors identified provide the relevant elements of the current (and potential future) policy framework. In order to develop this notion further, a model of best fit between the factors developed in this study and potential policy areas is required (Table 33). This provides a framework to discuss segment responses.

Table 33: Factor relationships with potential policy areas

| Factor | Summary of variables | Policy area |
|------------------------------|---|---|
| 1: Central to life | Focuses on the importance given to the activity in context of wider life context, but also linked to avidity through higher number of days fished | Monitoring participation rates or restricting access |
| 2. Keep and consume | Reflects intention to eat fish caught | Minimum sizes, daily catch limits, seasonal fishing restrictions, no-catch rules |
| 3. Identity | Links participation to self-identity (usually as someone who enjoys the outdoors and nature) | Monitoring participation rates or restricting access |
| 4. Biocentrism | Reflects a belief in parity of rights between fish and humans | Any regulation intended to further protect sustainability of fisheries or increase levels of protection from human activity |
| 5: Environmental impact | Recognises the abusive impact of humans on nature | Any regulation intended to further protect sustainability of fisheries or increase levels of protection from human activity |
| 6. A catch orientation | Places importance on catching at least something | n/a |
| 7. Friendship | Signifies that angling is strongly associated developing and maintaining friendships | Policies promoting inclusion, health and wellbeing |
| 8. Catch numbers | Places importance on catching high numbers of fish | Daily catch limits |
| 9. Catch characteristics | Places importance on large sizes, and challenging/trophy fish | Sizes restrictions, daily catch limits, seasonal fishing restrictions, no-catch rules for specific species such as sea bass |
| 10. environmental protection | Recognises that humans need to protect the environment | Any regulation intended to further protect sustainability of fisheries or increase levels of protection from human activity |

Table 33 demonstrates that most factors relate to specific forms of harvest regulation such as daily catch quotas or minimum species size, which currently form part UK

policy in recreational fishing. Additionally, some factors relate to the monitoring of participation, access and inclusion. The monitoring of participation is part of UK statutory reporting, conducted by Cefas, to inform Defra's management strategies. Access is also of high importance in the current policy agenda via FMPs (regulation of marine protected areas, access to general fishing grounds) and allocation of stocks between recreational and commercial sectors. Biocentrism and environmental impact is inherently linked to all policy that aims to protect the longevity and continuation of fisheries in light of being depleted by human consumption and negatively affected by forms of human activity.

Interpreting segment response to each policy domain requires further, more focused and structured research but existing data garnered from this study implies that consumers, for example, are unlikely to favour changes or newly introduced regulations that either restricts or affects their ability to catch and retain fish for consumption. While such changes may be unlikely in the near future policy context, this would include, for example, changes to current minimum landing sizes (minimum reference conservation sizes – MRCS), the introduction of recreational daily catch limits, and/or the introduction of closed seasons for certain species. By considering their catch profile in Chapter Four, this would include policy orientated towards sea bass, mackerel and whiting. Considering the segment's other factor scores, particular those associated with stewardship, consumers would also potentially be more averse to the introduction of regulations that put more onus on anglers to protect the environment. This would include strategies such as marine protection zones and nursery areas. In terms of message framing, the characteristics of the consumer group suggests that little may be gained by trying to appeal to environmental conscientiousness and more may be gained by communicating changes to policy and how that may affect future fish stock (for harvest).

Trophy anglers prefer to catch larger fish and express biocentric viewpoints, suggesting that anglers in this segment may be more receptive to changes in legislation that increase species specific minimum sizes (particularly sea bass, whiting and pollack when considering this group's catch profile). They are also least

likely to retain fish caught, suggesting they would be more receptive to catch and release strategies. Their dissociation between angling and socialisation suggest that they may not be the most responsive group of anglers to strategies promoting wider inclusion in angling. In terms of message framing, these anglers are potentially more likely to respond well to information appealing to environmental conscientiousness.

Of all segments, leisure-identity anglers are least motivated by catching fish, meaning that policy change regarding, for example, minimum harvest sizes may be met with some neutrality. This group is the most difficult to forecast in terms of potential responses to policy: angling is linked to their ability to participate in nature as part of their identity expression, suggesting that attempts to restrict access, such as protected zones or nursery areas, may be met with resistance; however, they are also pro-environmental protection, which may counterbalance such resistance. Their pro-environmentalism also suggests that they would be more receptive to messages appealing to environmental conscientiousness.

It is likely that social anglers would be most receptive to inclusivity strategies in recreational sea angling. Additionally, social anglers place low importance on catching fish, so changes and/or new regulations on harvest sizes may be met with some neutrality; they are the most likely to return fish caught of all segments, so may favour catch and release policies, particularly for species regarded as ‘trophy’ fish (e.g. sea bass), which they tend to favour according to their factor scores.

6.3 FUTURE APPLICATION OF THE TYPOLOGY

Objective: recommend methods for the future capture of angler types identified in this study (minimising the data collection burden).

Anglers in the UK are regularly targeted with invitations to take part in research geared at meeting statutory requirements (e.g. catch reporting) or exploring new agendas linked to policy change. Most of this involves surveying panels/samples of anglers (with organisation affiliations) who have opted for continued involvement in research over time. Such research is at risk of sample fatigue, affecting response

rates, partial-completion, drop-out, and responses bias. It is therefore vital that data collection methods are as efficient as can be to reduce likelihood of these pitfalls. This study has systematically reduced variables forming the typology into a digestible set of 10 factors and 34 associated statements. In its entirety, this framework can be used as a data collection tool, however, in practice it is still too large for inclusion in studies where the primary focus is on another topic. Future research will need a slimline (simpler) approach to assess the make-up of study samples and the significance of over/under representation of certain typology segments. This will be particularly useful in relation to national catch reporting studies for recreational angling, which form part requirement the UK's statutory requirements and require appropriate methods to adjust for sample bias. It is important to note, however, that this study does not provide data on the angler segments in a representative sample of anglers across England and Wales. Without this information, there is no systematic way to compare future study samples to segmentation in the national angling community in order to extrapolate findings. This research gap is discussed later in the Chapter.

Considering the above, the focus of this sub section is to: firstly, identify variables to be used in a slimline data collection instrument; and secondly, highlight potential impact of the typology on wider catch reporting programmes in the UK, such as that carried out by Hyder et al. (2021). Such work may wish to include the simplified data collection tools in order to correct for potential sample bias in the future.

6.3.1 FUTURE DATA COLLECTION

There are two approaches to simplifying the proposed data collection framework developed in this study: 1) single variable factor performance; and 2) segment statements. Both have advantages and drawbacks and are addressed individually below.

Single variable factor performance: in this scenario, the statement reflecting the highest loading variable for each factor identified in the analysis is used in the data

collection phase (all variables provide more than adequate loading scores). These are shown in Table 34. All of the statements are based on Likert agreement scales (strongly agree to strongly disagree), therefore a generic preceding question would be appropriate, such as: ‘to what extent do you agree or disagree with the following statements’. Reversing the response scale in the appropriate data collection tool would help to identify and reduce the chance of repeat response bias.

Table 34: Condensed factor variable set

| Factor | Summary of variables |
|------------------------------|--|
| 1: Central to life | FV5_Central: “Recreational sea angling occupies a central role in my life” |
| 2. Keep and consume | FV29_Eat: “I usually eat the fish I catch”* |
| 3. Identity | FV16_Seeing: “You can tell a lot about a person by seeing them take part in recreational sea angling” |
| 4. Biocentrism | FV32_Rights: “Fish have as much right to exist as humans” |
| 5: Environmental impact | FV39_Abusing: “Humans are severely abusing the environment” |
| 6. A catch orientation | FV20_No-fish: “A fishing session can be successful even if no fish are caught”*** |
| 7. Friendship | FV9_Opportunity: “Participating in recreational sea angling provides me with an opportunity to be with my friends” |
| 8. Catch numbers | FV23_More-fish: “The more fish I catch, the happier I am” |
| 9. Catch characteristics | FV26_Rather: “I would rather catch 1 or 2 big fish than 10 smaller fish” |
| 10. Environmental protection | FV41_Protect: “We anglers do not do enough to protect aquatic ecosystems” |

* Note that this is second highest scoring variable for this factor, scoring very closely to first highest loading statement (0.889 compared to 0.897 respectively). It has been chosen, however, because of its closer reflection of the factor definition.

** Note: reverse response expected

There are multiple strengths in this approach. Firstly, there is a direct, statistically-supported, link between the statements used and the factors. Secondly, there are only ten statements to include in data collection tools (e.g. survey questionnaires), which in practice, takes approximately two minutes to complete. Thirdly, the statements are generic and can be applied in multiple contexts: for example, non-species-specific, species-specific, or even method-specific studies. However, the limitations of this approach become apparent in subsequent profiling according to the typology. The analysis techniques used in this study involved an amalgamation of performance across a much wider set of variables than shown in Table 34 in order to, firstly, establish the factors (and scores) and, secondly, cluster responses into

segmentations. The performance in other variables affected the individual factor and cluster scores for respondents in relation to the single variables shown in Table 34. Therefore, while the single statements are the highest scoring variables, representing a high degree of accuracy in reflecting the factor themes, they are inherently linked to the scores of other variables in the factor; and, beyond this, as can be seen in the process of factor analysis (Chapter Four), the individual factors themselves are inherently linked to the whole set of variables across the wider variable matrix, which is why repeat tests are performed on the dataset after the removal of variables (due to various cut off criteria). For the same reasons, it is inappropriate to cluster the single variable scores to produce the typology, as only part of the required information is provided in that single score. For this reason, the variables shown in Table 35 are only considered proxies for the factor themes, and any clustering based on the associated raw data will provide inaccurate results that are exclusive of performance in other key/relevant variables.

If this reduced variable approach is taken, the reproduction of the typology would require appropriate clustering techniques (for ordinal data), and recognition that the results are not directly comparable to this study. An alternative segment allocation process could be based on individual responses to the associated statements based on post-hoc researcher profiling. While a systematic analysis approach would be required to aid the allocation, it is possible to use the segment scores from Chapter Four to forecast expected responses, particularly for variables that showed strong ability in segment definition. Examples, and expected responses, to aid in allocating respondents to different segments is shown in Table 35; those highlighted in red are where one would expect strong agreement. Researchers could allocate responses (post-completion) to angler segments based on these expectations.

Table 35: Predicted segment scores

| Variable statement | Scores (1 strongly disagree – 5 strongly agree) | | | |
|---|---|-----------|-------------|------------|
| | Resp. one | Resp. two | Resp. three | Resp. four |
| “Recreational sea angling occupies a central role in my life” | 2 | 3 | 3 | 3 |
| “I usually eat the fish I catch”* | 5 | 2 | 3 | 1 |
| “You can tell a lot about a person by seeing them take part in recreational sea angling” | 3 | 3 | 4 | 4 |
| “Fish have as much right to exist as humans” | 3 | 4 | 2 | 3 |
| “Humans are severely abusing the environment” | 3 | 3 | 3 | 3 |
| “A fishing session can be successful even if no fish are caught”** | 2 | 3 | 2 | 3 |
| “Participating in recreational sea angling provides me with an opportunity to be with my friends” | 4 | 1 | 2 | 5 |
| “The more fish I catch, the happier I am” | 2 | 2 | 3 | 4 |
| “I would rather catch 1 or 2 big fish than 10 smaller fish” | 3 | 5 | 1 | 3 |
| “We anglers do not do enough to protect aquatic ecosystems” | 1 | 3 | 4 | 3 |
| Segment allocation | Consumer | Trophy | Identity | Social |

Segment statements: as discussed, there is a reasonable degree of conceptual error presented in single statement approach. The approach also fails to include anglers themselves in the verification of the segmentation model. Angler-led segmentation, involving respondents categorising themselves into a suggested model is absent in the related angling literature, even though this offers the least amount of bias and potential flaws in analysis/interpretation. In the case of the UK, this study has proven the existence of a statistically strong typology that describes heterogeneity across the (sample-based) recreational sea angling community; it seems most logical that in order to reproduce the typology in future study samples, and eliminate any of the aforementioned points of error, respondents could be asked directly what group they would place themselves in. In future work, this approach may require options to cater for anglers that may see themselves sitting equally between two or three segments, but in its design, both approaches are far simpler and direct. In order to elicit segment membership, a simple question, and pre-codes reflecting each segment of the typology, could be presented:

Q. “When taking part in recreational sea angling, what is most important to you from the options listed below? Please choose one option.”

- *To catch fish to eat*
- *To catch ‘trophy’ fish (based on size or other fish characteristics)*
- *To express my identity as someone who enjoys being outdoors or in nature*
- *To be with, or make new, friends*
- *Don’t know*
- *Prefer not to say*

It is recommended that the question is specifically phrased in this way to ensure a selection is made. It is a forced selection. A ‘none of the above’ option is purposefully omitted for two reasons: firstly, the purpose is to align responses and sample to the typology developed in this study, it is not a question designed to explore the creation of other groups of anglers, or test the existence of other constructs (this process has been achieved in the current study); secondly, if presented with a ‘none of the above’ option there is a likelihood that anglers will tick that box despite actually being aligned to one of the prescribed categories. The subsequent free text option following from non-response to an existing category would either replicate the existing options (therefore wasting time), collect information that does not allow a classification regardless of any guidance provided, or provide information that creates other angler groupings outside the existing typology. The risk in the latter scenario is that the additional groupings may be too diverse to categorise or would create too many segments, in which case the typology becomes larger and potentially diluted with segments that hold little weight in adding to the ability of the model to describe the fine line between the simplest form of heterogeneity but with enough homogeneity between groupings (i.e. the aim of cluster analysis). The situation in which a ‘none of the above’ category (and subsequent free text) would be useful is in further exploratory work being carried out, for example, with a representative sample. In such work, new analysis would be required to evaluate the validity of the new models based on the existing typology and newly formed groupings (if observed).

If the aim of future work is to explore the typology and the degree to which overlap exists between segments, the question could be presented as an importance matrix (formatted according to the data collection tool):

Q. “Please tell us how important the following angling experiences are to you?
Please answer on a scale from 1, not at all important, to 5 very important.”

- *Catching fish to eat (scale presented accordingly)*
- *Catching ‘trophy’ fish (based on size or other fish characteristics) (scale presented accordingly)*
- *Expressing my identity as someone who enjoys being outdoors or in nature (scale presented accordingly)*
- *Being with, or making new, friends (scale presented accordingly)*
- *Don’t know*
- *Prefer not to say*

In the subsequent analysis, sole indication of ‘very important’ (5) across the statements would indicate pure segment membership. Multiple fives, and so forth, would indicate blurred segmentation. In future studies, this approach may be combined with the simple statement approach discussed previously to discuss the strength of segmentation studies generally.

6.3.2 Considerations for future catch reporting

The capture of catch data in the current study allows inferences to be made on the impact that angler heterogeneity may have on existing and future programmes of research that monitor trends on species caught and release rates in the UK (see Hyder et al. 2021). To fully assess the impact of angler heterogeneity in such studies in the future, the capture of data to allow for angler segmentation according to the typology developed in this study would be required, using either method discussed in the previous sub section of this Chapter. It is key to note, however, that such integration is dependent on the typology presented in this study being applied in a

representative sample of anglers across the UK. When such data is accumulated, the reporting programmes can base sample representation on the typology segments and/or develop methods to extrapolate data accordingly. Prior to this, only data-based inferences can be made with regards to how angler differences may impact catch reporting.

UK catch data collected by Hyder et al. (2021) reported that release rates among recreational sea fishers were similar in 2018 and 2019, with approximately 80% of fish returned to the sea (based on both raw data and modelled data). In the current study, release rates varied considerably among angler segments, with trophy anglers returning 93% of catch and consumers 62%. Therefore, depending on the sample characteristics in Hyder et al. (2021), the release rate may require contextualising: for example, if the sample consisted of proportionally more trophy anglers, the 80% could be higher than expected when compared to a mixed sample, and conversely if the sample consisted primarily of consumers, the 80% could be lower. Both scenarios would give inaccurate result when extrapolating data to the wider angling population.

Data collected in this study also could potentially inform the calculation of numbers of fish caught. In this scenario, social anglers reported to catch more fish than any other group in segment. While they accounted for 35% of the sample, their catch numbers accounted for 45% of total catch across segments over the 12 months prior to the survey being implemented (ratio, angler to fish: 1:46). Trophy anglers caught the least fish, representing 18% of sample and 12% of total catch (ratio: 1:25). Forty-three million fish were reported to have been caught by recreational sea anglers in 2018 (Hyder et al. 2021). If the sample consisted of primarily trophy or social anglers, this figure may be subject to fluctuation in either direction (lower or higher). Impacts arising from the implementation of angler segmentation based on the typology developed in this study on both release rates and tonnage caught are significant because these parameters are used to gauge the impact of angling on the environment and fish stocks.

More in-depth work would be required to statistically adjust release rates and tonnages caught through selected modelling techniques. The above points are

purely speculative in an attempt to illustrate the impact of measures of angler segmentation when accounting for sampling. The aim of the Bayesian model employed by Hyder et al. (2021) was to test sample bias between those taking part in their annual catch reporting studies (via survey and diary methods) and other sources of angling data where information is available from larger numbers of anglers (WPS), allowing for comparison and post-hoc angler segmentation. The data used in the post-hoc segmentation included age, avidity, experience and method (i.e. those measures associated with catch rates). The discussion presented here suggests that angler segmentation according to values, attitudes and behaviours used in the formation the current typology may prove even more beneficial in capturing annual data on recreational angling across the UK.

6.4 CONCLUSIONS

The research presented in this thesis has provided a robust typology of recreational sea anglers in England and Wales. A valid and reliable methodology has been developed, using a cognitive hierarchy model of behaviour to inform a data collection framework inclusive of values, attitudes and behaviours. The approach successfully reduced a significant number of variables reflecting elements across the cognitive model into a more manageable and meaningful set of 10 factors, which, when subject to cluster analysis, provided an efficient way to describe heterogeneity across the sample of anglers. The resulting typology consisted of four angler segments, defined by the factors themselves. The factors largely echoed existing latent constructs developed in previous angling research, such as centrality, and larger multi-dimensional frameworks such as attitudes to catch and involvement. Drawing on characteristics from across concepts, dimensions and measures, segments were appropriately named and defined as: consumers, trophy anglers, leisure-identity anglers and social anglers.

Theoretical and applied observations were made based on the process of forming the angler typology. Key measures of angler specialisation did not feature in the reduced variable set based on their co-variance scores while recommendations

were made to refine variables measuring concepts such as identity and environmental attitudes. In a wider assessment of the typology, it is evident that the factors and associated variables are primarily value based or attitudinal by nature. Very few variables in the factor solution described angler behaviour. The angler segments themselves also provide an interesting contribution to wider discussion on the role of angler motivation. There is consensus over its conceptualisation, including equally numerous catch-related and non-catch related motives. This conceptual divide is also apparent in the angler typology developed in this study: two segments (consumers and trophy anglers) are defined by characteristics associated with catching fish (consumption and size); the other two segments (identity and social anglers) are defined by characteristics associated with aspects other than catch fish (the outdoors and people).

The macro level structure of the typology, and its constituent segments, is comparable to angler groupings in previous research outside the UK. For example, trophy anglers have been identified in several studies in the USA, Europe and Australia. While there are some limitations in direct comparisons between the definition of segments, certain unique characteristics are apparent in the segmentations developed in this study compared to those identified in studies elsewhere: consumer anglers display more tendency towards socialisation; trophy anglers are potentially less influenced by consumption and show less propensity to measures of centrality; and social anglers show more propensity for catching fish compared to other studies.

The segments show less ability to predict differences in views towards government, management and/or drivers of regulatory compliance. This finding has implications for the integration of angler heterogeneity in angling policy, or incentivising certain angler behaviours: blanket policies may yield common responses across angler segments; however, policies specifically reflecting themes apparent in the factors or latent constructs developed in the typology, such as harvest or catch and release regulation, are more likely to benefit from awareness of differences among the angling population.

Examples have been shown demonstrating the potential impact on catch modelling resulting from the identification of sample bias according to angler type. Recommendations have been made to reduce the data capture required to account for angler heterogeneity in future UK statutory catch reporting. It is highly recommended that future work incorporates these techniques. It has also been demonstrated that policy change is likely to be linked to different stakeholder responses depending on segment membership. The combination of this, in addition to the methodological recommendations, dictates that thoroughly understanding heterogeneity among recreational sea angler in England and Wales can improve the delivery and success of fisheries policy in the UK.

6.4.1 Future research

Further work is recommended to further support the integration of the angler typology developed in this study in future fisheries policy and research. These recommendations arise from gaps in the findings of the current research, and questions that have emerged that were beyond the initial remit of the doctoral programme. Each research area is summarised below:

Apply the typology in a representative sample of anglers across the UK: it is recommended that on-site surveys are carried out across the UK to gain a better understanding of the spread and representation of angler segments developed in this study. The surveys would include simple questioning, asking respondents to self-allocate to a segment based on the single fit method discussed earlier in this Chapter. Careful design of the sample frame would be required so that appropriate representation is based on factors such as age, residence, gender and avidity. In order to access a representative cross section of anglers, data collection would be best carried out across different time periods (weekdays/weekends) and locations (shore/boat).

Integrate the typology in catch reporting: it is recommended that data collection capturing angler segmentation be integrated in annual catch reporting programmes conducted by Cefas. Angler self-allocation is recommended using the single fit

method. Subsequent desk-based research would develop appropriate statistical techniques to assess the difference between modelled data based on segmentation and raw data captured via the un-modelled samples. This process is dependent on further research describing the proportional representation of segment across the UK.

Further test predictive ability of angler segmentation: the current study was limited in the number of anglers that could take part in the qualitative research exploring views towards governance and regulation. Further research through surveying and quantitative approaches is required to explore the predictive power of angler segments on condonement/compliance to specific regulations relevant to recreational anglers in the UK. The ability of segments to predict changes to specific policy could also be explored employing a choice modelling approach.

While the above-mentioned projects are based on the collection of new data, further analysis could be undertaken on the dataset compiled for this doctoral programme. For example, the aim of the current study was exploratory by nature, its focus was not to employ restrictive models exploring one-dimensional models of the angler psyche. The data, nonetheless, was captured to allow such work: for example, one could create an angler involvement index or use the data to identify predictors of angler stewardship behaviour using regression in a cognitive hierarchy model.

6.4.2 Summary of contributions to knowledge

The study has made several contributions to the scholarly understanding of heterogeneity among recreational anglers, summarised as follows:

- The recreational sea angling community in England and Wales consists of four main types of angler: the consumer, the trophy angler, the leisure-identity angler, and the social angler.
- A data collection framework has been developed centred on a cognitive hierarchy model in which 10 factors (latent constructs) describe key characteristics of the constituent groups within the typology.

- Attitudinal measures proved more useful in defining angler variation than measures of behaviour. Several multi-dimensional concepts were apparent in the factor solution, including: the four dimensions of attitudes to catch, facets of involvement (social bonding, identity, and centrality) and environmental perspectives. These reflect concepts developed in the pre-existing literature on the angler psyche.
- There is no correlation between the components of specialisation theory, suggesting that it is not an appropriate model to describe heterogeneity among anglers in the study sample.
- There is a level of commonality in views towards governance and management of fisheries in the UK across segments.
- The typology offers key insights that can guide policy implementation and communication with the angling community.
- The typology informs statutory catch reporting in the UK by providing a model on which to adjust for bias in future sampling.
- Methods have been recommended on how to implement the typology in future catch reporting programmes, based on an angler-self-selection method.

6.4.3 Policy recommendations

Based on the key findings discussed thus far, this section presents several specific recommendations regarding the policies currently in force or under development in UK fisheries. Policy across all domains is often under continual development and adaption, therefore the recommendations relate to both current regulation and the methods policy makers employ when forming legislation. The latter is therefore particularly relevant in context of future possible policy changes rather than being confined to current regulation. The recommendations are as follows:

- *Recommendation one:* As of December 2023, FMPs are being developed in consultation with relevant stakeholder across the UK, overseen by delivery partners such as the MMO and CEFAS. These consultations will continue into 2024. It is recommended that consultation with the recreational sector

attempts to include representation from different types of angler as per the typology developed in this study. The process of identifying types of angler should employ the single question method discussed in 6.3.1. Accounting for diversity in the angling community will increase the likelihood of policy catering for the diverse needs of anglers, and therefore increases the likelihood of compliance.

- *Recommendation two:* In principle, generic policies such as minimum reference conservation size (MRCS) will likely receive support from all anglers regardless of segmentation as per the typology developed in in this study. Proposals introducing MRCS for new species or lowering the limits for existing species under threat is recommended as compliance will likely be very high. However, it is also recommended that policy makers communicate these changes with consideration to the profile of different angler types as per the typology. For example, consumers would likely respond more positively to changes when they are contextualised as protecting the consumable fish stock; trophy anglers would likely respond more positively when changes are phrased as 'protecting the environment'. Achieving recommendation two is dependent on achieving recommendation three (i).
- *Recommendation three:* More accurate data is required to fully understand the impact of recreational angling on fish stock. It is recommended that policy makers and delivery bodies invest in research to i) undertake study on the existence of the angler typology in a representative/probabilistic sample and ii) integrate findings in future data capture on recreational angler catch to account for sample bias.
- *Recommendation four:* social bonding, angler identity and centrality all proved to be important features of the angling experience to those taking part in the study. While the onus of current policy is on protecting the environment and fish stocks, future policy should seek to positively influence and support these additional (human-dimension) values to further improve the experience of those engaging with recreational sea angling. The effects of sustaining and increasing angler participation by investing in these areas would i) continue

the important economic contribution of the recreational sector, and ii) increase angler health and wellbeing. Policy implementation may include, for example: in-person, angling community events, organised locally by bodies such as the Inshore Fisheries Conservation Authorities, to provide opportunity for social networking for those new to the activity; small grants for benefit recipients to pay for membership to organisations such as the Angling Trust; and/or, online guidance and materials to guide anglers that wish to reflect and document their experiences of recreational angling (other than recording catch). The latter would be particularly useful in supporting anglers to develop and understand the notions of identity and centrality.

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APPENDIX ONE: SURVEY QUESTIONNAIRE

Please note: the questionnaire differs in visual appearance to the electronic version completed by participants, but the wording is consistent.



COUNTRYSIDE
AND COMMUNITY
RESEARCH INSTITUTE



Economic
and Social
Research Council



Values, attitudes and behaviours of recreational sea anglers

About the survey

Recreational sea angling plays a key part in the way marine resources are sustainably managed: it is a hugely popular leisure activity/sport with numerous benefits to anglers, but it also has potential to negatively impact on the natural environment.

Research in countries outside the UK has suggested that managing recreational fishing activities for maximum angler benefit requires an understanding of the differences in motivations, attitudes and behaviours of recreational anglers. This ensures a greater chance that strategies aimed at protecting the natural environment will also cater for anglers with different expectations and experiences of angling. In the UK, however, little is known about the recreational sea angling community in terms of their attitudes, behaviours or preferences.

The data gathered in this survey will be used to generate a classification of anglers in England and Wales that describes common characteristics of those that take part in this popular activity. The project is funded to specifically look at these geographies within the UK. The survey questions focus on why you take part in recreational sea angling, your views on nature, the impact of fishing, behaviours you think are appropriate, and actions you carry out when angling.

The survey questions take about 10-15 minutes to complete.

The survey is part of a PhD project overseen by [CCRI](#) at the University of Gloucestershire. The findings will be published in scientific journals and made available to policy makers in the UK Government, therefore helping to inform the future management of recreational sea angling. Those who submit a completed survey will be given the opportunity to enter a prize draw competition to win **£100 in vouchers** for an angling store of your choice.

We encourage anyone over the age of 18 who lives in England or Wales, and takes part in recreational sea angling at least three times a year, to complete the survey. Recreational sea angling is defined as fishing with a rod and line from any type of shoreline (e.g. estuaries, beaches, rocks or harbours) or afloat a boat or kayak, with no financial payment for fish caught.

Remember, there are no right or wrong answers and your responses will be kept strictly confidential (in accordance with GDPR standards). You will not be identifiable in any reports resulting from the survey. You are free to withdraw your responses from stored datasets at any time, and if you do not wish your anonymised responses to be included in any resulting reports please contact the lead researcher (below) within 30 days of submitting your answers. Please download, read and save the Further Information Sheet by clicking [here](#). This document gives full details about the project and how your data will be handled.

If you have any further questions about the research, please contact Adam Fisher on +44 (0) 1242 714122 or email adamfisher@connect.glos.ac.uk.

Please click next (below) to take part in the survey.

Please give your informed consent to take part in the survey by reading the statements and ticking the boxes below.

By ticking all boxes, you are agreeing to take part in the study and your responses to be used as described on the previous page and in the supporting information.

If you do not agree with all of the statements and do not tick all boxes, you will not be able to take part in the study and can close the browser/web page now to exit the survey.

Terms of consent

Please select exactly 5 answer(s).

- I have read the information above and participant information sheet, and have had the opportunity to ask further questions
- I understand that my participation is voluntary and I am free to withdraw my responses at any time without any reason (within 30 days of submitting my survey to ensure my responses are not included anonymously in published reports)
- I am at least 18 years old and live in either England or Wales
- I consent to take part in the survey and my (anonymous) responses to be used as part of this study
- I agree to my (anonymised) responses being archived in a public data repository and used for future research projects

Q. In what settings do you take part in recreational sea angling (with rod and line)?

Please select ALL that apply from the list below. Required

Please select at least 1 answer(s).

- Shore (e.g. estuaries, beaches)
- Privately owned boat
- Charter boat
- Kayak (or [similar](#))
- Other
- Don't know

Other (please specify):

Your answer should be no more than 50 characters long.

Q. On how many DAYS in the LAST 12 MONTHS have you gone recreational sea angling? For example, if you fished for three hours every week, on a Saturday, for the entire 12 months, your answer would be 52 (representing the 52 days on which you fished). If you fished once per month over the year, with each session lasting 10 hours, your answer would be 12 (again, representing the 12 days on which you fished).

Please type the NUMBER (to the best of your memory) in the space below.

If you are unsure or don't know, please leave blank and click next to continue. *Optional*

Please enter a whole number (integer).
The number should be 365 or lower.
Your answer should be no more than 3 characters long.

Q. Has the COVID-19 pandemic affected the total number of days you have gone recreational sea angling over the past 12 months?

- Yes
- No
- Don't know

Q. Which, if any, of the statements below best describes the impact of the COVID-19 pandemic on the total number of days you went recreational sea angling over the past 12 months?

Please select ONE option from the list below:

- I fished significantly less than I would have in non-pandemic times
- I fished less than I would have in non-pandemic times
- I fished more than I would have in non-pandemic times
- I fished significantly more than I would have in non-pandemic times
- Don't know

Q. Approximately how much money in total have you spent in the past 12 months on equipment and tackle for recreational sea angling? Examples of equipment includes rods, reels, and landing nets etc. Examples of tackle includes hooks, weights, and lures etc.

Please exclude costs for travel, food, baits, costs associated with ownership/use of boats, and/or costs associated with accommodation if you have stayed away from home when angling.

Please type your answer in whole pounds sterling in the space below, e.g. £25 = 25, £100 = 100, £1,000 = 1000.

If you are unsure or don't know, please leave blank and click next to continue. *Optional*

Please enter a whole number (integer).

Your answer should be no more than 5 characters long.

Q. How far did you travel when you last went recreational sea angling?

Please answer in reference to your outward journey **ONLY** (e.g. from your home to the place you last fished in England or Wales). Please type your answer in **MILES** in the space provided below. Use up to one decimal place for part miles. For example, one mile and a half, would be 1.5. If the distance is less than one mile, then use 0. as a prefix: for example, a quarter of a mile would be 0.25, and three quarters of a mile would be 0.75.

If you are unsure or don't know, please leave blank and click next to continue.

Please enter a number.

The number should be 1000 or lower.

Your answer should be no more than 6 characters long.

Q. Which of the statements below BEST DESCRIBES the primary motivation behind why you take part in recreational sea angling?

Please select **ONE** statement only. *Required*

- I am primarily motivated by experiences that only come from catching fish (e.g. the thrill of playing and landing a fish or to eat what I catch)
- I am primarily motivated by other experiences that are not related to catching fish (e.g. being outdoors or relaxation)
- I am motivated equally by each of the above (i.e. experiences related to both catching fish and other non-catch related aspects of angling)
- Don't know

Q. To what extent do you agree or disagree with the following statements reflecting how central recreational sea angling is to your life?

Please answer using the scale shown below by selecting **ONE** option for **EACH** statement.

| | Strongly disagree | Disagree | Neither disagree or agree | Agree | Strongly agree |
|---|-----------------------|-----------------------|---------------------------|-----------------------|-----------------------|
| I find that a lot of my life is organized around recreational sea angling | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Recreational sea angling occupies a central role in my life | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| To change my preference from recreational sea angling to another recreation activity would require major rethinking | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

Q. To what extent do you agree or disagree with the following statements reflecting how closely recreational sea angling is linked to your friendship circles?

Please answer using the scale shown below by selecting ONE option for EACH statement.

| | Strongly disagree | Disagree | Neither disagree or agree | Agree | Strongly agree |
|---|-----------------------|-----------------------|---------------------------|-----------------------|-----------------------|
| Most of my friends are in some way connected with recreational sea angling | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I enjoy discussing recreational sea angling with my friends | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Participating in recreational sea angling provides me with an opportunity to be with my friends | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

Q. To what extent do you agree or disagree with the following statements reflecting how attracted you are to recreational sea angling?

Please answer using the scale shown below by selecting ONE option for EACH statement.

| | Strongly disagree | Disagree | Neither disagree or agree | Agree | Strongly agree |
|--|-----------------------|-----------------------|---------------------------|-----------------------|-----------------------|
| Recreational sea angling is the most enjoyable thing I can do | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Recreational sea angling is very important to me | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Recreational sea angling is one of the most satisfying things I can do | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

Q. To what extent do you agree or disagree with the following statements reflecting how recreational sea angling may contribute to how you see yourself?

Please answer using the scale shown below by selecting ONE option for EACH statement.

| | Strongly disagree | Disagree | Neither disagree or agree | Agree | Strongly agree |
|--|-----------------------|-----------------------|---------------------------|-----------------------|-----------------------|
| When I participate in recreational sea angling I can really be myself | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I identify with the people and image associated with recreational sea angling | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| When I'm sea angling for recreation I don't have to be concerned about the way I look | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| You can tell a lot about a person by seeing them take part in recreational sea angling | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Participating in recreational sea angling says a lot about who I am | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| When I participate in recreational sea angling people see me the way I want them to see me | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

Q. How would you rate your overall sea angling skills in comparison to other anglers you know?

Please select ONE option from the list below.

- Much worse
- Worse
- About the same
- Better
- Much better
- Don't know

Q. To what extent do you agree or disagree with each of the following statements describing your attitudes towards catching varying numbers of fish when recreational sea angling?

Please answer using the scale shown below by selecting ONE option for EACH statement.

| | Strongly disagree | Disagree | Neither disagree or agree | Agree | Strongly agree |
|---|-----------------------|-----------------------|---------------------------|-----------------------|-----------------------|
| A fishing session can be successful even if no fish are caught | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| If I thought I wouldn't catch any fish, I wouldn't go fishing | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| When I go fishing, I'm not satisfied unless I catch at least something | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| The more fish I catch, the happier I am | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| A successful fishing session is one in which many fish are caught | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I'm happiest with a fishing session if I catch more than other anglers around me' | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

Q. To what extent do you agree or disagree with each of the following statements describing your attitudes towards the size and intention to release fish when recreational sea angling?

Please answer using the scale shown below by selecting ONE option for EACH statement.

| | □ <i>Required</i> | | | | |
|---|-----------------------|-----------------------|---------------------------|-----------------------|-----------------------|
| | Strongly disagree | Disagree | Neither disagree or agree | Agree | Strongly agree |
| I would rather catch 1 or 2 big fish than 10 smaller fish | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I'm happiest with a fishing session if I hook a fish that is challenging to catch | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I like to fish where I know I have a chance to catch a trophy fish | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I usually eat the fish I catch | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Thinking about my angling experiences and the range of species I usually encounter, I want to keep the fish I catch | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Thinking about my angling experiences and the range of species I usually encounter, I'm just as happy if I release the fish I catch instead of keeping them | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

Q. To what extent do you agree or disagree with each of the following statements describing the relationship between humans and the natural environment?

Please answer using the scale shown below by selecting ONE option for EACH statement.

| | Strongly disagree | Disagree | Neither disagree or agree | Agree | Strongly agree |
|---|-----------------------|-----------------------|---------------------------|-----------------------|-----------------------|
| Fish have as much right to exist as humans | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Humans have a right to change the natural world to suit their needs | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Fish are valuable in their own right, regardless of people | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Humans were meant to rule over the rest of nature | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Humans are not more important than other parts of nature | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Fish should primarily be managed for human benefit | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

Q. To what extent do you agree or disagree with each of the following statements describing your attitudes toward the level of risk, if any, humans present to the natural environment?

Please answer using the scale shown below by selecting ONE option for EACH statement

Please note: the term 'aquatic ecosystem' (below) refers to a body of water (such as the sea) where interactions take place between living and non-living parts of the environment. Ecology or ecological refers to the relationship between living organisms and their physical surroundings (the environment).

The term 'interfere' below means to intervene in a situation when it is not absolutely necessary, or to prevent something from taking its natural course.

| | Strongly disagree | Disagree | Neither disagree or agree | Agree | Strongly agree |
|--|-----------------------|-----------------------|---------------------------|-----------------------|-----------------------|
| When humans interfere with nature it often produces disastrous consequences | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Humans are severely abusing the environment | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| If things <u>continue on</u> their present course, we will soon experience an ecological catastrophe | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| We anglers do not do enough to protect aquatic ecosystems | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| We anglers are well qualified to manage and protect aquatic ecosystems | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| We anglers should be willing to change our present angling behaviour to protect aquatic ecosystems | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

Q. To what extent do you agree or disagree with each of the following statements about how you think you and others should act when taking part in recreational sea angling?

Please answer using the scale shown below by selecting ONE option for EACH statement.

Please note: the term 'fishery' (below) refers to a body of water (such as the sea or rivers) that holds a stock of fish and/or other aquatic lifeforms

| | Strongly disagree | Disagree | Neither disagree or agree | Agree | Strongly agree |
|---|-----------------------|-----------------------|---------------------------|-----------------------|-----------------------|
| People like me should do whatever they can to conserve fishery resources and aquatic ecosystems | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I do not feel morally obliged to try to conserve fishery resources and aquatic ecosystems | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I would feel guilty if I didn't do my part to conserve fishery resources and aquatic ecosystems | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

Q. In the last 12 months, have you returned any of the fish you caught back to the water? *Required*

- Yes
- No
- Don't know

Q. In the past 12 months, how often have you demonstrated the following behaviours when catching and releasing fish back to the water?

Please answer using the scale shown below by selecting ONE option for EACH statement.

| | Never | Rarely | Sometimes | Often | Always |
|---|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| Returned fish that are intended to be released back to the water as quickly as possible | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Cradled fish in water to ensure they can swim before being released | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Kept fish to be released in water while being unhooked | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Used barbless hooks | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

Q. Below is a list of actions that anglers may carry out to support the conservation of fishing sites and the environment. Please tell us which of these actions, if any, you have carried out in the past 12 months by selecting relevant boxes.

Please select ALL that apply to you. *Optional*

- Contacted a political representative (e.g. local MP) about a fishery or aquatic conservation-related issue
- Donated money to an organisation that supports fishery or aquatic conservation (e.g. the Angling Trust)
- Participated as an active member in a fishery or aquatic conservation organization
- Talked to others in my angling community about appropriate conservation behaviours (online or in person)

Q. Shown below is a list of fish species commonly caught by recreational sea anglers in the UK. Please select ONE fish species within this list that you have caught at least twice over the past 12 months. Following your selection, you will be asked three further questions about your angling activity and the chosen species.

If you have NOT caught any of these species, please select 'other' and

type the name of ONE fish species that you have caught in the last 12 months in the space provided.

Required

[More info](#)

- Cod
- Mackerel
- Pollack
- Sea bass
- Whiting
- Other

If you selected Other, please specify:

Q. Thinking about the species you chose, approximately how many have you caught over the past 12 months? Please type the number in space below.

If you are unable to remember the number, please leave blank and click next below.

Please enter a whole number (integer).

Your answer should be no more than 10 characters long.

Q. Thinking again about the fish species you chose in the previous question, please select ONE statement below that best describes how often you have released these fish over the last 12 months. *Required*

- I never released these fish
- I released these fish occasionally
- I released these fish more often than not
- I always released these fish
- Don't know
- Prefer not to say

Q. Which, if any, of the reasons listed below influenced your decision to return these fish back to the water.

Please select ALL that apply. You can add an additional factor not listed here by selecting 'other'.

IF you are UNSURE, please select 'Don't know' to continue with the final few pages of the survey.

- To conform to regulations (e.g. daily bag limit for sea bass)
- To conserve future fish stocks
- Because you had already caught what you needed but wanted to continue fishing
- Because you thought it was the ethical and/or moral thing to do
- Because others around you were doing so
- Because they were too small
- Other
- Don't know

If you selected Other, please specify you the main reason that influenced your decision to release (up to 250 characters):

Your answer should be no more than 250 characters long.

Q. What is your age? Please type your answer (in years) in the space below. Leave blank if you would prefer not to say.

Please enter a whole number (integer).

Please make sure the number is between 18 and 113.

Your answer should be no more than 3 characters long.

Q. What is your gender?

Please select ONE option from the list below. *Required*

- Male
- Female
- Other
- Prefer not to say

Please use the space below to describe your gender if you wish to do so:

Your answer should be no more than 50 characters long.

Q. Please select ONE option below that best represents your total personal annual income from all sources before deductions for income tax, national insurance etc.

Please note that your responses are anonymous and will not be reported in any way, shape or form at an individual level. Responses to this question will be mainly used to understand the basic demographic profile of those completing the survey compared to the general population in the UK.

Required

- £0 to £20,000
- £20,001 to £40,000
- £40,001 to £60,000
- £60,001 to £100,000
- £100,001 to £200,000
- Over £200,000
- Don't know
- Prefer not to say

Q. Do you have any physical or mental health conditions or illnesses that have lasted or are expected to last 12 months or more? Please select one answer from the options below.

Required

- Yes: Physical
- Yes: Mental
- Yes: both Physical and Mental
- Neither
- Prefer not to say

Q. In which region do you live?

Please select ONE option from the list below. *Required*

- East Midlands
- East
- London
- North East
- North West
- South East
- South West
- West Midlands
- Yorkshire & Humber
- Wales
- Prefer not to say
- Other

Please type the first part of your postcode, e.g. PL4:

Your answer should be no more than 10 characters long.

Q. Which one of the following best describes your ethnic group or background?

Choose ONE option from the list below. *Required*

- White or White British
- Mixed / Multiple ethnic groups
- Asian or Asian British
- Black or Black British
- Other
- Prefer not to say

How would you describe your ethnicity? Please type below if you wish to do so:

Your answer should be no more than 50 characters long.

Please type a memorable word (up to 16 characters in length) in the space below, which may be used to identify your responses should you wish to withdraw from the survey in the future.

Please note: in order to make your word unique, you may wish to incorporate the day and month of your birth, e.g. 0910Unicorn. *Required*

Your answer should be no more than 16 characters long.

Would you like to provide any further information related to the topics covered in this survey (e.g. to further explain or qualify some of your answers)?

- Yes
- No

Please use the space below to provide any further information. You can write up to 2500 characters, which is about 300 words.

- White or White British
- Mixed / Multiple ethnic groups
- Asian or Asian British
- Black or Black British
- Other
- Prefer not to say

How would you describe your ethnicity? Please type below if you wish to do so:

Your answer should be no more than 50 characters long.

Please type a memorable word (up to 16 characters in length) in the space below, which may be used to identify your responses should you wish to withdraw from the survey in the future.

Please note: in order to make your word unique, you may wish to incorporate the day and month of your birth, e.g. 0910Unicorn. *Required*

Your answer should be no more than 16 characters long.

Would you like to provide any further information related to the topics covered in this survey (e.g. to further explain or qualify some of your answers)?

- Yes
- No

Please use the space below to provide any further information. You can write up to 2500 characters, which is about 300 words.

APPENDIX TWO: PILOT GUIDANCE



COUNTRYSIDE
AND COMMUNITY
RESEARCH INSTITUTE



Values, attitudes and behaviours of recreational sea anglers in England and Wales

Survey Questionnaire Pilot Guidance

About the project

The survey questionnaire is being run as part of a PhD project supervised by the Countryside and Community Research Institute (University of Gloucestershire) and Centre for Fisheries and Aquaculture Sciences. The project aims to develop a greater understanding of the recreational sea angling community in England and Wales to inform the future fisheries policy framework in UK. It is anticipated that the outputs of the project will directly inform policy makers on how to best integrate and engage with anglers who may have diverse expectations and experiences. A central part of the project involves understanding anglers' motivations, attitudes towards nature, actions taken to protect the environment and behaviours towards certain species of fish subject to rules set by the Government. The survey questionnaire explores these topics.

About the survey and pilot

The survey will be launched (online) to the public in September 2021, but before then the questionnaire itself needs to be tested. The process involves a few selected anglers completing the questionnaire after which they will take part in a short conversation with the lead researcher (below) discussing some of the key elements deemed for a successful survey (e.g. time it takes to complete or whether there were any problems in answering the questions). This part could also be done via email. The answers to the questions in the survey itself will not be used in any analysis and will not be stored or used as per the aims of the project given above. However, pilot participants are encouraged to answer using real-life opinions and experiences. This will ensure that the survey questions are tested accurately. The answer will not be viewed by anyone and will be deleted within 24 hours of being submitted. Taking part in the pilot phase does not preclude you from completing the survey when it is formally launched in September 2021.

Your input at this stage is greatly appreciated and plays a vital part in the overall success of the research. Guidance on how to complete the pilot is given below. Please read these notes before taking part.

Any questions related to the survey or wider project should be directed to the lead researcher (PhD candidate), Adam Fisher, mob: [redacted] or email: [\[redacted\]](#)

How to take part in the pilot survey

Adam Fisher, the lead researcher, probably would have been in contact with you by email or phone and will have explained the pilot process. If not, these notes are sufficient for giving you an understanding of how to complete the pilot phase and the topics we are interested in knowing about at this stage of the research process. If you are unsure what to do or have any questions, please contact Adam (details above).

Please access the survey by clicking on the following link:

<https://glos.onlinesurveys.ac.uk/values-attitudes-and-behaviours-of-recreational-sea-angle-2>

There will be on-screen instructions guiding you through the questions. It is anticipated that the survey will take about 20 minutes to complete.

Please ignore the information on how your data/responses will be handled as this relates to the live survey when it is launched in September 2021.

Please complete the survey as normal, making a note of the time when you started. Please then take note of the time when you submit the responses. Please record the number of minutes it took to complete the questionnaire.

We are interested in the usability of the survey and how respondents understand/interpret the questions. In this regard, you may want to consider the questions listed below when taking the survey the first time around, or retake the survey with these in mind. Retaking the survey will involve more time, but this is the best way to get both an accurate timing for completion, and your thoughts on the usability of the questionnaire. You can either jot notes as you go or feedback from memory when you meet over the phone/by email with Adam. You can take the survey as many times as you want by clicking on the link.

The questions in the survey are based on those used in various studies related to angling in the UK and abroad. We have no expectation for you to find faults, but we are very interested in any feedback you may have that is either negative or positive (regardless of how big or how small). Below are some suggested questions to guide your thoughts, but please feel free to think beyond these areas:

- Are there any questions that you find difficult to answer?
- Are there any words used that you are not familiar with?
- Are the subjects covered things that you have thought about before?

- For questions where there are pre-set categories, are these suitable for you?
- Do any of the questions or pre-coded statements seem odd or out of place?
- Is the survey easy to navigate?

Once you are finished with the survey, please contact Adam (mob: [redacted] or email: [redacted] to arrange a convenient time to gather your views. We are aiming to complete the piloting phase in early September 2021.

Once, again, your input in this aspect of the research is vitally important and is greatly appreciated!

APPENDIX THREE: FURTHER INFORMATION (SURVEY)



COUNTRYSIDE
AND COMMUNITY
RESEARCH INSTITUTE



Economic
and Social
Research Council

Values, attitudes and behaviours of recreational sea anglers in England and Wales: Survey

Participant Information Sheet

It is important that you understand why this research is being done and what it will involve. Please take time to read the following information carefully so that you understand why this survey is being conducted and how your data will be handled. If you have any further questions about the research, please contact the main researcher: Adam Fisher on +44 (0) 1242 [redacted] or email [redacted]. The research is being conducted as a part of a PhD project supervised by the Countryside and Community Research Institute (CCRI) at the University of Gloucestershire. It is funded by the Economic and Social Research Council and the Centre for Environment, Fisheries and Aquaculture Sciences (CEFAS).

Why am I being asked to participate?

You are being invited to participate because we are keen to find out about views, opinions and behaviours of recreational sea anglers who live in England and Wales. By involving you in our research, we will be able to gain a better understanding of the diverse expectations among marine fishery users, therefore helping to maximise angler enjoyment and work towards establishing a sustainable fish stock for future generations. You have been invited to take part in this survey because your details are held by Substance as part of the Angler Diary Project, or because you have been alerted to the survey through your involvement with angling representative organisations and/or online discussion forums for recreational sea angling (such as the Angling Trust).

Who should get involved?

Everyone aged 18 years and over who lives in either England or Wales and takes part in recreational sea angling at least a few times a year. Recreational sea angling is defined as fishing with rod and line, either from shore or afloat (boat or kayak), without receiving financial payment for fish caught. You must also be a resident in England or Wales, although you do not have to be English or Welsh to take part.

Do I have to take part?

It is entirely your decision whether or not you participate in the survey. You can exit the online survey at any point before submitting your answers and this data will not

be returned to the researcher or stored in any way. If you take part, you can withdraw at any time post completion by removing your responses from the database. However, to ensure that your data is excluded from any subsequent published results that may be in the public domain (e.g. through published journals), please contact the lead researcher (details above) within 30 days of submitting your responses. After this period, while your information will be removed from the database of response, it may have already been included in some analyses and reporting. Please note that even though this may be the case, you will still not be identifiable in any way in the resulting analysis. In order that we can remove your responses from the data set, please make sure to include a memorable word when asked prompted in the questionnaire. This will help us track your responses in case you decide to withdraw.

What are the benefits of taking part?

Firstly, you will be making an important contribution to research that will help inform the future management of recreational sea angling in England and Wales. Secondly, we hope that you have fun answering the questions as they all revolve around an activity that you enjoy doing! Thirdly, all those submitting a completed questionnaire will be entered into a prize draw where you will have the opportunity to win £100 of vouchers for an angling retailer of your choice. To be entered, make sure you provide your contact details by following the link at the end of the survey. The draw will take place in early 2022, after which the winner will be contact by either phone or email.

Who will use of the research?

It is intended that the data gathered through the survey will be published within academic journals, but will also be used in the thesis submitted for doctoral candidacy at the University of Gloucestershire by the main researcher. The findings will also be shared with the Department for Food, Environment and Rural Affairs, part of the UK Government that oversees fisheries management, and CEFAS. Through these channels, the research will ultimately help inform the development and management of marine fisheries and recreational sea angling.

What is the procedure if I take part?

To take part, please use the buttons shown on the screen to navigate through the questions. Responses mainly require you to choose from a list of options, but a small number require you to type a response. Make sure to click submit at the end of the questionnaire so that the responses are sent to the lead researcher. The questionnaire should take up to 10 minutes to complete. If you require the questionnaire in an alternative format, please contact: Adam Fisher on +44 (0) 1242 [redacted] or e-mail [redacted]

How will my responses be handled and stored? Approximately

When the survey is finished, the data will be downloaded from the online survey software, including both the questionnaire responses and the separate database of personal information that you may have provided in order to be entered into the prize draw. Because the survey itself and prize draw have been treated separately (the prize draw is run from a link after you submit your responses), there will be no way in which your personal data and survey responses can be linked. Both sets of information will be stored on a password protected laptop, accessible only to the main researcher (above). A back up of the information/data will be saved on the University of Gloucestershire server and will only be accessible to the lead researcher via password encryption. Both the personal information file and separate dataset of responses will be treated with the strictest confidentiality. Outputs from the analysis may also be shared with the academic supervisors of the project: Dr Julie Urquhart (CCRI), Dr Kieran Hyder (CEFAS) and Dr Hannah Chiswell (CCRI).

All raw data from the survey questionnaire will be stored for the duration of the project (until 2024). Personal information collected for the prize draw will be destroyed after the winner has been randomly chosen (early 2022). The database of (anonymised) survey responses (excluding emails regarding the Diary Project), however, may also be archived on the (password encrypted) University of Gloucestershire data repository after the project has been completed (post 2024).

Published analysis of the data from the questionnaire will only present findings in an aggregated form. This protects participants that may have provided responses that are low in number from being identifiable in any of the materials produced from the survey data.

Further information on data handling policy is provided in CCRI's Privacy Statement, which can be found at: <http://www.ccri.ac.uk/data-protection/>

Who has reviewed this study for ethical clearance?

This study has been reviewed and granted clearance by the University of Gloucestershire's School of Natural and Social Sciences Research Ethics Panel. If you wish to discuss any ethical issues relating to this project, please contact the Chair of the University's Research Ethics Committee, Dr Emily Ryall at eryall@glos.ac.uk.

Further questions?

If you have any further questions about the research, please contact the lead of the research: Adam Fisher on +44 (0) 1242 [redacted] or email [redacted]

APPENDIX FOUR: INTERVIEW QUESTIONS

Section A: About your angling activity

Q1. Would you be able to tell me a bit about the type of recreational sea angling you do (marks and methods)?

Q2. What motivates you to fish?

Probe:

- What is it about catching fish that motivates you most?
- What aspects of the non-catch experience motivates you most (e.g. being outdoors etc)?
- Are your motivations consistent, or do they change?

Section B: Identity

The next set of questions are about angling and your identity. Identity can be defined in a number of ways, including the main characteristic that defines you, the way you think about yourself, the way you present yourself, and the way you are viewed or how you would like to be viewed by others. Anyone can have a main identity, in addition to different identities for different part of life.

Q3 How important is angling to your identity (is it part of your identity)?

- *High association...* What part of your identity does angling relate to (main or leisure setting)?
 - What is it about angling that relates to your identity?
 - What does angling say about you or that part of you?
 - Does it reflect or help define your identity
 - Is angling similar (or not) to other ways you spend your leisure time?
 - In what ways?
- *Low association...* are there any specific reasons why you don't link angling with your identity?

Q4. What gives you the most pleasure from taking part in recreational sea angling?

Section C: Future governance of recreational sea angling in the UK

You may be aware that since the UK's departure from the European Union there has been suggestions by Government that recreational angling should play a larger part in the way that marine fishing is managed for greater sustainability. Sustainability can be viewed the long-term availability of a natural resource such as the sea, and its ability to meet the needs of a wide range of users.

Q5. In your opinion, what is the largest threat to the sustainability of recreational sea angling in England and Wales?

Q6. Whose responsibility is it to ensure that there is a sustainable recreational angling sector?

Prompt:

- How much do you trust these groups to act in the interest of 1) anglers, and 2) future sustainability of the seas?
 - o Why do you say that?
- *If low trust*, what could be done to increase levels of trust?

You may also be aware that recreational angling is governed by a series of regulations, e.g. minimum landing sizes set by UK government and protected areas of the sea and coast for conservation purposes. Some species have additional protection measures that limit how many you can keep (e.g. sea bass) or states that fish must be released at all times (e.g. tope).

Q7. How familiar would you say you are with recreational sea angling regulations and rules in general?

Q8. What rules do you come across most (if any)?

- o How legitimate are these rules – do you feel confident that they are being made by the right people, and protect the species adequately?
- o Do you abide by these rules when you fish (if relevant)?
- o Do you think other follow the rules – what is the level of ‘rule breaking’ in the community?

Q9. Do you feel engaged in the making of rules for sea fishing (probe for details and level of engagement)?

- What could improve engagement between anglers with policy makers?

Q10. Thinking more generally about regulations, in your opinion what influences anglers’ decisions to follow the rules (or not)?

Prompt (but only if needed):

- Morality?
- Peer/angler pressure?
- Fear of prosecution or being caught?

Q11. Let’s imagine that the UK Government has decided to change the way it manages recreational angling by introducing a compulsory licensing and/or catch reporting system. Let’s also imagine that while access to licenses and the reporting scheme is easy and free to all, little information has given from

Government on how the scheme will be enforced. What approach would work best to make anglers follow the rules?

Prompt:

- Increasing visible enforcement, based on the idea that anglers would respond to the new regulations in fear of being caught or risk of prosecution?
- Approaches that influence anglers follow the rules by changing their beliefs or values:
 - o signs demonstrating desired behaviours or highlighting the impact of following/breaking the rules?
 - o fostering a culture of angler-to angler-enforcement?
- Why do you say that?

Section C: Angler categories

The final few questions are about different types of angler. My research so far has identified four broad angler types: the consumer; the trophy angler; the leisure identify angler; and the social angler [interviewer to read descriptive definitions of these segment].

Q12. If you had to label yourself as one of these angler types, which one would it be?

| Single selection | |
|------------------|--|
| Consumer | |
| Trophy | |
| Identity | |
| Social | |

Prompt:

- What made you allocate yourself to that group?

Q13. Thinking about those same angler groups, I would like you to tell me how much you think each one reflects you. We can go through each one individually and I'd like you to give me a score between 1 to 4, with 1 meaning that you completely identify yourself with this type of angler (this may reflect your previous answer), 2 meaning that strongly identify with that group but not completely, 3 meaning you partially identify as that type, and 4 meaning that you do not associate yourself at all with that type of angler. You can give as many 1,2,3,4 as you like, its not a ranking exercise.

| | Score |
|----------|-------|
| Consumer | |
| Trophy | |
| Identity | |
| Social | |

Q14. Is there anything about how you think of yourself as an angler that you don't think is captured by these four types?

Q15. That's all the questions I would like to cover today as part of my research, would you like to give me the details of where you would like the voucher to be used? Collect send out information.

APPENDIX FIVE: INTERVIEW CONSENT



COUNTRYSIDE
AND COMMUNITY
RESEARCH INSTITUTE



Countryside & Community Research Institute
University of Gloucestershire

Francis Close Hall
Swindon Road
Cheltenham
GL50 4AZ
Tel: +44 (0)1242 715377

Informed Consent Form: telephone discussions

Title of project: **Values, attitudes and behaviours of recreational sea anglers**

By marking each box given below you are giving your full consent to take part in the study as described in the supporting information.

Please tick box

1. I confirm that I have read and understand the subject information sheet for the above study and have had the opportunity to ask questions which have been answered fully prior to the interview.
2. I am at least 18 years old and live in either England or Wales.
2. I have received enough information about this study.
3. I understand that my participation is voluntary, and I am free to withdraw at any time without giving any reason (within 30 days of the interview for complete withdrawal from any analysis).
4. I agree to take part in the above study.
5. I agree that my anonymised data collected as part of this study may be archived at the end of the project (2023) in a public repository.

Please print/type your name below (this will act as an electronic signature):

Date:

Please email your completed consent form as soon as possible to Adam Fisher (project lead) at [email redacted]

Alternatively, you can print and send a copy to the address given at the top of the page.
Please retain a copy of the consent form for your records.

APPENDIX SIX: PARTICIPANT INFORMATION SHEET (INTERVIEWS)



COUNTRYSIDE
AND COMMUNITY
RESEARCH INSTITUTE



Cefas



Economic
and Social
Research Council

Values, attitudes and behaviours of recreational sea anglers in England and Wales: interviews Participant Information Sheet

It is important that you understand why this research is being done and what it will involve. Please take time to read the following information carefully so that you understand why the interviews are being carried out and how your data will be handled. If you have any further questions about the research, please contact the main researcher: Adam Fisher on (number) or email adamfisher@connect.glos.ac.uk. The research is being conducted as a part of a PhD project supervised by the CCRI at the University of Gloucestershire and CEFAS, while it mainly funded by the ESRC.

Why am I being asked to participate?

In early 2022 you completed a survey about recreational sea angling as part of a PhD project looking at differences among anglers in England and Wales. The survey is now closed but, to jog your memory, the survey included questions about your motivations, views on the environment, as well the species of fish you catch and how often you release them. The survey also asked if you would be willing to take part in future research, to which you answered yes (leaving an email and/or telephone number). Results of the survey have been generated and we have an idea of how the main ways in which anglers differ across England and Wales. You are being invited to participate in further related research, however, because we are keen to find out a bit more about how anglers themselves view the different groups we think exist in the fishing community. By involving you in our research, we will be able to gain a better understanding of how well our research fits the 'real world'. Ultimately, understanding how anglers differ means that policy makers and government can better plan for a sustainable marine fishery in the UK, while meeting the diverse needs of its users.

Who should get involved?

Everyone aged 18 years and over, lives in either England or Wales, and who takes part in recreational sea angling at least a few times a year. Recreational sea angling is defined as fishing with rod and line, either from shore or afloat (boat or kayak), without receiving financial payment for fish caught. You must also be a resident in England or Wales, although you do not have to be English or Welsh to take part.

You would have already met these criteria when you took part in the related angling survey in early 2022.

Do I have to take part?

It is entirely your decision whether or not to participate. You can book in the telephone interview with the researcher and withdraw if you change your mind or reschedule at your convenience. You can also withdraw during the telephone interview itself or contact the researcher afterwards if you decide that you don't want your views included in any of the analysis. To ensure that your data is excluded from any subsequent published results, please contact the lead researcher (above) within 30 days of the interview taking place. Withdrawing your data after this period may mean that your information has already been included in any analysis and reporting. Please note that even though this may be the case, you will still not be identifiable in any way in the resulting analysis; we make it impossible for anyone to be identified in the write-up or presentation of our results by eliminating key data (for example place names or anything similar that arises in the discussion) and presenting those that have taken part anonymously (e.g. 'participant one', and so on).

What are the possible benefits of taking part?

Firstly, you will be making an important contribution to research that will help shape the future management of recreational sea angling in England and Wales. Secondly, we hope that you enjoy taking part in the telephone interview, which is simply a relaxed discussion. While we do have some key questions to ask you, this is essentially your opportunity to talk about what you think is important when thinking about diversity among the angling community! Thirdly, all those taking part will receive a £15 voucher for an online shop of their choice. Details of this will be collected at the end of the interview.

Who will use of the research?

The research will ultimately help inform the development and management of marine fisheries and recreational sea angling. It is intended that the data gathered will be published within an academic journal but will also be used in the thesis submitted for doctoral candidacy at the University of Gloucestershire. The findings will also be shared with the Department for Food, Environment and Rural Affairs, part of the UK Government that oversees fisheries management, and CEFAS.

What is the procedure if I take part?

To take part, please get in touch with Adam using either the email address or phone number provided below. Adam will then arrange a convenient time to call you and carry out the interview. The interview will last no more than 30 minutes. Contact: Adam Fisher on (number) or email [email redacted]

How will my responses be handled and stored?

Adam will ask for your permission for the interview to be recorded audibly, alternatively if you aren't comfortable with this, Adam will simply take written notes as the conversations happens.

When the telephone interview is finished, the recording will be typed into a written transcription; this, will then be saved with the omission of any identifying information (e.g. names, places, etc). The transcription will be stored on a password protected laptop, accessible only to the lead researcher (above). A back up of this data will be saved on the University of Gloucestershire server, but again, will only be accessible to the lead researcher via password encryption. The transcription (notes) will be treated with the strictest confidentiality. Outputs from the analysis may also be shared with the academic supervisors of the project: Dr Julie Urquhart (CCRI), Dr Kieran Hyder (CEFAS) and Dr Hannah Chiswell (CCRI).

Transcripts will be stored for the duration of the project (until 2023). After this period, the personal information you have provided will be destroyed. The anonymised transcripts, however, may still be archived on the (password encrypted) University of Gloucestershire data repository.

Further detailed information on how the CCRI (University of Gloucestershire) handles research related data can be found here ([Link to CCRI privacy statement](#)).

Who has reviewed this study for ethical clearance?

This study has been reviewed and granted clearance by the University of Gloucestershire's School of Natural and Social Sciences Research Ethics Panel. If you wish to discuss any ethical issues relating to this project, please contact the Chair of the University's Research Ethics Committee, Dr Emily Ryall at eryall@glos.ac.uk.

Further questions?

If you have any further questions about the research, please contact the lead of the research: Adam Fisher on (number) or email [email redacted]

APPENDIX SEVEN: DATA USED FOR CHI SQUARE ON INDEPENDENT VARIABLES

Note: cluster 1=consumer' 2=trophy; 3=leisure-identity; 4=social

| Age group_Cluster Number of Case Crosstabulation | | | | | | | |
|--|-------------------|------------------------|-------|-------|-------|-------|--------|
| | | Cluster Number of Case | | | | Total | |
| | | 1 | 2 | 3 | 4 | | |
| Age group | 18-34 | Count | 0 | 1 | 3 | 3 | 7 |
| | | % | 0.0% | 14.3% | 42.9% | 42.9% | 100.0% |
| | 35-54 | Count | 16 | 19 | 16 | 28 | 79 |
| | | % | 20.3% | 24.1% | 20.3% | 35.4% | 100.0% |
| | 55+ | Count | 94 | 62 | 80 | 128 | 364 |
| | | % | 25.8% | 17.0% | 22.0% | 35.2% | 100.0% |
| | Prefer not to say | Count | 2 | 0 | 0 | 1 | 3 |
| | | % | 66.7% | 0.0% | 0.0% | 33.3% | 100.0% |
| | Total | Count | 112 | 82 | 99 | 160 | 453 |
| | | % | 24.7% | 18.1% | 21.9% | 35.3% | 100.0% |

| Q. In what settings do you take part in recreational sea angling (with rod and line)? Shore (e.g. estuaries, beaches, harbours) * Cluster Number of Case Crosstabulation | | | | | | | |
|--|-----|-------|------------------------|-------|-------|-------|--------|
| | | | Cluster Number of Case | | | | Total |
| | | | 1 | 2 | 3 | 4 | |
| Q. In what settings do you take part in recreational sea angling (with rod and line)? Shore | Yes | Count | 88 | 80 | 94 | 140 | 402 |
| | | % | 21.9% | 19.9% | 23.4% | 34.8% | 100.0% |
| | No | Count | 24 | 2 | 5 | 20 | 51 |
| | | % | 47.1% | 3.9% | 9.8% | 39.2% | 100.0% |
| Total | | Count | 112 | 82 | 99 | 160 | 453 |
| | | % | 24.7% | 18.1% | 21.9% | 35.3% | 100.0% |

| Q. In what settings do you take part in recreational sea angling (with rod and line)? Privately owned boat Cluster Number of Case Crosstabulation | | | | | | | |
|--|-------|-------|------------------------|-------|-------|-------|--------|
| | | | Cluster Number of Case | | | | |
| | | | 1 | 2 | 3 | 4 | Total |
| Q. In what settings do you take part in recreational sea angling (with rod and line)? Privately owned boat Cluster Number of Case Crosstabulation | Yes | Count | 38 | 14 | 20 | 45 | 117 |
| | | % | 32.5% | 12.0% | 17.1% | 38.5% | 100.0% |
| | No | Count | 74 | 68 | 79 | 115 | 336 |
| | | % | 22.0% | 20.2% | 23.5% | 34.2% | 100.0% |
| | Total | Count | 112 | 82 | 99 | 160 | 453 |
| | | % | 24.7% | 18.1% | 21.9% | 35.3% | 100.0% |

| Q. In what settings do you take part in recreational sea angling (with rod and line)? Charter boat * Cluster Number of Case Crosstabulation | | | | | | | |
|--|-------|-------|------------------------|-------|-------|-------|--------|
| | | | Cluster Number of Case | | | | |
| | | | 1 | 2 | 3 | 4 | Total |
| Q. In what settings do you take part in recreational sea angling (with rod and line)? Charter boat * Cluster Number of Case Crosstabulation | Yes | Count | 43 | 23 | 37 | 59 | 162 |
| | | % | 26.5% | 14.2% | 22.8% | 36.4% | 100.0% |
| | No | Count | 69 | 59 | 62 | 101 | 291 |
| | | % | 23.7% | 20.3% | 21.3% | 34.7% | 100.0% |
| | Total | Count | 112 | 82 | 99 | 160 | 453 |
| | | % | 24.7% | 18.1% | 21.9% | 35.3% | 100.0% |

| Q. In what settings do you take part in recreational sea angling (with rod and line)? Kayak (or similar type of flotation device) * Cluster Number of Case Crosstabulation | | | | | | | |
|---|-------|-------|------------------------|-------|-------|-------|--------|
| | | | Cluster Number of Case | | | | |
| | | | 1 | 2 | 3 | 4 | Total |
| Q. In what settings do you take part in recreational sea angling (with rod and line)? Kayak (or similar type of flotation device) * Cluster Number of Case Crosstabulation | Yes | Count | 10 | 9 | 7 | 22 | 48 |
| | | % | 20.8% | 18.8% | 14.6% | 45.8% | 100.0% |
| | No | Count | 102 | 73 | 92 | 138 | 405 |
| | | % | 25.2% | 18.0% | 22.7% | 34.1% | 100.0% |
| Total | Total | Count | 112 | 82 | 99 | 160 | 453 |
| | | % | 24.7% | 18.1% | 21.9% | 35.3% | 100.0% |

| FV2_Spend * Cluster Number of Case Crosstabulation | | | | | | | |
|---|----------------|-------|------------------------|-------|-------|-------|--------|
| | | | Cluster Number of Case | | | | |
| | | | 1 | 2 | 3 | 4 | Total |
| FV2_Spend * Cluster Number of Case Crosstabulation | Q1 (<£79) | Count | 40 | 21 | 27 | 37 | 125 |
| | | % | 32.0% | 16.8% | 21.6% | 29.6% | 100.0% |
| | Q2 (£80-£255) | Count | 38 | 31 | 36 | 53 | 158 |
| | | % | 24.1% | 19.6% | 22.8% | 33.5% | 100.0% |
| | Q3 (£256-£663) | Count | 24 | 15 | 27 | 42 | 108 |
| | | % | 22.2% | 13.9% | 25.0% | 38.9% | 100.0% |
| | Q4 (£664>) | Count | 10 | 15 | 9 | 28 | 62 |
| | | % | 16.1% | 24.2% | 14.5% | 45.2% | 100.0% |
| Total | Total | Count | 112 | 82 | 99 | 160 | 453 |
| | | % | 24.7% | 18.1% | 21.9% | 35.3% | 100.0% |

| Distance travelled on last fishing trip - Number of Case Crosstabulation | | | | | | | |
|--|-------------|-------|------------------------|-------|-------|--------|--------|
| | | | Cluster Number of Case | | | | Total |
| | | | 1 | 2 | 3 | 4 | |
| Distance travelled on last fishing trip - Number of Case Crosstabulation | <10 miles | Count | 34 | 27 | 22 | 47 | 130 |
| | | % | 26.2% | 20.8% | 16.9% | 36.2% | 100.0% |
| | 11-40 miles | Count | 33 | 17 | 31 | 42 | 123 |
| | | % | 26.8% | 13.8% | 25.2% | 34.1% | 100.0% |
| | 41-80 miles | Count | 18 | 19 | 17 | 28 | 82 |
| | | % | 22.0% | 23.2% | 20.7% | 34.1% | 100.0% |
| 81> miles | Count | 27 | 19 | 29 | 43 | 118 | |
| | % | 22.9% | 16.1% | 24.6% | 36.4% | 100.0% | |
| Total | Total | Count | 112 | 82 | 99 | 160 | 453 |
| | | % | 24.7% | 18.1% | 21.9% | 35.3% | 100.0% |

| Q. Which of the statements below BEST DESCRIBES the primary motivation behind why you take part in recreational sea angling? Please select ONE statement only. * Cluster Number of Case Crosstabulation | | | | | | | |
|---|---|-------|------------------------|-------|-------|-------|--------|
| | | | Cluster Number of Case | | | | Total |
| | | | 1 | 2 | 3 | 4 | |
| Q. Which of the statements below BEST DESCRIBES the primary motivation behind why you take part in recreational sea angling? Please select ONE statement only. * Cluster Number of Case Crosstabulation | I am primarily motivated by experiences that only come from catching fish | Count | 19 | 7 | 4 | 17 | 47 |
| | | % | 40.4% | 14.9% | 8.5% | 36.2% | 100.0% |
| | I am primarily motivated by other experiences that are not related to catching fish | Count | 8 | 1 | 6 | 9 | 24 |
| | | % | 33.3% | 4.2% | 25.0% | 37.5% | 100.0% |
| | I am motivated equally by each of the above | Count | 85 | 74 | 89 | 134 | 382 |
| | | % | 22.3% | 19.4% | 23.3% | 35.1% | 100.0% |
| Total | Total | Count | 112 | 82 | 99 | 160 | 453 |
| | | % | 24.7% | 18.1% | 21.9% | 35.3% | 100.0% |

| Q. Please select ONE option below that best represents your total personal annual income from all sources before deductions for income tax, national Insurance etc. Cluster Number of Case Crosstabulation | | | | | | | | |
|---|----------------------|-------|------------------------|-------|-------|-------|--------|--------|
| | | | Cluster Number of Case | | | | Total | |
| | | | 1 | 2 | 3 | 4 | | |
| Q. Please select ONE option below that best represents your total personal annual income from all sources before deductions for income tax, national Insurance etc. Cluster Number of Case Crosstabulation | £0 to £20,000 | Count | 22 | 19 | 34 | 23 | 98 | |
| | | % | 22.4% | 19.4% | 34.7% | 23.5% | 100.0% | |
| | £20,001 to £40,000 | Count | 38 | 27 | 34 | 69 | 168 | |
| | | % | 22.6% | 16.1% | 20.2% | 41.1% | 100.0% | |
| | £40,001 to £60,000 | Count | 18 | 12 | 10 | 26 | 66 | |
| | | % | 27.3% | 18.2% | 15.2% | 39.4% | 100.0% | |
| | £60,001 to £100,000 | Count | 14 | 11 | 9 | 10 | 44 | |
| | | % | 31.8% | 25.0% | 20.5% | 22.7% | 100.0% | |
| | £100,001 to £200,000 | Count | 4 | 1 | 1 | 6 | 12 | |
| | | % | 33.3% | 8.3% | 8.3% | 50.0% | 100.0% | |
| | Prefer not to say | Count | 16 | 12 | 11 | 26 | 65 | |
| | | % | 24.6% | 18.5% | 16.9% | 40.0% | 100.0% | |
| | Total | | Count | 112 | 82 | 99 | 160 | 453 |
| | | | % | 24.7% | 18.1% | 21.9% | 35.3% | 100.0% |

| Q. In which region do you live? Please select ONE option from the list below. * Cluster Number of Case Crosstabulation | | | | | | | |
|---|--------------------|-------|------------------------|-------|-------|--------|--------|
| | | | Cluster Number of Case | | | | |
| | | | 1 | 2 | 3 | 4 | Total |
| Q. In which region do you live? Please select ONE option from the list below. | East Midlands | Count | 5 | 6 | 3 | 7 | 21 |
| | | % | 23.8% | 28.6% | 14.3% | 33.3% | 100.0% |
| | East | Count | 12 | 12 | 5 | 16 | 45 |
| | | % | 26.7% | 26.7% | 11.1% | 35.6% | 100.0% |
| | London | Count | 1 | 2 | 5 | 4 | 12 |
| | | % | 8.3% | 16.7% | 41.7% | 33.3% | 100.0% |
| | North East | Count | 6 | 6 | 8 | 7 | 27 |
| | | % | 22.2% | 22.2% | 29.6% | 25.9% | 100.0% |
| | North West | Count | 9 | 4 | 10 | 13 | 36 |
| | | % | 25.0% | 11.1% | 27.8% | 36.1% | 100.0% |
| | South East | Count | 27 | 16 | 23 | 35 | 101 |
| | | % | 26.7% | 15.8% | 22.8% | 34.7% | 100.0% |
| | South West | Count | 25 | 14 | 23 | 43 | 105 |
| | | % | 23.8% | 13.3% | 21.9% | 41.0% | 100.0% |
| | West Midlands | Count | 4 | 5 | 8 | 11 | 28 |
| | | % | 14.3% | 17.9% | 28.6% | 39.3% | 100.0% |
| | Yorkshire & Humber | Count | 10 | 5 | 6 | 9 | 30 |
| | | % | 33.3% | 16.7% | 20.0% | 30.0% | 100.0% |
| | Wales | Count | 12 | 11 | 8 | 15 | 46 |
| | | % | 26.1% | 23.9% | 17.4% | 32.6% | 100.0% |
| Prefer not to say | Count | 1 | 1 | 0 | 0 | 2 | |
| | % | 50.0% | 50.0% | 0.0% | 0.0% | 100.0% | |
| Total | Total | Count | 112 | 82 | 99 | 160 | 453 |
| | | % | 24.7% | 18.1% | 21.9% | 35.3% | 100.0% |

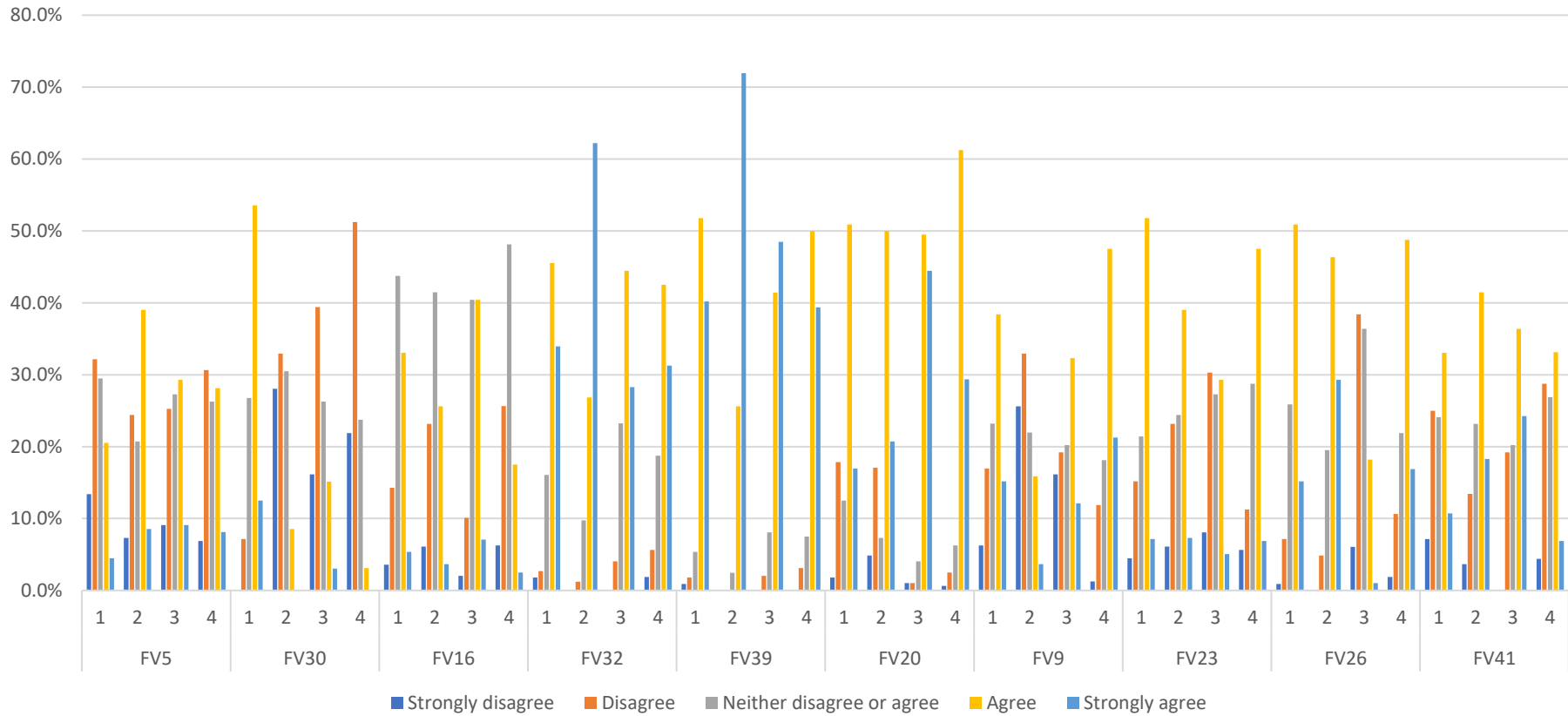
Q. Thinking again about the fish species you chose in the previous question, please select ONE statement below that best describes how often you have released these fish over the last 12 months. * Cluster Number of Case Crosstabulation

| | | | Cluster | | | | Total |
|--|---------------------|-------|---------|-------|-------|-------|--------|
| | | | 1 | 2 | 3 | 4 | |
| | Never | Count | 8 | 2 | 3 | 7 | 20 |
| | | % | 40.0% | 10.0% | 15.0% | 35.0% | 100.0% |
| | Occasionally | Count | 33 | 3 | 15 | 21 | 72 |
| | | % | 45.8% | 4.2% | 20.8% | 29.2% | 100.0% |
| | More often than not | Count | 54 | 41 | 46 | 60 | 201 |
| | | % | 26.9% | 20.4% | 22.9% | 29.9% | 100.0% |
| | Always | Count | 15 | 35 | 33 | 70 | 153 |
| | | % | 9.8% | 22.9% | 21.6% | 45.8% | 100.0% |
| | Don't know | Count | 2 | 0 | 1 | 2 | 5 |
| | | % | 40.0% | 0.0% | 20.0% | 40.0% | 100.0% |
| | Prefer not to say | Count | 0 | 1 | 1 | 0 | 2 |
| | | % | 0.0% | 50.0% | 50.0% | 0.0% | 100.0% |
| | Total | Count | 112 | 82 | 99 | 160 | 453 |
| | | % | 24.7% | 18.1% | 21.9% | 35.3% | 100.0% |

APPENDIX EIGHT: FACTOR VARIABLE SENSIBILITY CHECK

The percentage of each cluster (for each cluster solution) responding to each point on the respective Likert scales for the variables that loaded highest onto each factor.

Percentage of respondents by clusters for highest loading factor variables



Associated factor headings: FV5=central to life; FV30=keep and consume; FV16=identity; FV32=biocentrism; FV39=awareness of environmental impact; FV20=catch orientation; FV9=friendship; FV23=catch numbers; FV26=catch characteristic; FV41=environmental protection



Regarding FV5 (centrality), clusters 1 and 4 are slightly more likely to disagree to the statement reflecting how central recreational angling is to their life. Cluster 2 is more likely to agree that angling is central to life.

Regarding FV30, reflecting propensity to keep and consume fish, there is more variation between clusters. Cluster 1 has a higher proportion of anglers that keep and consume fish. Cluster 2, 3 and 4 have higher percentages of anglers that disagreed to the statement "I want to keep the fish I catch".

FV16 reflected the factor associating angling with personal identity. Cluster 1 and 3 showed slightly more propensity among anglers to link angling with their identity compared to clusters 2 and 4.

FV32 measured attitudes towards biocentrism, with all clusters reflecting positive attitudes to the worth and independence of nature. However, cluster 2 showed a higher proportion of anglers with biocentric viewpoints compared to the other clusters. Similar attitudes are evident across all clusters regarding F39 which measured the degree to which anglers felt they were having an impact on the natural environment.

FV20 measured responses to the statement "a fishing session can be successful if no fish are caught". Again, most anglers across clusters agreed to this statement across clusters.

FV9 reflects the factor that associates angling with friendship opportunities. Here, differences are evident with cluster 1,3 and 4 showing more anglers agreeing or strongly agreeing that angling provides opportunities for them to be with friends. Anglers in cluster 2, however, show opposite responses, therefore disagreeing with the association between angling and friendship.

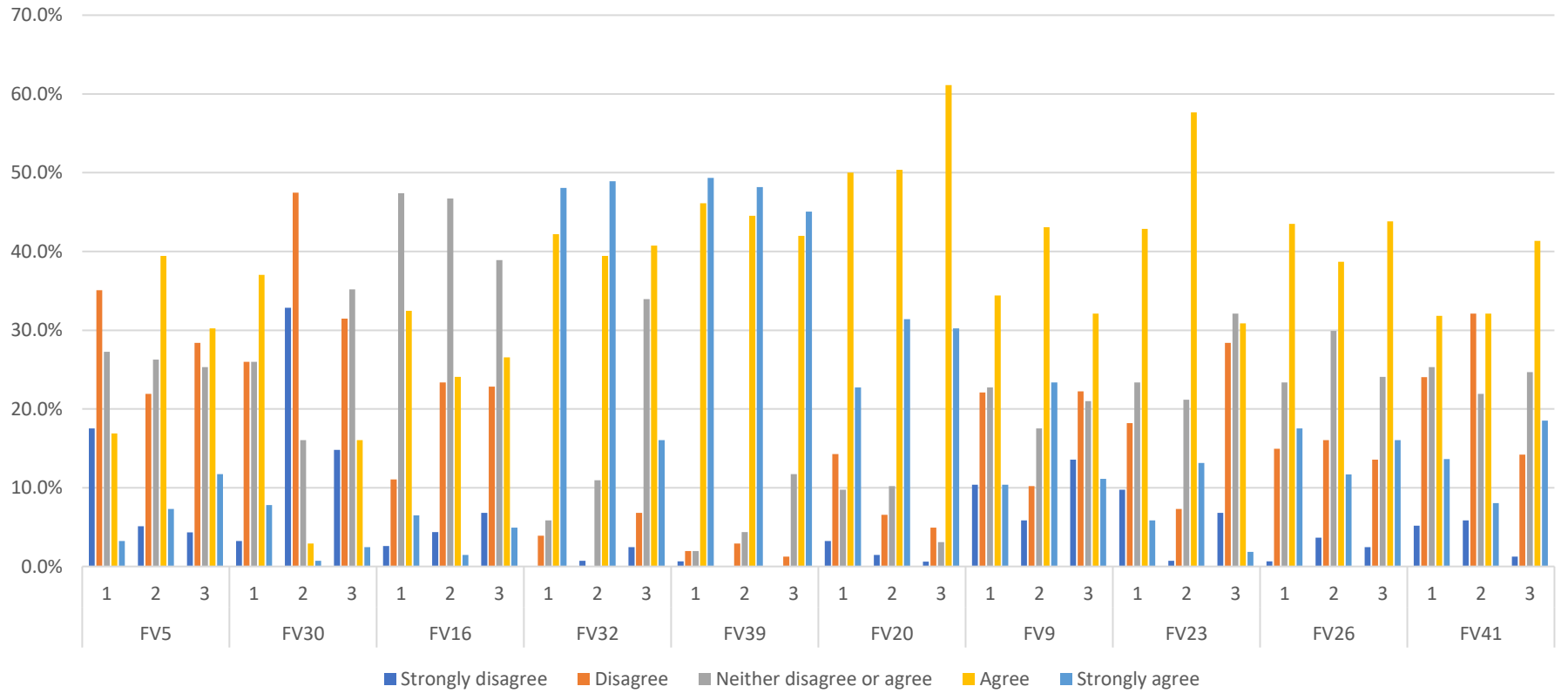
FV23, which reflects the factor regarding number of fish caught, also shows some differentiation between clusters. Both cluster 1 and 4 contain anglers agreeing to the statement that happiness results from catching more fish. Clusters 2 and 3, however, show a proportion of angler with such views. FV26 also shows some differentiation. It shows that cluster three has a higher proportion of anglers favouring to catch larger fish than numerous smaller fish.

FV41 reflects the factor associated with anglers making efforts to protect the environment. Some differentiation is shown here, with cluster 2 and 3 having proportionally less anglers compared to clusters 1 and 4 regarding the perspective that anglers could do more to protect the environment.

In summary, FV32 and FV39, linked to angling views towards the environment, in addition to FV20 linking angling success to catching fish, show minimal variation between clusters. FV5 (centrality), FV30 (keep and consume), and FV9 (friendship) show differentiation with one cluster always showing opposite Likert scale responses to the three others. FV42 (environmental responsibility) and F23 (number of fish caught) both show a split between clusters. Variation is therefore evident in just over two thirds of the variables in this simple sensibility test.

Similar data for the three-cluster non-hierarchical solution is below.

Percentage of respondents by clusters for highest loading factor variables



Associated factor headings: FV5=central to life; FV30=keep and consume; FV16=identity; FV32=biocentrism; FV39=awareness of environmental impact; FV20=catch orientation; FV9=friendship; FV23=catch numbers; FV26=catch characteristic; FV41=environmental protection



Regarding F5 (centrality), cluster 1 is more likely to disagree to the statement reflecting how central recreational angling is to their life. Clusters 2 and 3 are slightly more inclined to agree that see angling as central to life.

Regarding F30, reflecting propensity to keep and consume fish, there is variation between clusters. Cluster 1 has a higher proportion of anglers that keep and consume fish. Cluster 2 has a higher percentage of anglers that disagreed to the statement "I want to keep the fish I catch".

F16 reflected the factor associating angling with personal identity. Cluster 1 showed slightly more propensity among anglers to link angling with their identity compared to clusters 2 and 3.

FV32 measured attitudes towards biocentrism, with all clusters reflecting positive attitudes to the worth and independence of nature. However, cluster 2 showed a higher proportion of anglers with biocentric viewpoints compared to the other clusters. A similar weighting of positive attitudes are evident across all clusters regarding F39 which measured the degree to which anglers felt they were having an impact on the natural environment. Little variation is evident regarding this factor variable.

FV20 measured responses to the statement "a fishing session can be successful if no fish are caught". Again, most anglers across clusters agreed to this statement with cluster 3 showing a slightly higher percentage for those agreeing or strongly agreeing to the aforementioned statement.

FV9 reflects the factor that associates angling with friendship opportunities. Cluster 2 showed more anglers agreeing or strongly agreeing that angling provides opportunities for them to be with friends. Nevertheless, all clusters showed a positive relationship between angling and identity.

FV23, which reflects the factor regarding number of fish caught, also shows differentiation between clusters. Cluster 2 contains a higher portion of anglers agreeing to the statement that happiness results from catching more fish.

FV26 (catch characteristics), however, shows less differentiation with most anglers across all clusters (similar proportions) favouring to catch larger fish than numerous smaller fish.

FV41 reflects the factor associated with anglers making efforts to protect the environment. Some differentiation is shown here, with cluster 3 having slightly more anglers compared to clusters 1 and 2 with the perspective that anglers could do more to protect the environment.

In summary, FV20 (identity) and FV26 (catch characteristics) showed the least amount of variation between segments in the three-cluster solution. All other factor variables (four fifths of the set) had one cluster that performed differently to the others. Although it is difficult to directly compare these results to the previously discussed four-cluster solution (because cases are reassigned in non-hierarchical clustering), it is evident that in this test it is easier to describe variation in the three rather than four cluster solution across the set of variables.

APPENDIX NINE: NVIVO CODING FRAME

| Name | Files | References |
|--|-------|------------|
| (min sizes) | 1 | 1 |
| Anglers breaking the rules | 1 | 1 |
| IDENTITY | 17 | 48 |
| Constructs and reflects identity | 3 | 3 |
| Constructs identity | 2 | 2 |
| Hunter gatherer | 2 | 2 |
| Identity, Environment and the outdoors | 10 | 18 |
| Important in a leisure context | 4 | 4 |
| Important to identity | 11 | 19 |
| INFLUENCES ON ANGLER DECISIONS TO FOLLOW RULES | 21 | 27 |
| Fear of prosecution | 2 | 2 |
| Fear of prosecution unimportant | 6 | 6 |
| General messages about environmental issues | 2 | 2 |
| Peer pressure | 5 | 5 |
| Personal sense of morality and sustainability | 12 | 12 |
| LICENCE SCENARIO | 23 | 38 |
| Anglers likely to take up new licence | 3 | 3 |
| Change norms and values | 4 | 4 |
| Fear of prosecution unimportant | 3 | 3 |
| Incentivise | 3 | 3 |
| Publicity | 4 | 4 |
| Uptake if anglers get something back | 7 | 7 |

| Name | Files | References |
|--|-------|------------|
| Uptake in response to threat of prosecution: enforcement | 14 | 14 |
| MOTIVATION | 21 | 38 |
| Catch related motivation | 5 | 5 |
| Change over time from catch to non catch | 8 | 8 |
| Motivated by being outdoors | 15 | 15 |
| Motivation same over time | 5 | 5 |
| Parity of motivation | 4 | 5 |
| REGULATIONS | 0 | 0 |
| Good level of knowledge or awareness of regulation | 20 | 20 |
| REGULATIONS_BASS | 13 | 13 |
| Adequate to protect species | 3 | 3 |
| Community rule breaking: bass | 11 | 11 |
| Lack of knowledge around the rules | 2 | 2 |
| Less than adequate protection | 3 | 3 |
| REGULATIONS_MIN SIZES | 10 | 25 |
| Community rule breaking: minimum sizes | 6 | 8 |
| Confident in minimum sizes | 2 | 2 |
| Lack of confidence in minimum sizes | 3 | 4 |
| RESPONSIBILITY TO ENSURE A SUSTAINABLE RSA SECTOR | 23 | 50 |
| Angler representative organisations | 2 | 2 |
| Anglers | 4 | 4 |
| Authorities and anglers | 3 | 3 |
| Authorities: government | 14 | 14 |

| Name | Files | References |
|--|-------|------------|
| Improve trust by enforcing harsher rules | 2 | 2 |
| Improve trust by implementing policies to limit impact | 6 | 6 |
| Improve trust by Increasing presence of fishery officials | 1 | 1 |
| Improve trust with authorities: increase and improve communication | 1 | 1 |
| Low trust in angler representative organisations | 1 | 1 |
| Low trust in anglers | 1 | 1 |
| Low trust in authorities: government | 10 | 10 |
| Some trust in authorities: government | 5 | 5 |
| THREATS TO RSA | 21 | 23 |
| Apathy of anglers | 2 | 2 |
| Declining fish stocks | 1 | 1 |
| Ineffective angler representative organisations | 1 | 1 |
| Overfishing: commercial activity | 14 | 16 |
| Over-regulation | 1 | 1 |
| Pollution | 1 | 1 |
| Poor policy | 1 | 1 |
| TYPOLOGY | 16 | 16 |
| Competition angler | 3 | 3 |
| Existing typology covers all types of angler | 11 | 11 |
| Relaxation | 2 | 2 |