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Anglers' views on stock conservation: Sea Bass angling in Ireland

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Abstract: Bottom-up approaches to natural resource management are considered to be more effective for conservation than traditional top-down approaches because the policy-making process is legitimized by stakeholders. In particular, when decisions are shared with direct users of the resource, compliance with the law may be achieved more easily and potential sources of conflict averted. However, empirical evidence on this topic is still limited. In this paper, we investigate how recreational anglers perceive stricter legislation for sea bass fishing, using Ireland as a case study. The new legislation aims to limit harvest rates to restore a viable bass population following years of declining stocks. Data were collected by means of an angler survey and analysed with a seemingly unrelated ordered probit model. Results suggest that most respondents are willing to trade harvested fish for a healthier and long-term sustainable bass population, suggesting strong compliance with this new law.

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1. Introduction

Traditionally governmental agencies have been responsible for natural resource management, using top-down approaches in which decisions are often taken without broad consultation. This kind of governance is deemed to have failed because it is often insensitive to local communities and stakeholders, ignoring considerations of equity and fairness (McGoodwin, 1995). Imposing decisions on the use of local resources may generate conflict, hostility and hamper cooperation (Churchill et al., 2002; Grilli et al., 2015; Paletto et al., 2013, 2014). The 'not in my backyard' (NIMBY) effect, for example, is a phenomenon usually occurring when decisions are made without the involvement of the local population (Van der Horst, 2007; Sugden, 2009; Kemp, 1990). Social conflicts may arise in the presence of competing resource uses, for example when utilitiarian needs contrast with the views of conservationists (Niemelä et al., 2005; Buijs and Lawrence, 2013). In fishery management, ignoring fishers may lead not only to social conflicts but also jeopardize fish conservation (Hannesson et al., 1996; Jentoft et al., 1998). As an example, northern cod fish stocks in Canada almost collapsed in the 1990s because the government overestimated the size of the population regardless of claims made by fishermen (Finlayson and McCay, 1998; Mason, 2002). For these reasons fishery management is shifting to new approaches foreseeing participation of stakeholders and local communities in the decision-making process. Decentralised and polycentric governance is thought to be effective not only for fisheries but for natural resources in general (Ostrom, 1999, 2009, 2010, 2015). 'Adaptive management', 'ecosystem management', 'responsible fisheries' and 'co-management' are terms frequently used to indicate decision-making shared with stakeholders (Armitage et al., 2010; Jentoft et al., 1998; Walters, 2007; Pikitch et al., 2004). There are two main reasons supporting participatory management. First, resource users have experience-based knowledge that might be useful for management challenges. Fisher experience and fishery science might constitute a fruitful mix to produce effective policies. Secondly, participation increases legitimacy of the decision process, thus enhancing compliance with the legislation (Jentoft et al., 1998). Compliance and involvement are interrelated and larger participation in decision-making contributes to compliance (Hall, 1977).

Non-compliance with the law is possibly the greatest cause of management failure in fisheries (King and Sutinen, 2010). Illegal, unreported and unregulated fishing (IUU) has been a major reason for fishery collapse worldwide (UN General Assembly, 2006). Allowing fishers to participate may help to legitimize the decision-making process, thus increasing compliance with legislation. Studies in the commercial context have shown that management legitimacy has a significant effect on compliance. For example, Nielsen and Mathiesen (2003) noted that there were strong indications that participation of fishers in the management process stimulated rule compliance. Viteri and Chávez (2007) observed that along with traditional enforcement tools (detection and penalties) the perception of decision-makers' legitimacy among fishers is also relevant for compliance behaviour. Hønneland (2000) also concluded that the extent of surveillance seems to be less important than the legitimacy of management bodies. Fewer studies have looked at the compliance behaviour and perceptions of fishers in the recreational context. Empirical studies in the recreational sphere are mainly related to attitudes (Murphy Jr et al., 2015), violations (Schill and Kline, 1995) and relationship between knowledge and compliance (Page and Radomski, 2006). Anglers' compliance with legislation should not be overlooked. Recreational activities require effective management because their impact on ecosystem and fish population is similar to commercial fisheries in terms of harvesting and ecosystem impacts (Cooke and Cowx, 2006, 2004). Recreational angling is estimated to be responsible for about 12% of fish catches worldwide (Cooke and Cowx, 2006) while Lewin et al. (2006) report that recreational landings of some popular species, such as largemouth bass (*Micropterus salmoides*), rainbow trout (*Oncorhynchus mykiss*), sockeye salmon (*Oncorhynchus nerka*) and yellow perch (*Perca flavescens*) are

larger than commercial catches. Recreational angling may also have significant effects on the demographic profile of a fishery, reducing the share of large fish (Jouvenel and Pollard, 2001; Westera et al., 2003).

To reduce environmental impacts caused by recreational angling, effective regulation is important, but anglers' compliance is also fundamental. In this paper we evaluate factors affecting anglers' opinions and attitudes towards measures aiming at improved stock conservation, by means of legislation curtailing recreational fishing. Where concerns for conservation is highest amongst anglers compliance with restrictions on catches is also highest. We test this in a case study in Ireland, where additional restrictions on sea bass (*Dicentrarchus labrax*) angling have been recently introduced due to the rate of population decrease. Sea bass is a popular species among Irish and UK sea anglers (IFI, 2015). Because of its biological characteristics sea bass is a particularly vulnerable species and can be easily overfished. Juvenile bass occupy nursery areas close to exposed estuaries, they grow slowly (Pickett and Pawson, 1994) and exhibit strong site fidelity (Pickett et al., 2004). The life-cycle and traits of sea bass make them easily susceptible to over fishing. In European Union (EU) waters total biomass of sea bass has declined in recent years due to an extended period of poor recruitment and increasing fishing mortality (Graham et al., 2014). There are both national and EU controls on commercial and recreational fisheries for sea bass, which range from a moratorium on commercial fishing for sea bass around Ireland, minimum landing sizes, weekly or monthly boat limits in some commercial fisheries, closures of nursery areas in England and Wales, and some closed seasons for French fleets (Graham et al., 2014). Commercial fishing is just one source of pressure on sea bass stocks, as roughly 25% of bass harvested in European waters are caught by recreational anglers (Graham et al., 2014). Regulation measures for recreational angling have been introduced in Ireland, concerning season length, bag limits and minimum fish size. Up to 2015 regulations limited harvest to two sea bass per day in addition to a minimum size limit of 40cm. The fishery was also closed from 15th of May to 15th June every year to protect spawning fish (Graham et al., 2014). Regulations for 2016 included Catch and Release only from January 1st to June 30th. Additional regulations included a reduction in the retained fish per day from two to one, and an increase in the minimum size from 40cm to 42cm. Compliance with this strict regulation could be achieved only if anglers are aware of the urgency of conservation. We explore this issue with survey data collected from anglers who fished for bass in the Republic of Ireland during 2015 and were facing more stringent regulations for the 2016 sea bass season.

The rest of the manuscript is organized as follows. In the second section, we describe data collection and the econometric models. Subsequently, the third section introduces results of the analysis. The fourth section discusses the results and their implications for policy-making. We then offer some conclusion of our study in the last section.

2. Methods

2.1. Data Collection

A survey of sea bass anglers was undertaken between April and June 2016 to elicit anglers' feedback on the current and proposed regulations pertaining to the Irish recreational bass fishery. The survey targeted domestic and international visiting anglers who fished for sea bass in Ireland during 2015. The survey was conducted online and was advertised via a number of channels including the IFI's website, Facebook and Twitter accounts. Notice of the survey was also emailed to subscribers of IFI's Angling newsletter. Specialist tackle shops who cater for bass anglers were requested to alert their customers to the survey. On-line

surveys are susceptible to sampling bias (Fleming and Bowden, 2009) but no method of survey administration has been proven superior to any other (Champ, 2003). On-line surveys do have several advantages over traditional survey methods, not least the low costs incurred and also the speed and accuracy of data collection. Data can be collected continuously regardless of date or time and also without geographical limitation (Madge, 2006). On-line survey questionnaires can be tailored to suit the individual respondents' answers therefore guiding the respondent to the next relevant question for their specific needs. While acknowledging that a cautious view should be taken of the representativeness of our sample to the population of sea bass anglers fishing in Ireland, we believe the survey approach undertaken was the most feasible given the difficultly of carrying out a full on-site survey of bass anglers or of locating them in randomised household surveys.

Table 1: Descriptive statistics of the variables included in the analysis

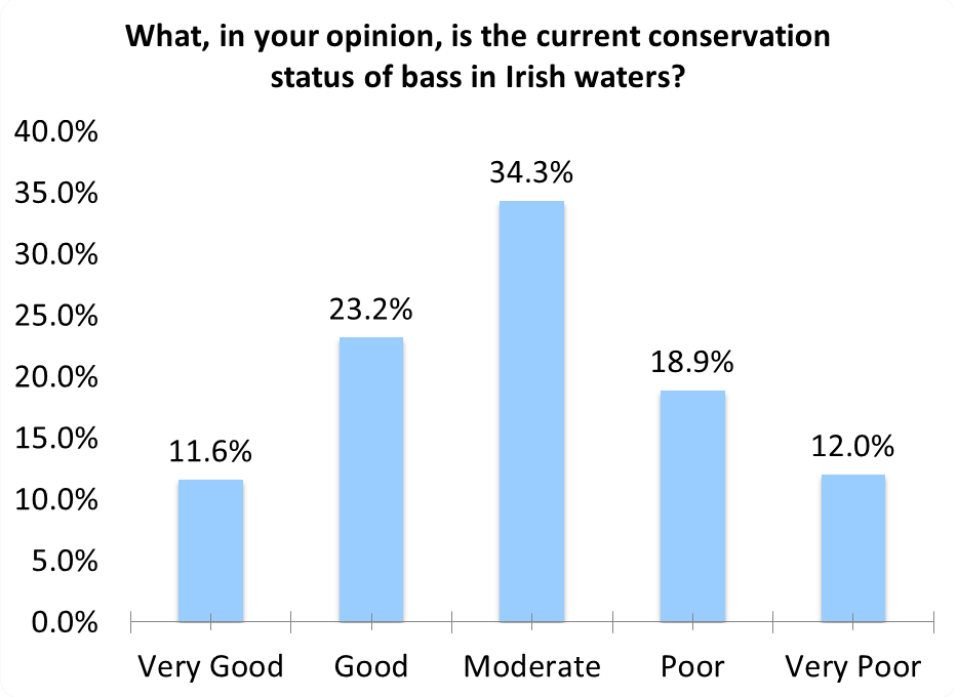
Variable	Description	Mean	Std. Dev.	Min	Max
Fishing_Days	Number of separate days participated in bass angling	30.757	28.443	0	140
Total_Catch	Total bass catch in Ireland in 2015	31.461	49.673	0	300
Trip_Cost	Average daily trip expenses (€'000)	0.048	0.097	0	1.30
Session_length	Average length of a fishing session (hours)	4.300	1.358	2	6
Angler_bass	Angler targeting bass =1, 0 otherwise	0.191	0.394	0	1
Catch&Release	Engaged in 'catch & release' =1, 0 otherwise	0.848	0.360	0	1
Boatfishing	Regularly fished from a boat =1, 0 otherwise	0.152	0.360	0	1
Cork	Mostly bass fished in Cork/Kerry =1, 0 otherwise	0.412	0.493	0	1
Ireland	Living in Republic of Ireland =1, 0 otherwise	0.678	0.468	0	1
Employed	In full time employment =1, 0 otherwise	0.535	0.500	0	1
University	Holds university degree =1, 0 otherwise	0.322	0.468	0	1
Age55+	Aged 55 years or older =1, 0 otherwise	0.326	0.470	0	1

The survey generated 266 responses, of which 222 were used in the econometric analysis. The balance of omitted observations were due to item non-response to critical questions. The survey itself comprised 35 questions and took approximately 15 minutes to complete. Questions were grouped in thematic sections including questions on fishing experience in Ireland (type of fishing, number of annual trips, expenditures, number of successful catches). One section focused on the status of the sea bass fishery and the regulatory measures designed to improve its conservation status. Descriptive statistics of the sample are summarized in table 1. The majority of respondents were from the Republic of Ireland (69%), 5% from Northern Ireland, 10% from Great Britain with the remainder of the sample from other European countries. Almost all respondents were male with only 5 responses from women. Concerning educational levels, around 30% of the sample had a high school degree and 27% held a university degree. The median age bracket was 35-44 years old. The median income class (excluding missing values) was between €30–45,000.

Respondents were generally frequent anglers, declaring 32 fishing days on average in 2015 (median = 25). Average expenditure per angling day (for travel, food, drink, bait, lines, guides, etc) was €48, with a high variability across respondents (standard deviation = €98). The stated average annual catch is 32 bass (std.dev. = 50) with a maximum of 300 (including released fish). Concerning fishing locations 78% of the sample fished in southern counties, which is the area in Ireland where the likelihood of catching bass is higher.

Figure 1 summarizes responses on anglers' opinions on the then current conservation status of sea bass. There was a wide distribution of replies with a majority stating that conservation status is moderate but

Figure 1: Anglers' opinion on regulations for 2015 and 2016



there are substantial minorities who believe that the status is either good/very good or poor/very poor. Respondents were also asked to state their opinions on the new legislative measures for the 2015 and 2016 season. Figure 2 reproduces frequency of answers to each of the proposed measure for 2015 and 2016, while questions for 2016, which are the key variables for the subsequent analysis, are reproduced in figure 3. For the policy measures of 2015 many respondents stated that they were lenient or too lenient and only the season closure during the spawning period (from the 15th May to the 15th June) was considered strict or too strict by a large share of respondents (24%). The majority of respondents considered the limit of two fish per day and the minimum size of 40 cm lenient or too lenient measures. For the 2016 legislation the vast majority of respondents stated that the proposed measures are just right for conserving sea bass. The conservation measure that the highest proportion of anglers believing it to be either strict or too strict was the 'catch & release measure, while the measure to limit harvest size at 50cm had the highest proportion of anglers who believed it to be either lenient or too lenient. Across the three measures the distribution of responses are similar. This comparison suggests that the new legislation for 2016 has encountered positive opinions by a larger share of anglers compared to the measures proposed for 2015.

Respondents were also asked to state whether they were willing to undertake specific actions to improve conservations of bass stocks. Actions included willingness to fish with barbless hooks, record catch data, report illegal activities, comply with the regulation and collect scale samples and biometric data. These were in the form of yes/no questions, the responses to which are reviewed later to add additional insight to the model results. The survey questionnaire concluded with an open-ended question in which respondents could optionally include comments and further opinion on bass angling. It is interesting to note that this optional question was completed by the majority of respondents and, in some cases, their comments help with a qualitative understanding of their opinions.

Figure 2: Anglers' opinion on the current bass conservation status

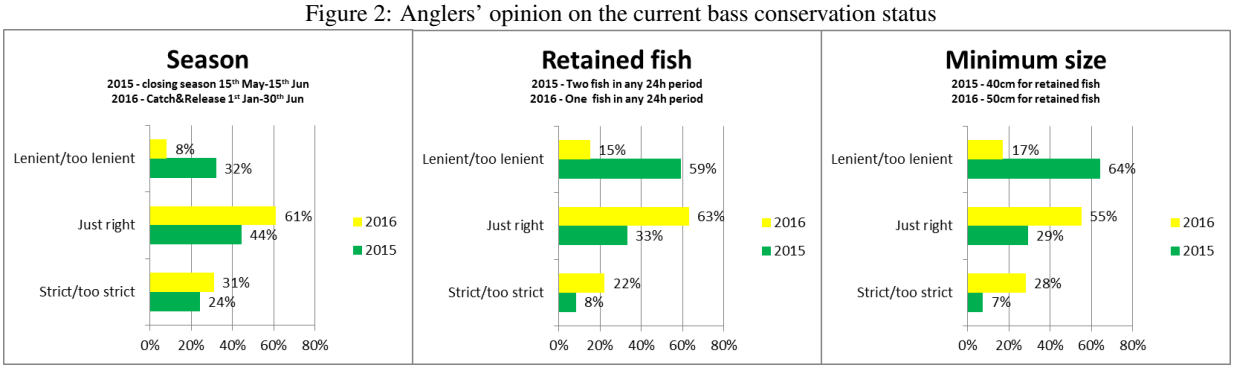
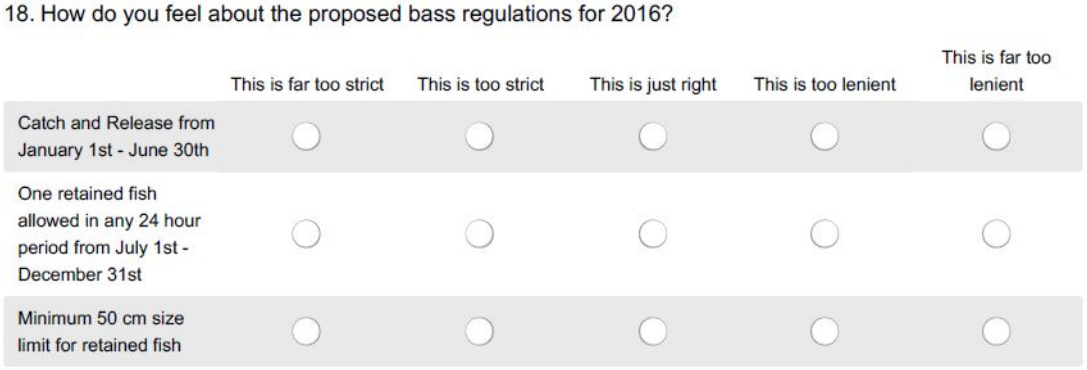


Figure 3: Survey questions on sea bass conservation measures for 2016 season



2.2. *Model specification and estimation*

Respondents were invited to rate their opinions on statements shown in figure 3 on a 5 point Likert scale. Answers were subsequently recoded in a 3 point scale because the share of extreme answers was quite small. Collecting answers into instead of 5 groups is not unusual and it usually does not affect results in a statistically significant way because the order of preference is maintained (Ezebilo, 2012). The lowest numerical ranking was assigned to policy measures considered too strict, while the highest numerical ranking was assigned to measures considered too lenient. Utility of bass conservation increases with higher scores, so that respondents with low scores might be labelled for convenience harvest-oriented anglers, while those with high scores conservation-oriented anglers. We also explored factors affecting opinions on the 2015 legislation but the analysis did not add any further insight so is excluded for reasons of brevity and clarity.

Outcome variables are discrete ordered values, therefore ordered regression models are suitable for the analysis and the random utility model (RUM) framework is used. Let y_k^* be the underlying utility that anglers derive from the k-th legislative measure for bass conservation. Within the RUM utility can be modelled as follows:

$$y_k^* = \beta' X + \epsilon$$

Where X is a set of individual characteristics; β is a set of parameters to be estimated, indicating the effect of each variable on the utility; ϵ is the error component assumed to be identically and independently distributed (IID). We assume that y^* is a latent and continuous measure of utility, ranging in the interval $[-\infty, +\infty]$ (Greene and Hensher, 2009). However, y^* is only observed in the discrete form y, through a system of censoring given by:

$$y_k = \begin{cases} 0, & \text{if } -\infty < y_k^* \leq \tau_0 \\ 1, & \text{if } \tau_0 \leq y_k^* \leq \tau_1 \\ 2, & \text{if } \tau_1 \leq y_k^* < +\infty \end{cases}$$

In which τ_0 and τ_1 are the threshold parameters to be estimated. The probability of outcome j is given by:

$$Prob[y_k = j|X] = F[\mu_j - \beta' X] - F[\mu_{j-1} - \beta X], \ j = 0, 1, 2.$$

Typical regression models for this problem are either an ordered probit or logit, depending on the distributional assumption of the error term ϵ. The two models return similar results (Cameron and Trivedi, 2009). In this study we assume a normal distribution for the error term, thus implementing an ordered probit regression analysis. The three variables could be modelled separately, however opinions on these topics are likely to be correlated. For this reason, we implement a seemingly unrelated (SUR) ordered probit model. Equations seem unrelated in the sense that no left-hand side variables appear in the right-hand side of other equations but the non-observed component of utility are assumed to be correlated. The simultaneous estimation of these three equations takes into account the full covariance structure, with a gain in efficiency. The SUR model with three outcomes can be formalized as follows:

$$\begin{aligned} y_1 &= \mu_1 + \epsilon_1 \\ y_2 &= \mu_2 + \epsilon_2 \\ y_3 &= \mu_3 + \epsilon_3 \\ \epsilon &= (\epsilon_1, \epsilon_2, \epsilon_3) \sim \mathcal{N}(0, \Sigma) \\ \Sigma &= \begin{bmatrix} 1 & \rho_{12} & \rho_{13} \\ & 1 & \rho_{23} \\ & & 1 \end{bmatrix} \end{aligned}$$

where $\mu_i = \beta_i X'$ for the i-th equation and ρ_{12}, ρ_{13} and ρ_{23} are correlation coefficients across error terms to be estimated. The set of X regressors does not have to be the same in all equations [1]. The log-likelihood function LL for this SUR model is (Cappellari et al., 2003):

$$LL = \sum_{i=1}^{N} log\Phi_3(\mu_1, \mu_2, \mu_3; \Sigma)$$

where $i = 1...N$ are the observations and $\Phi_3(.)$ is the trivariate normal distribution. A major issue in this estimation is computing trivariate normal integrals. Computational difficulties do not allow a convenient specification for the ordered logit form, for this reason SUR for ordered response variables are available

[1] In the special case in which regressors are the same for all equation, the SUR model is called also multivariate analysis.

in the literature only for probit specifications[2]. Quadrature-based methods have been proposed in the literature (Genz, 2004, among others), however simulation-based methods with the GHK algorithm (Geweke, Hajivassiliou and Keane) are generally more efficient (Greene and Hensher, 2009). We implemented the GHK simulation with 2000 scrambled Hammersley draws. Models were estimated in Stata®, with the user-written command *cmp* (Roodman, 2017).

3. Results and Discussion

Before running econometric analyses, we tested the presence of multi-collinearity (i.e. correlation among covariates) by means of the Variance Inflation Factor (VIF) (Greene, 2003). In the presence of multicollinearity results may change dramatically even for minor changes in the model or the data, contributing to model instability. A VIF higher than 10 for one independent variable is an indication of severe multicollinearity and requires further investigation. In our model, the maximum VIF for a variable was 3.10 and the mean VIF 1.60, suggesting that multicollinearity does not represent a serious problem for the model.

Table 2 presents results of the econometric models exploring factors that affected respondents' expressed opinions. Correlation coefficients ρ_{12}, ρ_{13} and ρ_{23} are all significant al 1% confidence level. This suggests that the joint estimation of the three equations allows a gain in the overall efficiency because there are some common unobserved factors affecting opinions on the three different measures. Correlations are all positive, indicating that factors affecting large scores for one conservation measure are also associated with large scores for the other conservation measures. Compared to estimates of standard univariate ordered probit models we found no sign reversal for the coefficients, only their magnitude and significance levels varied. Threshold parameters τ_0 and τ_1 indicate the values at which the response variables are segmented. They are statistically significant for all equations thus indicating that the binning of response variables was appropriate.

Within the SUR ordered probit model the signs of coefficients across the 3 equations are similar, except for some non-significant variables. This suggests that most angler characteristics affect opinions on conservation measures in a similar way. The variable *Catch&Release* has a positive coefficient, meaning that people fishing catch and release are more likely to accept conservation measures, all else held equal. This is reasonable because they are most likely affected only marginally by the measures aiming to reduce harvest. This hypothesis is also confirmed by some of the anglers' qualitative comments, stating that they already release all the fish and this should be mandatory for all. *Catch&Release* is also the variable with the largest coefficient in absolute terms. Anglers already engaging in catch and release are more likely to favour all 3 conservation measures.

Anglers specifically targeting sea bass (captured by the variable *Bass Anglers*) are more likely to accept catch and release and bag limits compared to other anglers who also fish for sea bass among other species. This is an indication that what matters for bass anglers is the challenge of landing a fish, rather than keep it (Hynes et al., 2017). Also, specialized bass anglers might have a deeper knowledge of the conservation status. A positive relationship was also found for the size limit at 50 cm, but the coefficient was not signifi-

[2]The working paper by Dardanoni and Forcina (2004) is, to our knowledge, the only example of numerical results obtained from a multivariate ordered logit regression.

Table 2: Results of the SUR ordered probit analysis

	Catch_Release	*Retained*	50*cm Size*
Variables:			
Catch&Release	0.987***	1.171***	0.839***
	(0.292)	(0.281)	(0.253)
Bass Anglers	0.666***	0.402*	0.187
	(0.200)	(0.208)	(0.190)
Boat Fishing	0.808***	0.835***	0.729***
	(0.235)	(0.222)	(0.250)
Total Catch	0.000842	-0.000564	0.00129
	(0.00246)	(0.00212)	(0.00160)
Fishing in Cork/Kerry	-0.560***	-0.333*	-0.424**
	(0.211)	(0.201)	(0.200)
Fishing in Cork/Kerry × *TotalCatch*	0.00432	0.00680**	0.00520*
	(0.00352)	(0.00347)	(0.00309)
University Degree	0.115	0.321**	0.337**
	(0.191)	(0.163)	(0.171)
Full Employed	-0.0960	0.187	0.104
	(0.172)	(0.177)	(0.167)
Irish	0.159	-0.0432	-0.321*
	(0.185)	(0.187)	(0.184)
$Age35-44$	-0.0613		
	(0.172)		
$Age45-54$	0.440**		
	(0.197)		
$Age55+$	0.0987		
	(0.206)		
τ_0	1.206***	1.089***	0.674*
	(0.430)	(0.373)	(0.362)
τ_1	3.357***	3.153***	2.350***
	(0.467)	(0.410)	(0.386)
ρ_{12}		0.801***	
		(0.049)	
ρ_{13}		0.622***	
		(0.067)	
ρ_{23}		0.652***	
		(0.067)	
AIC		1001.5	
BIC		1134.2	
ll		-461.8	
Observations		222	

Robust standard errors in parentheses
$*p < 0.10 * *p < 0.05 * * * p < 0.01$

cant.

Boat Fishing increases the likelihood of accepting conservation measures in a significant way. People fishing from boats have a positive coefficient for catch and release, bag and size limits. Conversely, people who normally fish in the counties of Cork or Kerry are less likely to accept these measures. This result is interesting because Cork and Kerry are among the counties where the probability of catching sea bass is greatest (IFI, 2015). In this area anglers may not perceive the urgency of conservation. Annual catch of anglers did not influence results in a statistically significant way. However, we tested an interaction term between the annual catch and fishing in Cork or Kerry. This variable had a significant effect for explaining attitudes towards bag and size limit. The coefficient was positive, which indicates that most successful anglers fishing in Cork and Kerry are more likely to be in favour of conservation. Bass fishing is an activity requiring skill and experience. Possibly more experienced anglers are aware of dangers related to stock levels, which might partly explain this result.

Socio-demographic characteristics had little explanatory power on expressed opinions concerning the proposed conservation measures. Anglers with a university degree generally favoured the bag and size limit measures compared to non-degree respondents though their opinions do not differ with respect to the catch and release measure. This result is consistent with the literature, which suggests that highly educated people are more likely to be in favour of conservation (Shibia et al., 2010; Ngonidzashe Mutanga et al., 2015; Kideghesho et al., 2007). People in a full-time employment (variable labelled *Full Employed*) were not statistically different from the rest of the sample. Interestingly, Domestic anglers (*Irish*, living in the Republic of Ireland) are on average less likely to accept the new size limit compared to foreign visitors, while their opinions are not statistically different with respect to catch and release and bag limit. Age was not an important explanatory variable except in the case fo catch and release, where anglers in the 45-54 age cohort were significantly most in favour of this conservation measure. In the other equations the age variables were highly insignificant and excluded from the final model.

4. Discussion

Effective fishery management is of utmost importance to avoid fish stock losses. In this regard, it is important for decision-makers to deploy strong legislation but, at the same time, obtain high levels of compliance. Collecting information on opinions and attitudes of anglers before passing restrictive measures could help legitimacy and acceptance levels. Anglers are quite concerned about sea bass stocks in Irish waters, as the opinion of more than 65% of respondents was that conservation status is from moderate to very poor. As a result this analysis shows that most anglers are generally in favour of stronger protective measures. Support among anglers for stronger protective measures mirrors the experience in a number of countries (e.g., Veiga et al., 2013; Brouwer et al., 1997).

Anglers often oppose catch and release regulations either because they want to retain fish for the table or due to ethical considerations (Muir et al., 2013; Bartholomew and Bohnsack, 2005). Designating the Irish bass fishery as only catch and release for the period of January-June 2016 was broadly supported by respondents. This is important because it is recognized that catch and release, if properly implemented, can contribute to sustainable angling tourism (Zwirn et al., 2005). Additional comments made by anglers in the optional open ended question add further insight. In particular, most respondents stating that catch and

release measure for January–June 2016 was lenient or too lenient also commented that it should be mandatory the whole year. Some anglers were in favour of retaining fish, as an action to prevent illegal harvesting. Retention of one fish per day had the largest support among anglers. This is in line with previous research, which highlights that usually bag limits are not a source of conflict (Sauer et al., 1997; Edison et al., 2006; Reed and Parsons, 1999; Prior and Beckley, 2007). Though the new size limit restriction was supported by the majority of anglers, there is less consensus on this measure. Many respondents suggested alternative measures even when they agreed with the minimum size. In some cases, respondents commented that the size limit for 2015 of 40 cm was lenient because they have caught fish of that size full of eggs. Another recurring suggestion was the introduction of a size slot rather than just a minimum because very large specimen produce more offspring. In addition, a large share of respondents advocated more enforcement from public authorities to increase policy effectiveness. The idea that increased enforcement would reduce illegal activities was broadly reported. In some cases respondents wrote that poaching occurs at night with no enforcement. Opinions expressed within these comments are based on experience and personal feelings and do not necessarily reflect sea bass biology or the current management situation. There are, however, examples of how local knowledge and experience might affect judgements and attitudes towards legislation (Berkes, 2009). Managing local resources though traditional and local knowledge is shown to be effective in some cases and therefore worth considering anglers' suggestion (Olsson and Folke, 2001; Close and Hall, 2006; Maurstad, 2002; Silvano and Valbo-Jørgensen, 2008). A thorough analysis of anglers' open-ended responses requires qualitative techniques, such as qualitative content analysis, is for future research.

Table 3: Anglers willing to undertake actions for a more effective bass management

Actions:	Respondents	Yes Answers:
Fish with barbless hooks	221	88%
Record catch data and communicate it to IFI	218	90%
Report illegal fishing activities	219	95%
Comply with sea bass fishing regulation	221	96%
Collect scale samples and fish biometric data	216	83%

While the models report general support for sea bass conservation measures, particularly among those already practising catch and release methods, the anglers also indicated in the survey other conservation measures they were willing to undertake. In table 3 we report the frequency of respondents willing to undertake a number of specific stock conservation actions. The measures included use of barbless hooks, when help minimise harm to fish; communication of catch data for stock management purposes; report illegal fishing activity; compliance with sea bass regulations; and finally collection of biometric data for stock management and research purposes. Across all these measures the greater majority of anglers expressed a willingness participate, which further confirms that the angling community is positively disposed to sea bass conservation measures.

Despite a general consensus towards more restrictive measures, results of this study are limited and they should be interpreted carefully. A critical issue is the level of diverging opinions with respect to the current bass conservation status, as highlighted in figure 1. The share of respondents that believe that the current status is very good is similar to the proportion that believe the stock is very poor. This might generate conflict when stricter measures are established because many anglers might not understand the reason. Sea bass anglers cannot be taken as one homogeneous group, with a broadly similar outlook. Any engagement

or outreach with bass anglers has to be extensive to ensure that all opinions are acknowledged. Any management measure will likely provoke quite different responses across the angling community, therefore a better disclosure of the current sea bass stocks situation would be desirable to avoid opposition. Effective communication of bass stock status could also help increase social capital, with positive effects on the management side (Bodin and Crona, 2008; Grafton, 2005) and contribute to a widespread awareness of dangers.

5. Conclusions

The fisheries management literature increasingly emphasises the importance of understanding fisher attitudes and perceptions. To that end, this study examined anglers' knowledge and opinions towards conservation measures relating to the Irish bass fishery. Analyses based on non-representative samples should be taken carefully and more research would be desirable to generalize the results. However, this study contributes and confirms the existing literature, as it revealed that a large portion of anglers are aware of the conservation status and willing to reduce angling pressure on bass population. Conservation measures were broadly supported by most anglers, with many actually viewing current and proposed regulations as being excessively lenient. Angling characteristics affected results more than socio-demographic traits. This potentially allows for more effective communication of stock status information and motivations for conservation measures. Results also showed that there was a wide range of opinions on the current conservation status of the bass fishery. This divergence in opinions could lessen the effectiveness of conservation policies, because the share of anglers believing that 2015 sea bass regulations are good might oppose to future policies limiting the fishing activity. Communication campaigns would be desirable to prevent this and increase awareness.

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