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Estimating a Total Demand Function for Sea Angling Pursuits☆

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ABSTRACT

Sea angling is often over-looked in debates related to the sustainability of commercial fisheries, tourism and impacts on marine ecosystem service provision from coastal developments. This paper presents the estimation of a sea angling demand function for Irish waters. The negative binomial models also account for truncation and endogenous stratification; two issues that need to be controlled for when dealing with on-site sampled populations. Given the dispersed nature of sea angling activity, the chosen model does not focus on one specific site as is common in the literature for count data travel cost models but rather estimates the total demand for sea angling in the season, no matter where the angling takes place along the Irish coast. We use this empirical work to discuss the more general debate surrounding resource allocation between commercial fisheries and recreational anglers. The results indicate the high value of the Irish marine environment as a recreational angling resource.

1. Introduction

Sea anglers are one of the main marine recreation user groups in Ireland. Within Ireland, an estimated 127,000 people go sea angling every year along Ireland's 5600 km of coastline (Inland Fisheries Ireland, 2015). In comparison, Armstrong et al. (2013) report that 884,000 from England, 76,000 from Wales and 125,000 from Scotland go sea angling each year.[1] Sea angling in Ireland can be divided into three distinct categories; shore angling (fishing from beaches, rocks, estuaries, quays and piers), inshore angling (fishing from small boats up to 6 m in length, generally less than 5 km from land) and deep sea angling (fishing offshore for shark and other deep water species). As pointed out in a number of previous studies, the recreational activities of sea anglers can make significant contributions to local economies but this group also gains considerable non-market value from their interaction with marine ecosystems (Beaumont et al. 2008; Stolk, 2009; Armstrong et al., 2013; Tourism Development International, 2013; Jobstvogt et al., 2014).

While there are numerous species of fish of interest to the sea angler around Ireland, sea bass is a particularly popular target species.[2] Inland Fisheries Ireland (2015) estimate that there are 35,434 anglers specifically targeting sea bass each year, i.e. almost 30% of all sea angling participants annually. This species has been in decline in European waters in recent years and the EU Scientific, Technical and Economic Committee for Fisheries (STECF) (2014) estimate that recreational anglers account for approximately 25% of total sea bass removals in European waters and can therefore have an important impact on the health of the stock. The importance of sea bass to sea anglers in Ireland is reflected in the fact that it is the only marine fish species that is retained for the recreational angler and no Irish commercial vessels may fish it. This ban on commercial fishing of sea bass by the Irish fleet has been in place since 1990. Indeed, due to concerns over stock levels, European Union (EU) member states agreed in 2015 on an extension of the moratorium of commercial fishing for sea bass in Irish waters to include all vessels.

Other measures decided upon at an EU level in 2015 to better manage the declining sea bass population included: 1) an emergency closure on pelagic trawling during the spawning season from 26 January to 30

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[1] This is not a direct comparison with the Irish data as the UK figures are for residents in each country only and do not include overseas visitors as in the Irish case.

[2] Some of the main fish species targeted by sea anglers in Irish waters include bass, flounder, turbot, ling, pollack, mackerel and ray. For a full listing and description of species targeted by anglers in Irish marine waters see http://www.fishinginireland.info/sea/species.htm.

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April, 2) a 3 fish bag limit for recreational anglers reducing to a 1 bag limit from June 2016, 3) the complete closure of Irish waters for commercial sea bass fishing as well as monthly catch limits for commercial vessels in all other EU waters and 4) an increase in the minimum size from 36 to 42 cm which applies to both recreation and commercial fishermen. The moratorium on all commercial fishing for sea bass in Irish waters was a considerable U-turn on discussions taking place 2 years previously where the EU were considering introducing a quota for this non-TAC (total allowable catch) species. Those discussions were shelved on the back of scientific advice which indicated that sea bass have suffered a steep decline in both quantity and size since 2010 and fisheries scientists have called for landings to be reduced by up to 80% (STECF, 2014).

There is continuous debate around whether it makes economic sense for a species such as sea bass to be managed exclusively as an anglers' rather than a commercial species. It could be argued that managing the stock for sea anglers is more sustainable as they are often more interested in the sport of landing a fish and would be happy to return the fish to the water unharmed once caught (catch and release) rather than actually taking it for consumption. Commercial fishermen on the other hand are predominantly interested in the return (revenue) to be made from permanently removing the fish from the marine environment. A key question then revolves around the economic benefit of maintaining a fish species for recreational fishing compared to the economic benefits of allowing the fish to be commercially exploited. If a catch and release policy is practiced by sea anglers and survivability is high then it may be the case that the potential marginal recreational values exceed the marginal values from commercially fishing the stock. As argued by Tinch et al. (2015, p53) this may be the case because "angling has many participants and relatively few externalities, with a potentially limited impact on fish stocks and the physical environment [especially if a catch and release policy is in place and consumer surplus remains high]. In contrast, in some commercial fisheries the revenue generated barely covers the costs of catching fish. Thus economic rents could be low".

As discussed by Edwards (1990) an appropriately standardised benefit-cost analysis of allocation between commercial and recreational fisheries would determine whether any proposed management measures would increase net national benefits from the use of fish for food versus recreation. Often however it is difficult to determine the net economic returns from a change in management policy as the information on the welfare impacts on both the recreational and commercial fishers (as well as on other relevant groups such as consumers of seafood and charter boat operators) are difficult to obtain.

While the value of commercial landings in Irish waters is assessed on an annual basis at both the national and EU level, much less emphasis is given to the value of marine fish stocks from a recreational use perspective. Future fisheries management plans aimed at generating greater overall value to society requires that the benefits of recreational anglers also be quantified. With this in mind this paper focuses on the use value associated with sea angling in Irish marine waters. In particular it estimates the first total demand model for sea angling recreational pursuits in a country where the total number of trips taken by anglers in the season to any location along the Irish coast, is modelled. Furthermore the analysis is timely given the current debates around how best to manage the heavily depleted stocks of sea bass in EU waters outlined previously.

A travel cost modelling approach is employed to estimate the sea angling use value of the marine resource around Ireland in terms of anglers' consumer surplus (CS) and willingness to pay (WTP). As discussed by Hanley and Barbier (2009) CS is considered as a good approximation of a welfare measure for this type of use value. The travel cost method (TCM), as applied to sea angling, measures benefits from the recreational use of the marine environment through analysing the factors that affect sea angling demand. To monetise the demand, the costs of undertaking a sea angling trip such as travelling to and from the sea angling location, purchasing bait, the opportunity cost of lost working time, equipment rentals, etc. may be included in the estimation. The economic hypothesis is that, in general, the frequency of visits is lower for sea anglers with higher travel costs, meaning that demand for angling trips decreases with higher prices.

There are two important sampling issues that need to be controlled for in the model specifications when respondents are intercepted on-site. Firstly, trip demand is truncated at zero since the anglers are only being interviewed on-site so the current trip is the minimum number of trips that must have been taken, i.e. those who make zero trips in the period are not represented. Secondly, there is a higher probability of sampling individuals with higher trip frequencies. This on-site sampling issue is referred to as endogenous stratification (Englin and Shonkwiler, 1995). If not controlled for in the modelling process both sampling issues can lead to an upward bias in demand estimation and welfare measures.

In what follows we first briefly review the valuation methods used previously in the literature to estimate the demand for recreational fishing and sea angling in particular. In Section 3 we then present the on-site survey methodologies and review the count data modelling specifications applied. Section 4 then presents the model results and welfare estimates, while Section 5 presents a discussion of results and offers some conclusions.

2. Estimating the Value and Benefits of Sea Angling Pursuits

The value of recreational fishing has been extensively investigated in the literature (see for example Hynes et al. 2015; Bilgic and Florkowski, 2007; Loomis, 2003; Curtis, 2002; Haab and McConnell, 2002; Ward and Beal, 2000; Kerkvliet and Nowell, 2000). Indeed, Johnstone & Markandya (2006) identified over 450 non-market valuation studies that deal with recreational fishing benefits and values while Loomis et al. (1999) carried out a meta-analysis involving 109 CS estimates of recreational fishing demand in the United States. The most common form of modelling approach employed in recreational angling studies has been the revealed preference travel cost model (Loomis and Walsh, 1997; Curtis, 2002; Murdock, 2006).

Within this modelling framework the Poisson and the negative binomial count data model specifications have remained particularly popular due to the non-negative integer nature of the demand for pursuits such as recreational fishing (as measured by the frequency of trips). Whether this trip data is collected on-site or at the household location will have a bearing on the ultimate specification used. With on-site surveys, data issues such as truncation and endogenous stratification need to be controlled for as in Curtis (2002) model of salmon angling demand. If the survey has been carried out randomly in the population at the respondent's place of residence the fact that you are likely to see a high proportion of zero trips amongst any given sample need to be addressed. The latter issue has been dealt with previously in the recreational angling demand modelling literature using zero inflation count models (Loomis, 2003) or hurdle count models (Bilgic and Florkowski, 2007; Hynes et al. 2015). In a review of on-site sampling control in travel cost models, Martínez-Espiñeira and Hilbe (2008) examines estimates from a number of previous studies in the literature that corrected for overdispersion, endogenous stratification, and truncation in on-site sampled datasets and found that zero-truncation accounts for most of the on-site sample bias. The effect of correcting for endogenous stratification was smaller but nevertheless it was also found to be significant.

Prayaga et al. (2010) used count data travel cost models to estimate the value of recreational fishing at a number of sites on the Capricorn Coast in Central Queensland, Australia. They found that the annual number of fishing trips demanded decreased as the costs of travel, the number of days spent fishing, the distance from residence to boat ramp and the age of recreational anglers increased. On the other hand the annual number of fishing trips increased as the number of people in the group, catch rates and the value of the boat increased. The CS per trip estimated