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# An evaluation of the social and economic impact of a Marine Protected Area on commercial fisheries

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17 **Abstract**

18 This study is an insight into the spatial use and economic performance of a fishery and linked  
19 fisher wellbeing across economic, social and health domains over a 12 year timescale pre and  
20 post Marine Protected Areas (MPA) designation. Since the MPA designation, there has been an  
21 increase in vessels using static gear inside and outside the MPA with a significant positive trend  
22 for vessels using static gear inside the MPA. Over time, static gear landings have decreased by  
23 110kg per vessel per month though there has been a significant positive trend over time in value  
24 achieved (landings of £1452 per vessel per month), linked to catches of high value species such  
25 as lobster, which are linked to the reef ecosystem. Fishing activity providing high volume  
26 (weight) and value landings from vessels using mobile demersal gears within the MPA ceased in  
27 July 2008. Mobile demersal gear fishing effort has since increased significantly outside the MPA.  
28 The value of mobile demersal gear landings in 2017 are comparable to fishing activity prior to  
29 the MPA designation but has not reached the peak landings values of 2008 at the point of MPA  
30 designation. Fishers predominantly using mobile demersal gear report lower subjective  
31 wellbeing and material losses. Static gear fishers report higher levels of subjective wellbeing over  
32 time compared to their mobile demersal gear counterparts. Positive subjective wellbeing are  
33 pronounced when the fishers are involved with an independent working group. Sustainability  
34 across ecological, social and economic systems requires an integrated rather than sequential  
35 approach to fisheries management and marine conservation.

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37 Key words: conservation; Lyme Bay; sustainable development; reef; trawl; protected areas

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45           **1. Introduction**

46   The Sustainable Development Goals (SDGs) advocate a ‘triple bottom line’ approach to maintaining  
47   human wellbeing; these being economic development, environmental sustainability and social  
48   inclusion (UN General Assembly 2015). SDG Goal 14 to ‘conserve and sustainably use the oceans,  
49   seas and marine resources for sustainable development’ places the designation of Marine Protected  
50   Areas (MPAs), as a means to mitigate biodiversity loss, firmly within the economic and social context  
51   of global development.

52   MPAs are recognised as having linked social and economic dynamics (Rees, Pittman et al. 2018) and  
53   thus (with the respective resource users) form a complex social-ecological system (SES) (Ostrom  
54   2009). The science underpinning the need for MPAs is considered to be mature (Lubchenco and  
55   Gorrod-Colvert 2015). MPAs where all forms of fishing are removed (no –take) are shown to be the  
56   most effective mechanism to restore and preserve biodiversity (Lester and Halpern 2008, Sala,  
57   Lubchenco et al. 2018). The parameters for the ecological success of an MPA further rely on the size  
58   of the MPA (large) and isolation of the MPA from human pressures (Edgar, Stuart-Smith et al. 2014).  
59   However, such thresholds for MPA success are unrealistic given that the majority of MPAs are small  
60   and located close to coastlines where much human activity exists (Halpern 2014).

61   Commercial fishing takes many forms and is widespread. Fishing often overlaps with MPAs and  
62   predates their designation. Whilst the objectives for MPAs are typically for conservation purposes,  
63   commercial fisheries are dependent on healthy functioning marine ecosystems (inside and outside  
64   MPAs), with many of the features of conservation interest (within MPAs) fundamental in supporting  
65   fish and shellfish during essential life history stages (Kritzer, DeLucia et al. 2016, Stewart and  
66   Howarth 2016). A more realistic pathway to sustainability will rely on the identification of synergies  
67   between conservation goals and fisheries management (Gaines, Lester et al. 2010, Brooker,  
68   Devenport et al. 2018, Rees, Sheehan et al. 2020). Ecosystem based fisheries management (EBFM) is  
69   proposed as a structured whole-of-system place-based planning process that uses adaptive

70 management to provide opportunities to consider overarching management goals for the social-  
71 ecological system (Levin, Essington et al. 2018).

72 It is reported that an overarching obstacle to improving the management of the marine environment  
73 is the limited empirical evidence of MPA impacts on socioeconomic outcomes despite the many  
74 descriptive arguments of the potential for economic benefits resulting from conservation (Wells, Ray  
75 et al. 2016, Rees, Sheehan et al. 2020). To date, there is very limited empirical evidence of how  
76 MPAs contribute towards human wellbeing and sustainable development (Haines, Hattam et al.  
77 2018, UNEP-WCMC, IUCN et al. 2018). Studies to link ecological and social metrics are rare (Gaines,  
78 Lester et al. 2010, Pollnac, Christie et al. 2010). Studies that explicitly link the conservation goals of  
79 an MPA to the performance of commercial fisheries inside and outside an MPA are equally rare in  
80 the European context (Haines, Hattam et al. 2018). A global synthesis of the literature confirms that  
81 most empirical work evaluating the social impacts of MPAs has focussed on economic outcomes and  
82 the processes of governance that can support improved wellbeing (e.g., rights and participation)  
83 (Ban, Gurney et al. 2019). To improve the evidence base, this study offers an insight into the  
84 economic performance of a fishery and linked fisher wellbeing across economic, social and health  
85 domains over a 12-year timescale pre and post an MPA designation.

## 86 **1.1 Case study site and context**

87 In June 2008, the United Kingdom's (UK) Department of Environment, Food and Rural Affairs (Defra)  
88 established a Statutory Instrument (SI), The Lyme Bay Designated Area (Fishing Restrictions) Order  
89 2008, SI 2008/1584, under the Sea Fish (Conservation) Act 1967. The SI came in to force in July 2008  
90 and prevented mobile fishing gear, namely dredging and trawling (mobile demersal fishing gear) in  
91 206km<sup>2</sup> of Lyme Bay (SI 2008/1584). The SI enabled the reef and the inter reef sediment areas to be  
92 protected from mobile demersal fishing gear across a whole-site (Solandt, Mullier et al. 2019, Rees,  
93 Sheehan et al. 2020). Creating, at that time, the UK's largest and the most strongly protected MPA

94 for reef features. Within the SI boundary, static gear fishing (pots and nets) and SCUBA diving to  
95 collect King scallops (*Pecten maximus*, Pectinidae) are permitted.

96 Overlapping and extending the SI is a 312km<sup>2</sup> Special Area of Conservation (SAC) designated under  
97 the European Union Habitats Directive 92/43/EEC to protect Annex I reef features. In 2013, the  
98 regional Inshore Fisheries and Conservation Authority's (IFCA) implemented byelaws to protect  
99 236km<sup>2</sup> of reef across the SAC and the SI. Outside of the SI and within the SAC, fishers using mobile  
100 demersal fishing gear are allowed to fish between the reef features, where they are currently  
101 delineated. The combination of the SI and the SAC form the boundary of the Lyme Bay Marine  
102 Protected Area (MPA) Figure 1.

103 *[inset Figure 1 here]*

104 Since the initial SI closure in 2008, ecological data on macro benthic sessile and sedentary organisms  
105 have been collected annually. The results demonstrate that there have been positive responses for  
106 species richness, total abundance and assemblage composition inside the SI and abundances of  
107 seven out of thirteen indicator taxa showed a positive response inside the SI (Sheehan, Stevens et al.  
108 2013, Davies, Attrill et al. 2020). These species were found in greater abundance on reef habitat and  
109 pebbly-sand habitat in areas within three years of being closed to mobile demersal fishing to areas  
110 outside the SI exposed to mobile demersal fishing (Sheehan, Cousens et al. 2013, Sheehan, Stevens  
111 et al. 2013). Collection of socio-economic data has been more limited, confined to one year post SI  
112 closure for the fishing industry (2009-2010). Initial results demonstrated that there had been  
113 displacement of the mobile demersal fishing fleet, but that permitted commercial fishing activities  
114 (fishing with pots) had proliferated within the SI closure (Mangi, Rodwell et al. 2011). In the three  
115 years post SI closure, data also shows that recreation participants (divers and anglers) and providers  
116 (charter boat operators and dive businesses), had increased their use of the area within the SI  
117 closure citing the recovery of the reef and the reduction in conflict with the mobile demersal fishing

118 fleet as key reasons for undertaking their activity in the area (Rees, Rodwell et al. 2010, Rees, Mangi  
119 et al. 2015).

120 In 2011, a non-governmental organisation (NGO), the Blue Marine Foundation, formed a pro-active  
121 working group for the Lyme Bay MPA. An initial Memorandum of Understanding (MoU) between  
122 interested parties established the basis for the Working Group (the Lyme Bay Consultative  
123 Committee (LBCC)) for members to promote and implement best practice in fishery and  
124 conservation management. Fishery and conservation management actions included a voluntary  
125 Code of Conduct, proposed as a means of achieving effective management to maintain sustainable  
126 fishing practices within the Lyme Bay MPA. Wider partnership activities by the LBCC have included  
127 development of new markets and branding, investment in post-harvest icing infrastructure,  
128 knowledge-sharing and training activities.

## 129 **2. Methods**

### 130 **2.1 Fishing activity and landings 2005 - 2017 data collection and analysis**

131 Data on the weight and value of species landed by different gear types were obtained from the  
132 Marine Management Organisation (MMO) for each vessel that fished in Lyme Bay (International  
133 Council for the Exploration of the Sea (ICES) statistical rectangles 30E6 and 30E7, Figure 1) from 2005  
134 to 2017. The catch data included the wet weight and value of landings from ports around Lyme Bay  
135 reported by fishers and fish merchants to the MMO. The dataset included the date the landing took  
136 place, species caught, ICES rectangle fished, and the gear type used. It is noted that these data could  
137 be underestimating the actual landings and fishing effort as there is no statutory requirement for  
138 fishers to declare their catches for 10 metre and under vessels. Landings records for 10 metre and  
139 under vessels were therefore collated from log sheets and landings declarations supplied by fishers  
140 and sales notes from buyers and sellers (MMO 2016). This log book data was cross referenced with

141 the MMO landings data to provide a complete data set of weight and value of species landed by the  
142 under 10 and over 10 metre fishing fleet.

143 Information from management and enforcement agencies (MMO, IFCA) (sightings data and expert  
144 opinion) were used to match locations of fishing effort as either inside or outside the MPA, treating  
145 the SI as a whole site closure (reef in inter sediment areas) and the SAC as a feature based (reef)  
146 closure to mobile demersal fishing gear. Data were further divided into vessels that are  
147 predominantly set up for either mobile (specifically using mobile demersal gear – dredging and  
148 trawling) or static gear fishing (pots and nets). Whilst it must be noted that individual fishers may (at  
149 different times of year) switch to an alternate form of fishing to take advantage of available stocks,  
150 e.g. predominantly mobile gear vessels may also set static gear (pots) for whelks. The gear  
151 separation reflects activities which are no longer permitted in the SI section of the Lyme Bay MPA  
152 and conservation (reef) features within the SAC that intersect with the IFCA “no mobile (demersal)  
153 gear”, byelaws.



154 **2.2. Commercial Species**

155 Commercial species that are not subject to quota restrictions in ICES Area 7e, the ICES area that  
156 interacts with the study site, are the focus for this research. The under 10 metre commercial fleet,  
157 dominant in this section of Lyme Bay, receive less than 5% of UK fish quota allocation (Urquhart,  
158 Symes et al. 2014, Anbleyth-Evans and Williams 2018, MMO 2019). Additionally, landings of non-  
159 quota species are more linked to fishing opportunity and availability than quota allocated species  
160 (Urquhart 2014). Landings data for these non-quota species are presented within gear categories.

161 **Static gear:** Pots: brown crab (*Cancer pagurus*, Cancridae) and european lobster (*Homarus*  
162 *gammarus*, Nephropidae); SCUBA diver: king scallop (*P. maximus*); Other pots: whelk (*Buccinum*  
163 *undatum*, Buccinidae), common cuttlefish (*Sepia officinalis*, Sepia); Static nets: lemon sole  
164 (*Microstomus kitt*, Pleuronectidae).

165 **Mobile demersal gear:** Scallop dredge (king scallop *P. maximus*); demersal trawl (cuttlefish *S.*  
166 *officinalis*); demersal trawl (lemon sole *M. kitt*).

167 **2.3. Statistical analysis of fishing activity and landings data**

168 Fishing within the Lyme Bay MPA is dominated by smaller under 10 m (inshore) vessels that mainly  
169 fish within 6 mile from the shore. Under 10 metre vessels comprise approximately 74% of the total  
170 number of vessels registered to ports within Lyme Bay as a whole and 96% of vessels registered to  
171 ports within the boundary of the MPA. Over the 10 year evaluation period the number of under 10  
172 metre vessels registered to ports within Lyme Bay MPA has remained stable, between 38 to 44  
173 vessels, representing approximately 38-73 at sea jobs (Rees, Ashley et al. 2016). In the same period,  
174 there were 1-4 over 10m vessels registered to ports within the MPA, noting that post 2008 three of  
175 these vessels with scallop licences would operate predominantly outside the MPA boundary (Rees,  
176 Ashley et al. 2016).

177 Fishing activity and landings data were separated into categories. First, the data were separated by  
178 vessel gear type, mobile (demersal gear such as trawls or dredges) or static gear (such as pots, static  
179 nets or collection of seafood by scuba diving). Fishing effort data (number of vessels and number of  
180 trips per month) were separated spatially depending on if the vessel was recorded as fishing within  
181 the area of the MPA or outside, using a July to June year to reflect before and after designation of  
182 the SI.

183 Values such as fisheries landings for a species may rise and fall between years and do not necessarily  
184 provide a linear trend over time. Therefore, to visually identify if a trend over time occurred, annual  
185 data (2005/06 – 2016/17) were first plotted in line charts in Microsoft Excel to observe inter-year  
186 changes. To statistically test for the presence of a trend, Kendall's tau-b statistical tests were  
187 calculated in Statistical Package for the Social Sciences (IBM SPSS®) to test for presence of a  
188 monotonic relationship between fishing effort or landings data and time (2010-2017). A significant  
189 positive or negative trend was assessed at the 95% confidence limit ( $>0.05$ ). To test for changes  
190 between data from years before the SI closure and after, Welch's *t*-test was used as a more reliable  
191 test due to unequal variance present between data sets.

192 Three year averages were also compared where possible, to identify a change in average values  
193 between the most recent 3-year period and the three year periods previous to it (e.g. increase,  
194 decrease or no change in the 3-year average between 2012-2014, and 2015-2017).

## 195 **2.4 Fisher wellbeing**

196 A learning history approach was adapted to measure how the wellbeing of Lyme Bay fishers was  
197 impacted by regulatory and environmental change events over time (Douthwaite and Ashby 2005, K.E.  
198 Abernethy, Ö. Bodin et al. 2014). First, a multi-stakeholder workshop (n=16) was held to: i) develop  
199 an integrated timeline of events impacting Lyme Bay between 2005 and 2015, and; ii) prioritise key  
200 indicators of subjective and objective wellbeing.

201 Following development of the event timeline, workshop participants were introduced to the concepts  
202 of subjective and objective wellbeing across the domains of social, economy, health and environment.  
203 Participants then identified and ranked in order of importance indicators they deemed most relevant  
204 to the wellbeing of Lyme Bay fishers. The workshop identified four indicators of subjective wellbeing  
205 (job satisfaction, income satisfaction, stress and conflict) and three objective indicators of material  
206 wellbeing (turnover/profit, investment in the industry and sales strategy) as the most important.  
207 These workshop results were used to design a questionnaire survey for fishers. Along a ten-year  
208 timeline, fishers were asked to identify a year when a specific aspect of subjective wellbeing, such as  
209 job satisfaction, was highest. They were asked to rank on a scale of 0-10 (none – complete/extremely  
210 high) their wellbeing at that time. They repeated this for the time of lowest and current wellbeing (as  
211 of 2015). Respondents were then asked to identify key events that explained the highest, lowest and  
212 current levels of wellbeing, i.e. changes in wellbeing over time. Finally, fishers were asked to rank  
213 perceived levels of support for the Lyme Bay MPA on a scale of 0-10 (no support – full support). Fishers  
214 were surveyed face to face in pre-arranged meetings. A total of 28 fishers using static and/or mobile  
215 demersal fishing gear were interviewed representing the main ports in the study region.  
216 Approximately 41 vessels were registered in Lyme Bay ports within the MPA boundary resulting in an  
217 interview sample size of 68%. Of this sample 19 reported to operate predominately inside the MPA  
218 (n=19) and 9 outside the MPA (n=9).

219 For all survey analyses, fishers were categorised into three groups: static-gear fishers involved in the  
220 Lyme Bay Consultative Committee (LBCC) partnership (Static Y), static gear fishers not involved in the  
221 LBCC partnership (Static N) and mobile gear fishers (using mobile demersal gear). Only one of these  
222 was not involved in the LBCC partnership (mobile). For each category of subjective wellbeing  
223 respondents provided three data points reflecting highest, lowest and current wellbeing. To create a  
224 timeline for every respondent which could be aggregated, the highest or lowest data points were  
225 repeated each year at the same value until the next reported data point. This assumed that fishers did

226 not experience dramatic changes in wellbeing in-between the years they nominated as significant and  
227 provided a mean ranking that better reflects the average scores of all respondents across the years.

### 228 **3. Results**

#### 229 **3.1. Changes in fishing activity and spatial effort**

230 Overall, the number of vessels actively fishing inside and outside the Lyme Bay MPA and reporting  
231 landings from ICES statistical rectangles 30E6 and 30E7 per month, increased over the period  
232 2004/05-2016/17, aside for those using mobile demersal gear inside the MPA (Figure 2). Fishing  
233 activity providing high volume (weight) and value landings from vessels using mobile demersal gears  
234 within the MPA ceased, following the SI closure in July 2008 (Figure 3). There is a corresponding  
235 increase in mobile demersal gear effort outside the MPA in the years following the SI designation.  
236 (Figure 2).

237 *[insert figure 2 here]*

238 There has been an increase in effort from vessels using static gear across the study region, with a  
239 significant positive trend for vessels using static gear inside the MPA between 2005/6 and 2016/17,  
240 Kendall's tau-b 0.489  $p = 0.03$ ) and increase of 7 vessels between the first and last 3-year average in  
241 the time series (Table 1).

242 *[inset table 1 here]*

243 Fishing effort (mean number of trips per month) for vessels with static gears increased significantly  
244 within the MPA in comparison of annual data before and after the 2008 SI closure (Welch's  $t$  test =  
245 7.45,  $p < 0.001$ ) and displayed smaller significant increase outside the MPA (Welch's  $t$  test = 3.83,  $p$   
246 0.05) (Table 1, Figure 2). There was an increase of 223 fishing trips per month inside the MPA and  
247 185 outside the MPA between the first 3-year average before the 2008 SI closure and the most  
248 recent 3-year average (Table 1).

249 Despite an increase in number of trips per month by vessels using static gear over the time series,  
250 there was a decrease in overall landings weight (Table 1). However, there was a significant positive  
251 trend over time in value of those landings from fishing activity using static gears inside the MPA  
252 (Kendall's tau-b 0.788  $p = <0.001$ ) and outside (Kendall's tau-b 0.485  $p = 0.03$ ) (Table 1, Figure 3).  
253 This was represented by a £1452 increase (per vessel per month) between first 3-year average and  
254 last 3-year average for static gear landings inside the MPA and £866 (per vessel per month) for static  
255 gear landings from outside the MPA (Table 1).

256 *[insert figure 3]*

257 Mobile demersal gear effort (average number of trips per month) has displayed a significant positive  
258 trend outside the MPA during the study period (Kendall's tau-b 0.840,  $p = >0.001$ ) (Table 1, Figure 2).  
259 There was also a significant increase in effort (number of trips) outside the MPA, from vessels using  
260 mobile demersal gears, when comparing years before and after the SI closure (Welch's  $t$  test = 5.49,  
261  $p <0.001$ ). The increase in effort from vessels using mobile demersal gears outside the MPA  
262 following the SI closure provided increased value (+£2231 average per vessel per month) from  
263 landings, when comparing 2004/05-2007/08 and 2014/15-2016/17, 3-year averages (Table 1, Figure  
264 3). Value of landings for vessels using mobile demersal gears in Lyme Bay have shown some return  
265 to those achieved prior to the SI closure, with a value of £9021 (average per vessel per month), from  
266 landings outside the MPA in 2016/17. However, values have not reached the peak values prior to the  
267 SI closure, where inside the MPA alone landings per vessel per month in 2005/06 were valued at  
268 £15311 (Table 1, Figure 3).

### 269 3.2. Changes in landings weight and value related to species landings from Lyme Bay 2005/06 -

270 2016/17 (ICES rectangles 30E6 and 30E7)

#### 271 *Static gear fisheries*

272 Increase in weight (+735 kg pre vessel per month, 177% increase) and value (+£1507 per vessel per  
273 month, 412% increase) of diver caught scallops between 3-year averages at either end of the time

274 series (Table 2), had the greatest contribution to the significant uplift in value obtained for landings  
275 from all static gear fishing effort, inside the MPA (Table 2). Due to high values for scallop landings in  
276 all years since the SI closure, the positive trend in value over time, for landings from scallop diving  
277 was not significant (Kendalls tau-b 0.44,  $p = 0.15$ ).

278

279 [inset table 2 here]

280 Significant positive trends in landings from potting (combined crab and lobster landings) also  
281 contributed to the uplift in value inside the MPA (+178kg, 66% increase in weight, resulting in +£628,  
282 104% increase in value) (weight Kendall's tau-b = 0.5,  $p < 0.01$ ; value Kendall's tau-b = 0.87,  $p =$   
283  $< 0.001$ ). Increase in landings weight and value associated with potting fisheries also occurred outside  
284 the MPA (Table 2) with the 51% increase in value over time also being significant (weight Kendall's  
285 tau-b = 0.36,  $p = 0.1$ ; value Kendall's tau-b = 0.51,  $p = 0.01$ ).

286 Landings from net fisheries of the high value species, such as lemon sole *M. kitt*, also contributed to  
287 the uplift in value from static gear activity within the MPA (+£285, 4750% increase, Kendall's tau-b  
288 0.75,  $p = 0.005$ ). Of the other trap fisheries targeting non-quota species, whelk *B. undatum* provided  
289 the largest contribution to value from static gear activity inside and outside the MPA in all years,  
290 especially within the MPA (Table 2). Landings of cuttlefish *S. officinalis* are extremely variable across  
291 years based on factors (such as previous recruitment strength, sea surface temperature, exploitation  
292 of stocks offshore) that influence the availability of the stock to the inshore fisheries. When available  
293 to the inshore fisheries this high value stock adds significantly to the overall value of the static trap  
294 fisheries. Excluding cuttlefish *S. officinalis* landings, whelk *B. undatum* average annual landings value,  
295 per vessel per month, from inside the MPA between 2014/15 - 2016/17 was £7832.

#### 296 *Mobile demersal gear fisheries*

297 High value associated with mobile demersal gear activity before the SI closure was due to scallop *P.*  
298 *maximus* landings (2005/6-07/08 3-year average, £11,479) (Table 3). Following the SI closure,  
299 increased landings of scallops from dredge activity, as well as greater landings of non-quota species  
300 associated with mobile demersal fishing effort occurred outside the MPA (Table 3). Significant  
301 positive trends in value from mobile demersal gear landings from outside the MPA occurred over  
302 time (all landings: Kendall's tau-b 0.840,  $p < 0.001$ ). Scallop landings provided the greatest  
303 contribution to increase in weight and value over time from effort outside the MPA (Kendall's tau-b

304 0.66,  $p = <0.017$ ). However, 3-year average values over the final 3-year period in the time series  
305 were still below those for scallop landings from within the MPA before the SI closure (£4,717  
306 compared to £11,479) (Table 3). Increased whelk landings were also associated with vessels that had  
307 principally used mobile demersal gears (Table 3). There was a very large increase in weight and value  
308 of whelk landings associated with those vessels, which occur within 1-2 years of the SI closure (Table  
309 3). This resulted in a significant increase when comparing years before and after the SI closure  
310 (Welch's t test = 5.49,  $p <0.001$ ). The positive trend was not significant over the 12 year time series,  
311 as landings rapidly increased from a pre-closure 3 year average weight of 9kg and value of £11, to 3  
312 year averages immediately post-closure of 1583kg and £968 and remained high throughout the 9  
313 year post-closure time series (value, Kendall's tau-b 0.32,  $p = 0.148$ ).

### 314 **3.3. Subjective wellbeing**

315 The subjective wellbeing data reveals different wellbeing trajectories over the past decade for  
316 different sub-sectors of the Lyme Bay fishery (Figure 4). On average across the ten-year period,  
317 mobile demersal gear fishers report lower levels of job and income satisfaction and higher levels of  
318 perceived stress and conflict than the static-gear fishers (Figure 4). For static gear fishers involved in  
319 the LBCC partnership, job and income satisfaction were high in 2005 (2005 job satisfaction: Static Y =  
320 7; income satisfaction: Static Y = 6.8) and have increased marginally in the last ten years (2015  
321 reported job satisfaction: Static Y = 8.3; income satisfaction: Static Y = 7.5). Perceived levels of stress  
322 and conflict were low for this group (2005 stress Static Y = 4.5; conflict: Static Y= 3.4) and have  
323 decreased over the last ten years (2015 stress: Static Y = 4.3; conflict: Static Y= 2) (Figure 4). This  
324 group of respondents identified the SI closure and LBCC partnership activities, in particular the  
325 Reserve Seafood brand and investments in port-storage and icing as the two most beneficial events.  
326 Gear conflicts prior to the closure in 2008, winter storms (2013/2014) and poor weather (2014-2015)  
327 were viewed as the most negative events. For static-gear fishers not involved in the LBCC  
328 partnership, job and income satisfaction were also high (2005 job satisfaction: Static N = 7.7; income  
329 satisfaction: Static N = 7.3) but have decreased or remained steady over the last ten years (2015 job



330 satisfaction: Static N = 5.9; income satisfaction: Static N = 7.5). Perceived levels of stress were  
331 moderate and have increased marginally over the last ten years (2005 stress: Static N =3.3; 2015  
332 stress: Static N= 4.3). Perceived levels of conflict were moderate but have decreased to low levels in  
333 the last ten years (2005 conflict: Static N =5.7; 2015 conflict: Static N= 1.8). Many of these fishers  
334 were initially negatively impacted by the closure in 2008 but, having converted to static gears, have  
335 experienced improvements in subjective wellbeing. Poor weather in 2014-2015 and low quotas, in  
336 particular the combination of the two, were the most important negative events reported by this  
337 group. For mobile demersal gear fishers, job and income satisfaction were high (2005 job  
338 satisfaction: Mobile= 9.3; income satisfaction: Mobile= 10) but declined sharply into low reported  
339 levels of subjective wellbeing in 2008, at the point of the SI closure, (2008 job satisfaction: Mobile=  
340 3.4; income satisfaction: Mobile= 3.4) and have steadily increased since (2015 job satisfaction:  
341 Mobile= 5; income satisfaction: Mobile= 6.6) (Figure 4). Perceived levels of stress and conflict were  
342 low, spiked in 2008 and have decreased steadily over the last ten years (2005 stress: Mobile = 2.4;  
343 2008 stress: Mobile=8.6; 2015 stress Mobile =4.3) (Figure 4). Individuals from this group (group n=9)  
344 reported examples of symptoms of psychological and physical ill health during the process for the SI  
345 closure, for example suicidal thoughts, heart problems and persistent headaches. Stress has reduced  
346 since due to increased experience, 'just getting on with things', and good catches for some species.  
347 With respect to conflict, where the SI closure reduced gear conflicts for many static-gear fishers, it  
348 increased gear conflicts outside of the closed area particularly when extended through the SAC  
349 bylaws in 2013.

350 Overall, respondents identified 2007-2008 and 2014-2015 as the years in which they experienced  
351 the greatest impacts on their fishing activities and related subjective wellbeing. The introduction of  
352 the Lyme Bay SI closure in 2008 was the event mentioned the most often by respondents (n=25).  
353 The event was identified as positive for 25% of respondents and negative for the majority of fishers  
354 (at the time), including those that used static gear in the SI closure but who had to change or adjust  
355 gears when the SI closure was established. Other events mentioned that had a consistently negative

356 impact included quota limitations (n=11), loans (n=5), fuel and insurance costs (n=5) and general  
357 concerns about future changes to regulation or the industry (n=5). On the contrary, supporting more  
358 positive wellbeing, a number of fishers stated that they were always satisfied with fishing and their  
359 income from fishing (n=7) while others mentioned that their satisfaction had improved (n=7) or  
360 their stress levels decreased as a result of being older, having cleared debts and generally being  
361 more experienced (n=5). In the latter few years, winter storms and general bad weather were  
362 identified as the events that had the greatest negative impact on fishers' wellbeing (n=20). Half of  
363 these (n=20) fishers surveyed reported 'pushing the weather' (going out in more dangerous sea  
364 conditions) when the weather had been bad for a while, or in order to avoid debt or use up quota.  
365 The most recent comments linked to 2015 demonstrate that subjective wellbeing concerns are also  
366 linked to a perception that the fishery is over crowded (n=6) and there is gear conflict (n=6).

367

368 [inset figure 4 here]

### 369 3.4. Objective wellbeing

370 Fishers stated their annual turnover for 2015 and estimated what percentage of their turnover was  
371 profit. Ten respondents chose not to answer and two did not know. Data from respondents suggests  
372 that mobile demersal gear fishers turnover was substantially more (+£200,000; n=9) than that of  
373 static gear fishers (<£60,000; n=8), on average. In terms of profit, three static gear fishers replied  
374 that they made “no profit”, “just enough to cover costs” and “the minimum wage”. Data indicate  
375 that for mobile demersal gear fishers there are large disparities in profits with five respondents  
376 earning between £10,000-£30,000 per annum and the remaining three respondents earning  
377 between £100,000 and +£250,000.

378 In the ten years preceding 2015, over 85% of the fishers we sampled across all sectors invested in  
379 their fishing business. Just over a third planned to invest further in the next five years with moderate  
380 confidence that future investments would be sufficiently profitable (Table 4). Investments related  
381 primarily to boat and gear renovation, upgrades or expansion with the aim of fishing more safely  
382 and/or for longer. The majority of these fishers did not have additional livelihoods. Only a few  
383 operators (n=3) invested in processing or selling facilities.

384 Approximately a third of the catch from static-gear fishers is sold to local retailers, restaurants and  
385 hotels compared to 5% of the catch of mobile demersal gear vessels in Lyme Bay. On average, 15%  
386 of the catch of static-gear fishers involved in the LBCC partnership is now sold as ‘Reserve Seafood’  
387 at a premium price directly to London. A third of fishers sampled across all sectors would prefer  
388 more local or direct sales, but noted as constraints the limitations of time after fishing, infrastructure  
389 and transport requirements, and the potential risks of maintaining a good selling price while relying  
390 on fewer buyers.

391

392 **4. Discussion**

393 This study offers a first insight into the social and economic performance of a fishery over a 12-year  
394 timescale, covering a period pre and post an MPA designation. The results demonstrate that whilst  
395 there have been subjective and material losses for mobile demersal gear fisheries, there have been  
396 social and economic gains for fisheries predominantly operating static gear inside and outside the  
397 MPA. These fishers report higher levels of subjective wellbeing over time compared to their mobile  
398 gear counterparts. These parameters of subjective wellbeing are further pronounced when the  
399 fishers are involved with the LBCC partnership. The economic loss to mobile demersal gear fishers  
400 who were annexed from the MPA by the SI is significant. The high point of dredge caught scallop  
401 landings (kg and £) in 2005-2007 (prior to the SI) has never been repeated. For those mobile  
402 demersal gear fishers who were displaced or remained operating outside the SI part of the MPA,  
403 there has been an increase in weight and value of shellfish landings from grounds outside, in relation  
404 to increased effort outside the MPA. Self-reported turnover and profit data suggest that in 2015  
405 mobile demersal gear fishers enjoyed higher returns from fishing than static gear fishers.  
406 Nevertheless, factors such as storms and poor weather and a requirement to increase effort further  
407 offshore, to maintain an income, has increased the personal risk to these operators. Overall, mobile  
408 demersal gear fishers report much lower levels of subjective well-being linked to their livelihood.  
409 Such differences in social impacts between groups of fishing industry stakeholders reflect findings  
410 from other MPA interventions (McNeill, Clifton et al. 2018). The impacts of the MPA in Lyme Bay are  
411 therefore nuanced and dynamic over time.

412 The main social and economic effect of the MPA (SI and SAC) has been due to the introduction of a  
413 spatial management measure that has enabled a clear separation of gear types that had previously  
414 been in conflict for fishing grounds. The introduction of the MPA has primed a behavioural response  
415 within the local fleet with a significant increase in static gear fishing effort within the boundary of  
416 the MPA and lower levels of perceived conflict. Fisheries which set pots for species such as whelks *B.*  
417 *undatum*, cuttlefish *S. officinalis*) brown crab *C. pagurus* and european lobster *H. gammarus* all

418 continue to make use of the MPA, as well as fisheries using nets for finfish species. Dive caught  
419 scallops *P.maximus* fishing effort has also significantly increased within the MPA as a direct result of  
420 the removal of mobile demersal gear. Demonstrated here is the rapid reflex of fisheries activity to  
421 MPAs with the conservation designation acting as a (fisheries) spatial management measures. The  
422 increase in static gear fisheries has triggered a local post-ante fisheries management response to  
423 limit further increases in static gear effort (<https://www.devonandsevernifca.gov.uk>). From a  
424 governance and sustainability perspective there has been a sequential response to the MPA  
425 designation rather than an integrated plan for fisheries and conservation. The lack of early  
426 integration of the synergistic effects has the potential to 'mask' or hinder MPA performance  
427 (ecological goals) through the removal of one pressure and the unmanaged/unintended introduction  
428 of another.

429 The link between conservation designation and fisheries performance is a key tool to the delivery of  
430 ecosystem-based fisheries management. Noting that counterfactuals in social and economic  
431 protected area research are extremely challenging to identify (Ferraro and Pressey 2015) it is  
432 necessary to observe the findings of this study against wider data sources and trends. For example,  
433 any changes in landings by fishers using different gear must also be considered against factors  
434 affecting fishing site preferences, rather than simple assumptions of increased abundance. In the  
435 Lyme Bay SI, *P. maximus* and *Cancer pagurus* both continue to increase in abundance along with  
436 sessile species such as ross coral *Pentapora foliacea* and Hydroids that create stable nursery habitats  
437 for commercial species to settle and develop (Sheehan, Cousens et al. 2013, Sheehan EV, Holmes L  
438 et al. 2020). There has been a significant increase in landings weight and landings value of scallops  
439 *P.maximus* from within the MPA (dive caught) and landings value outside the MPA (dredge). For  
440 example, the national trend for scallop *P.maximus* landings (weight and value) into England by UK  
441 vessels decreased between 2009 and 2014, the period when the greatest increase in landings  
442 occurred from within Lyme Bay MPA (increased mean per vessel per month) (Elliott 2014). In  
443 agreement with this, the Lyme Bay MPA ecological studies have demonstrated greater abundances

444 of *P.maximus* within the MPA (Sheehan, Stevens et al. 2013). This potentially signals that this fishery  
445 (inside and outside the MPA) is directly benefitting from the MPA management that enables  
446 protection and recovery of the reef.

447 There have also been significant increases in landings of brown crab *C. pagurus* from sites both  
448 inside and outside the MPA. The ecological studies demonstrate an increased abundance of *C.*  
449 *pagurus* between 2008 and 2011 in benthic monitoring studies in regions outside the MPA but close  
450 to the boundary (Sheehan, Stevens et al. 2013). Interestingly, no corresponding observed abundance  
451 recorded from the ecological monitoring studies within the MPA. This suggests that the fishing effort  
452 has increased within the MPA to potentially 'top slice', by removing a proportion of the increased  
453 abundance. Set within the national performance, fisheries statistics, landings (weight and value) of  
454 crab to ports in England by UK vessels increased between 2009 and 2015, suggesting changes in  
455 Lyme Bay may be within this national trend (regardless of the MPA) (Elliott 2014).

456 In terms of the impact of MPAs on measures of subjective and objective wellbeing, the MPA (SI  
457 closure) designation was identified as the most impactful event on subjective wellbeing across the  
458 fishing sector interviewed. Subjective wellbeing improved for negatively impacted static and mobile  
459 fishers since establishment, yet mobile demersal gear fishers still reported lower levels of subjective  
460 wellbeing than static gear fishers. Objective measures of wellbeing suggest that mobile demersal  
461 gear fishers receive higher income returns from fishing than the static gear sector and that they  
462 continue to invest in the fishery, often investing in bigger boats to increase safety and number of  
463 days at sea. In their global review of MPAs, Ban et al. (2019) report overall benefits to wellbeing  
464 from MPAs and highlight that the benefits to subjective wellbeing are lower than objective measures  
465 of wellbeing, and find that older MPAs report more benefits. Our findings similarly suggest  
466 differences between subjective and objective measures of wellbeing, and indicate that wellbeing can  
467 recover over time post MPA establishment. Wellbeing benefits (Static gear) are most strongly  
468 attributed to the role of the Lyme Bay Consultative Committee. In particular, they perceived high

469 benefits to their fishing business from the additional icing and port storage facilities and the Reserve  
470 Seafood brand, and more moderate benefits from the voluntary Code of Conduct and Fully  
471 Documented fisheries projects.

472 Finally, changes in effort, profits or landings data cannot be solely attributed to the MPA. The fishing  
473 industry is agile to markets and demand for seafood as well as being responsive to exogenous (e.g.  
474 price elasticity, environmental shocks) and endogenous factors (e.g. shifts in fishing technology,  
475 species-habitat interactions) driving the outcomes observed (van Putten, Kulmala et al. 2012). The  
476 rapid pace of change in the mobile gear fleet size is demonstrated clearly in the years preceding the  
477 MPA when there was a significant increase in mobile gear vessels (dredgers) in Lyme Bay.

478 2006/2007 was a “bumper” year for scallop *P.maximus* landings from the local fleet and it was also  
479 reported that additional vessels (with greater fishing capacity) joined the fleet in Lyme Bay from  
480 fishing grounds as far as Scotland and the Channel Islands where changes in scallop *P.maximus*  
481 availability and restricted access, fuelled displacement of their activity to Lyme Bay (Rees, Attrill et  
482 al. 2010). The arrival of this fleet operating over the reef, with a greater fishing capacity (compared  
483 to the local fleet) triggered the MPA designation to protect the reef habitat (Rees, Attrill et al. 2010).

484 Fishing for cuttlefish *S. officinalis* also demonstrates market agility and opportunity for the fleet.  
485 Cuttlefish spend the winter months in deeper offshore waters, where the water temperatures  
486 remain above 9 °C (Bloor, Attrill et al. 2013, Bloor, Wearmouth et al. 2013). Both adults and sub-  
487 adults are then assumed to undertake an inshore migration to shallow water areas during the spring.  
488 Despite variable landings by volume (weight) cuttlefish provide high value landings to static-gear  
489 fishers operating inside the MPA, as well as fishers using mobile demersal and static gear outside the  
490 MPA. In good years (such as 2007/08 or 2015/16), the cuttlefish fishery provides a noticeable bonus  
491 income in spring months, between April and June.

492 Landings of whelks *B. undatum* in such high volumes is a relatively new occurrence in Lyme Bay (over  
493 the last 10 years). This species significantly dominates the catch, driven by demand from the Asian

494 markets and now representing the highest value contribution to the overall landings value for static  
495 gear fisheries operating both inside and outside the MPA, and since the closure has contributed to  
496 overall landings value for mobile demersal gear fisheries diversifying into the whelk fishery. Mobile  
497 demersal gear fishers operating outside the MPA have potentially switched to pots to either take  
498 advantage of the market or supplement income due to displacement effects. Overall, whelks are not  
499 associated solely with the reef ecosystem but naturally occur on all broadscale habitats present in  
500 Lyme Bay. *B. undatum* are scavengers and carnivorous predators feeding on polychaetes, bivalves  
501 and carrion, feeding across the range of habitats present in Lyme Bay (Hancock 1967, Scolding,  
502 Richardson et al. 2007). In the UK as a whole, fishing effort has generally increased on whelk stocks  
503 due to displacement of effort from whitefish and pot fisheries and the development of improved  
504 markets. In recent years, whelks have become increasingly valuable. In 2017 whelk landings into  
505 English ports represented the fifth most valuable landings stock after scallops, cuttlefish, crabs and  
506 lobster respectively (Lawler 2013).

## 507 **5. Conclusion**

508 Sustainability across ecological, social and economic systems is a key requirement to maintaining  
509 human wellbeing. Despite the fact that the majority of MPAs support fishing within and adjacent to  
510 their boundaries, fisheries management and conservation goals are largely unlinked in current  
511 management frameworks. Progress towards sustainability is therefore fractured. Social-ecological  
512 theory suggests that transformations to sustainability occur in 'niches' at local level (Lotz-Sisitka,  
513 Wals et al. 2015). Lyme Bay is an example of such a 'niche', a unique UK example where much  
514 research and community effort has been placed on documenting and securing sustainable  
515 outcomes. With more forethought given to the metrics used to define ecological change, an  
516 integrated rather than sequential approach to fisheries management, MPAs and fisheries can form a  
517 positive social-ecological feedback loop. From this learning, wider social changes and  
518 transformations towards sustainability can potentially emerge.



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526        **7. Data Availability Statement** To remain GDPR compliant on the holding of social and economic  
527        data. Aggregated data is available on request to the corresponding author.

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659 9. Tables

660 Table 1 Range +/- between 3-year average pre SI closure (2004/05-2007/08 and the 3-year average >6years  
 661 post SI closure (2014/15-2016/17), significant monotonic trends (Kendall's tau-b) between 2004/05 and  
 662 2016/17 data are indicated by \*.

| Gear Category and Location | Wet weight mean per vessel per month (Kg) |                                     | Value per vessel per month (£) |                                     | Approximate number of vessels per month |                                     | Approximate number of trips per month by all vessels |                                     | Overall change across categories +/- |
|----------------------------|---|-------------------------------------|--------------------------------|-------------------------------------|---|-------------------------------------|--|-------------------------------------|--------------------------------------|
|                            | 2014-2017, 3-year average                 | Change over time 2005/08 to 2014/17 | 2014-2017, 3-year average      | Change over time 2005/08 to 2014/17 | 2014-2017, 3-year average               | Change over time 2005/08 to 2014/17 | 2014-2017, 3-year average                            | Change over time 2005/08 to 2014/17 |                                      |
| Static gear inside.        | 2851                                      | -110                                | 3739                           | <u>+1452*</u>                       | 36                                      | <u>+7*</u>                          | 281  | <u>+223*</u>                        | +                                    |
| Static gear outside.       | 1672                                      | -391                                | 3399                           | <u>+866*</u>                        | 52                                      | +12                                 | 343  | <u>+185*</u>                        | +                                    |
| Mobile gear inside.        | 0   | -6381                               | 0                              | -9960                               | 0                                       | -7                                  | 0  | -52                                 | -                                    |
| Mobile gear outside.       | 5116                                      | -7659                               | 8144                           | 2231                                | 21                                      | <u>+7*</u>                          | 144  | <u>+99*</u>                         | +                                    |

663

664 Table 2 Landings weight (kg) and value (£) associated with static gear fishing effort, most recent 3-  
 665 year average data in the time series (2014-17) are compared to the 3-year average before the SI  
 666 closure (2005-08) for gear types and associated non-quota species inside and outside the MPA.

| Gear Category and Location         | Non-Quota Species Included | Weight (kg)       |                                     |          | Value (£)         |                                     |          |
|------------------------------------|----------------------------|-------------------|-------------------------------------|----------|-------------------|-------------------------------------|----------|
|                                    |                            | 2014-2017 Average | Change over time 2005/08 to 2014/17 | % change | 2014-2017 Average | Change over time 2005/08 to 2014/17 | % change |
| <b>Static gear inside the MPA</b>  |                            |                   |                                     |          |                   |                                     |          |
| Pots                               | Crab, Lobster              | 448               | <u>178*</u>                         | ↑ 66%    | 1232              | <u>628*</u>                         | ↑ 104%   |
| Scuba Dive                         | Scallop                    | 1008              | <u>735*</u>                         | ↑ 177%   | 1874              | <u>1507</u>                         | ↑ 412%   |
| Other Traps                        | Whelk, Cuttlefish          | 8268              | -4803                               | ↓ 37%    | 8456              | <u>311</u>                          | ↑ 4%     |
| Nets                               | Lemon sole                 | 58                | <u>57*</u>                          | ↑ 5700%  | 291               | <u>285*</u>                         | ↑ 4750%  |
| <b>Static gear outside the MPA</b> |                            |                   |                                     |          |                   |                                     |          |
| Pots                               | Crab, Lobster              | 966               | 183                                 | ↑ 24%    | 2700              | <u>909*</u>                         | ↑ 51%    |
| Scuba Dive                         | Scallop                    | 2459              | -559                                | ↓ 0.18%  | 3524              | -2059                               | ↓ 0.37%  |
| Other Traps                        | Whelk, Cuttlefish          | 3955              | -3714                               | ↓ 0.48%  | 3798              | -560                                | ↑ 13%    |
| Nets                               | Lemon sole                 | 2                 | -93                                 | ↓ 98%    | 10                | -364                                | ↓ 97%    |

667 Table 3 Landings weight (kg) and value (£) associated with mobile demersal gear fishing effort, most  
 668 recent 3-year average data in the time series (2014-17) are compared to the 3-year average before  
 669 the SI closure (2005-08) for gear types and associated non-quota species inside and outside the  
 670 MPA, \* indicates significant positive or negative trends.

| Gear Category and Location         | Non-Quota Species Included | Weight (kg)       |                                     |          | Value (£)         |                                     |          |
|------------------------------------|----------------------------|-------------------|-------------------------------------|----------|-------------------|-------------------------------------|----------|
|                                    |                            | 2014-2017 Average | Change over time 2005/08 to 2014/17 | % change | 2014-2017 Average | Change over time 2005/08 to 2014/17 | % change |
| <b>Mobile gear inside the MPA</b>  |                            |                   |                                     |          |                   |                                     |          |
| Scallop dredge                     | Scallop                    | 0                 | -7705                               | ↓ 100%   | 0                 | <b>-11479*</b>                      | ↓ 100%   |
| Trawl / mobile nets                | Lemon sole                 | 0                 | -22                                 | ↓ 100%   | 0                 | <b>-121*</b>                        | ↓ 100%   |
| Trawl                              | Cuttlefish                 | 0                 | -365                                | ↓ 100%   | 0                 | <b>-442*</b>                        | ↓ 100%   |
| Trap                               | Whelk                      | 0                 | -6                                  | ↓ 100%   | 0                 | -3                                  | ↓ 100%   |
| <b>Mobile gear outside the MPA</b> |                            |                   |                                     |          |                   |                                     |          |
| Scallop dredge                     | Scallop                    | 3889              | 1540                                | ↑ 65%    | 8216              | <b>4717*</b>                        | ↑ 136%   |
| Trawl / mobile nets                | Lemon sole                 | 357               | <b>308*</b>                         | ↑ 628%   | 1587              | <b>1362*</b>                        | ↑ 605%   |
| Trawl                              | Cuttlefish                 | 689               | 469                                 | ↑ 213%   | 1586              | 1315                                | ↑ 485%   |
| Trap                               | Whelk                      | 839               | 830                                 | ↑ 9222%  | 810               | 800                                 | ↑ 7900%  |

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672 Table 2 Past and future investment in the fishing industry, and sales strategy for static-gear fishers  
 673 involved in the Lyme Bay Consultative Committee (Static Y), static gear fishers not involved in LBCC  
 674 (Static N) and mobile demersal gear fishers.

|                | Objective wellbeing metrics   | Static (Y) | Static (N) | Mobile |
|----------------|---|------------|------------|--------|
| Investment     | Proportion of respondents who have invested previously  | 100%       | 75%        | 80%    |
|                | Proportion of respondents with plans to invest in the next five years   | 20%        | 50%        | 50%    |
|                | Average confidence that future investment will be beneficial (score 0-10 with 10 being extremely high confidence) | 8.0/10     | 6.5/10     | 7.1/10 |
| Sales strategy | Reserve Seafood brand   | 15%        |            |        |
|                | Local shops and restaurants   | 38%        | 22%        | 5%     |
|                | Processors / auctions   | 47%        | 78%        | 95%    |

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676 **10. Figure legends**

677 Figure 1 The Lyme Bay Marine Protected Area (MPA) comprising of the Statutory Instrument - The  
678 Lyme Bay Designated Area (Fishing Restrictions Order) and the European Union Habitats Directive  
679 92/43/EEC Special Area of Conservation.

680 Figure 2 Number of vessels per month (mean) and Number of trips per month (mean) actively fishing  
681 inside and outside the Lyme Bay MPA for a) static gear inside the MPA b) mobile demersal gear inside  
682 the MPA c) static gear outside the MPA d) mobile gear outside the MPA.

683 Figure 3: Wet weight of landings (kg) and value of landings (£) per vessel per month for a) static gear  
684 vessels fishing inside the MPA, b) mobile demersal gear vessels fishing inside the MPA, c) static gear  
685 vessels fishing outside the MPA and d) mobile demersal gear vessels fishing outside the MPA.

686 Figure 4: Fishers' subjective wellbeing over time a) job satisfaction, b) income satisfaction, C)  
687 perceived levels of stress and d) perceived levels of conflict. Static Y = fishers using static gear who are  
688 involved in the Lyme Bay Consultative Committee partnership. Static N = fishers using static gear who  
689 are not involved in the LBCC partnership. Mobile = fishers using mobile demersal gears who are not  
690 involved in the LBCC partnership (with the exception of one respondent).

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