Marine Social Attitudes on Arran

Dissertation is submitted in part fulfilment of the MSc Marine Environmental Management, University of York

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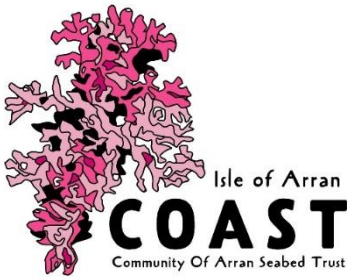
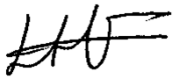
Date: September 2020



DECLARATION

I, Lucy Howarth-Forster, declare that the work submitted in this dissertation is the result of my own work and investigation and all the sources I have used have been indicated by means of completed references.

Signed: 

Date: 22 September 2020

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Abstract

Stakeholder engagement and social acceptance are crucial to the success of Marine Protected Areas (MPAs). Community outreach is an important tool in stakeholder engagement and can often foster pro-environmental behaviours and attitudes in individuals involved. Conservation efforts on the Isle of Arran have been led by the Community of Arran Seabed Trust (COAST), resulting in the establishment of a No-Take Zone (NTZ), and later a wider MPA, to protect the local marine environment. A survey of 314 Arran residents and visitors was conducted to investigate the effects of community engagement by COAST. Results were first compared to the recent Marine Scotland survey to determine whether Arran residents had different attitudes to Scottish residents, then to a similar survey from 2011 to investigate changes in awareness and perceptions of the Lamlash Bay NTZ. Finally, awareness and attitudes towards the South Arran MPA were also examined. The results suggest that Arran residents have different attitudes to certain topics compared to Scottish residents. In particular, Arran residents indicated they had more knowledge of the fish farming sector yet ranked it less economically important than Scottish residents. Awareness of the NTZ was high at 95.2%, an increase of 23.5% from 2011, and support was high at 97%. Awareness and overall support of the MPA was also relatively high at 65.9% and 90.8%, respectively. The results demonstrate that COAST's conservation efforts have been successful from a social, as well as ecological, standpoint.

1 Introduction

Marine protected areas (MPAs), including No-Take Zones (NTZs), are now recognised as important conservation tools in the face of marine ecosystem health and biodiversity declines (Gray, 2010). International targets are to conserve 10% of the oceans by 2020 (CBD, 2010), and there have been calls for this to be tripled by 2030 (O'Leary et al., 2016). Successful MPAs can restore habitats and biodiversity, which in turn improve ecosystem function and increase the quality and quantity of services derived from the oceans (Naeem et al., 2016; Worm et al., 2006).

A key component of successful MPAs is stakeholder engagement (Giakoumi et al., 2018) and social acceptance (Voyer et al., 2015). The nature of MPAs is that they restrict or displace human activity which can have socio-economic consequences for local communities (Ranger et al., 2016). So, accommodating for these social factors, through stakeholder engagement, allows minimisation of negative effects of MPA designation whilst maximising the benefits (Oldekop et al., 2016; Voyer et al., 2012). For example, engaging with local communities can increase acceptance and encourage local governance of MPAs (McKinley and Fletcher, 2012). Furthermore, there is a link between social impacts and attitudes towards MPAs. For example, one study found that perceived negative impacts of MPAs can cause negative attitudes, even if these impacts are not realised (McNeill et al., 2018). Equally, support for MPAs was stronger when stakeholders understood the positive impacts they could have (Leleu et al., 2012; Sutton and Tobin, 2009). Understanding these attitudes can help identify successes and failures in stakeholder engagement, which can inform future campaigns (Jefferson et al., 2015) and ultimately, contribute to the long-term success of MPAs.

1.1 Isle of Arran and COAST

The Isle of Arran is located off the west coast of Scotland, in the Firth of Clyde (Figure 1). These waters once supported various finfish fisheries, but over two centuries of destructive fishing practices and overexploitation have degraded the ecosystem and led to the loss of many commercially important species (Heath and Speirs, 2012; Thurstan and Roberts, 2010). Now, the only viable fisheries in the Clyde are for shellfish such as Dublin bay prawns *(Nephrops norvegicus)* and king scallops (*Pecten maximus*) (Howarth et al., 2014) which, while lucrative, bear heavy environmental costs. Scallop dredges damage delicate, complex habitats (Hall-Spencer and Moore, 2000) and the Clyde *Nephrop* fishery has an estimated bycatch of up to 25,000 tonnes per year (Ryan and Bailey, 2012).

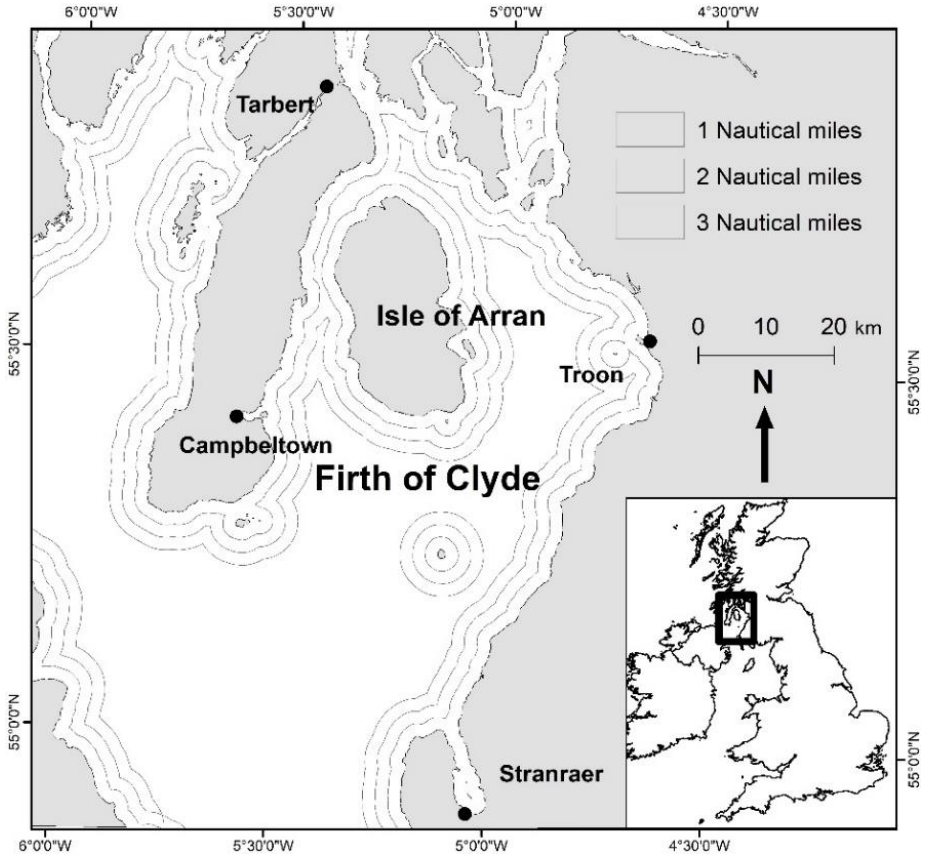

Figure 1: The Isle of Arran in the Firth of Clyde, insert shows the location off the west coast of Scotland. Source: Stewart et al. (2020).

The Community of Arran Seabed Trust (COAST) was founded in 1995 by two local divers, Howard Wood and Don MacNeish, who had witnessed the decline of Arran's marine environment first-hand (COAST, n.d.). The first of COAST's achievements, after over a decade of campaigning, was the establishment of a 2.67km^2 No-Take Zone (NTZ) in Lamlash Bay in September 2008 (Figure 2). This was the first, and remains the only, NTZ in Scotland and was only the second in the UK at that time (Stewart et al., 2020). Then in 2012, COAST submitted a proposal for the South Arran MPA, which was designated in 2014 and has been legally enforced since 2016 (Figure 2) (Stewart et al., 2020). Both these areas have demonstrated the benefits of protection (**Box 1**).

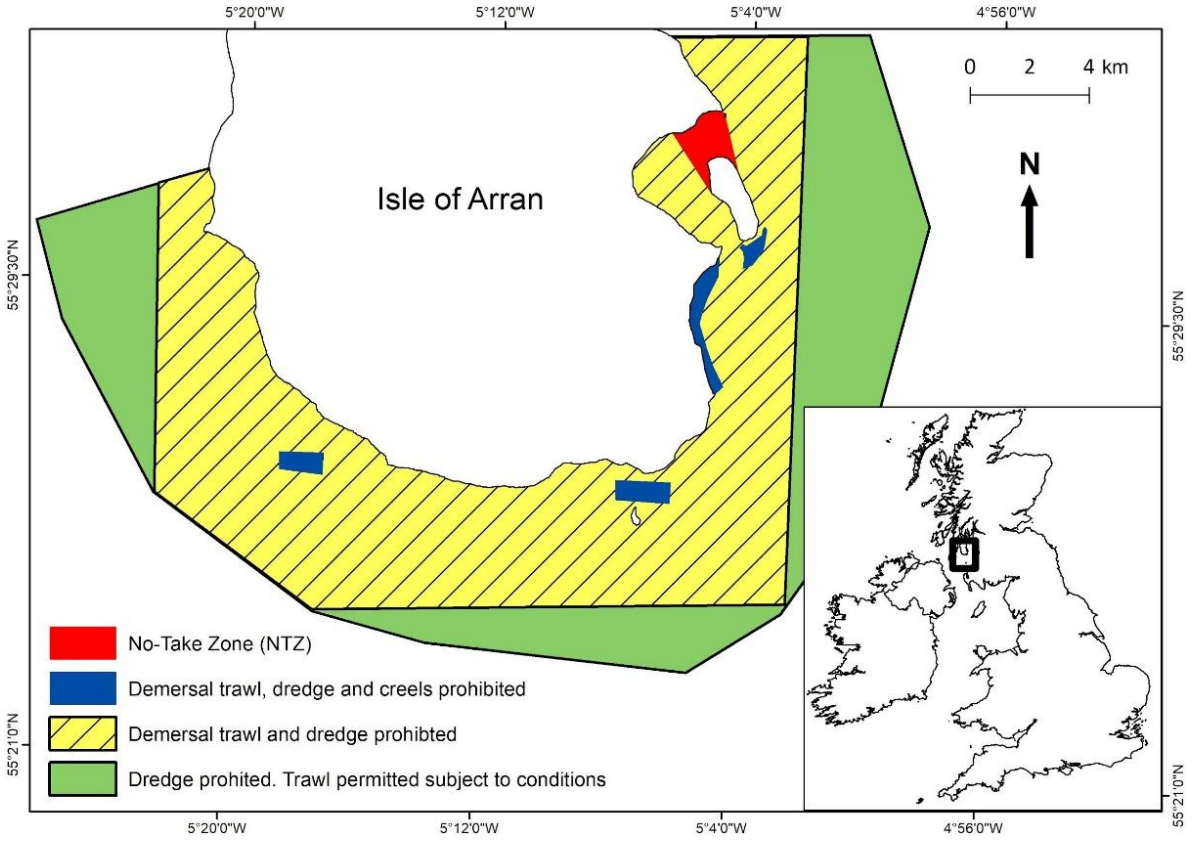

Figure 2: Map of the marine protected areas around Arran, including the Lamlash Bay No-Take Zone and South Arran Marine Protected Area, which has different zones as indicated. Source: Stewart et al. (2020).

Box 1: Benefits of Arran's NTZ and MPA

Both the Lamlash Bay NTZ and South Arran MPA have been the subject of scientific monitoring and have demonstrated the benefits of protection. Within the NTZ, seabed habitats were found to be more abundant than in surrounding areas (Howarth et al., 2015b). The recovery of these habitats was considered the cause of a two to five times increase in juvenile scallops in the NTZ compared to neighbouring fishing grounds (Howarth et al., 2015a). More recent studies showed king scallop densities within the wider MPA had increased six-fold compared to baseline surveys (James, 2019). There is also evidence of benefits beyond conservation, as lobster catch per unit effort was higher closer to the NTZ (Howarth et al., 2017) and the South Arran MPA was recognised for its high carbon storage capacity (Burrows et al., 2017).

A core mission of COAST, and a key to its successes, is public engagement and education about the marine environment and conservation. The community organisation collaborates with local businesses, creates education packs for schools, hosts 'Seashore scrambles' for visitors (COAST, n.d.) and, in 2018, opened Scotland's first MPA visitor centre – the Octopus Centre. The continued efforts of COAST's community outreach have been attributed to the strong community support of the protected areas around Arran (Sutton and Rudd, 2016). COAST also works to raise awareness of threats facing marine environments, including marine litter, climate change and, more locally, the expansion of open-cage fish farming (COAST, 2019). Beyond Arran, COAST has played an integral role in the formation of the Sustainable Inshore Fisheries Trust (SIFT) and, in partnership with Flora and Fauna International, the Coastal Communities Network (communitiesforseas.scot), all of whom aim to improve community engagement among other goals.

Community-led conservation efforts are not often seen in developed countries, where a top-down approach is usually adopted (Jones, 2012). However, the success of COAST demonstrates the effectiveness of a more 'grassroots' approach, which has since been adopted elsewhere. Monitoring public perceptions allows investigation of the effects of public outreach by COAST and informs further engagement efforts.

1.2 Previous work

A study by Bower (2011) carried out a survey of residents, businesses and visitors on the Isle of Arran to examine public awareness and perceptions of the Lamlash Bay NTZ. Results from this study revealed that awareness of the NTZ was generally high and highest among businesses and residents of Arran. Overall, there were positive perceptions of the NTZ, but some respondents believed there had been negative impacts, predominantly restrictions to fishing.

1.3 Aims

There are three main aims of this study. First, to investigate whether Arran residents have different social attitudes towards the marine environment compared to mainland Scotland. This will be achieved by comparing the results of this study to a recent survey by Marine Scotland in 2019. It is hypothesised that, due to high community engagement in conservation efforts on Arran, residents may have different attitudes and possibly greater awareness of issues faced by the marine environment. Second, to assess whether awareness and attitudes of residents and visitors to Arran have changed since Bower's study in 2011. It is expected that awareness has increased since the NTZ has been in force for over a decade and because of continued community engagement by COAST. Finally, this study will probe awareness and perceptions of the more recently designated South Arran MPA.

2 Methods

2.1 Survey design and data collection

This project was conducted remotely, so an online survey was designed and created using Qualtrics®. To achieve the first two aims of this study, investigating if Arran residents have different attitudes to the rest of Scotland and if awareness and attitudes to Lamlash Bay No-Take Zone (NTZ) have changed, the results from this survey were compared to previous research. Therefore, some questions were taken directly from the 2019 survey of attitudes towards the marine environment in Scotland (Marine Scotland, 2019) and the 2011 survey of marine social attitudes on Arran (Bower, 2011) (Table 1). Further questions were added to probe awareness of the South Arran MPA and to gauge understanding of what the NTZ and MPA are. A pilot survey was conducted with 10 participants of the researcher's friends and family. This highlighted errors and areas for improvement; for some questions, the wording was altered to improve clarity, a back button was added, and one question was removed as it was similar to another and had caused confusion.

A non-probabilistic self-selection sampling method was used (Vehovar et al., 2016) as the survey was primarily distributed through social media. Residents and visitors to Arran were targeted by posting to Arran community forums, publishing articles in local news and creating posters for local businesses to share with customers (Table 2). Different platforms were used because it was thought this would reach a variety of age ranges and help improve representativity (Stern et al., 2017). The survey was open from 15th July to 16th August 2020.

Table 1: Outline of survey questions with respect to the aims of the study. See Appendix A for full questions.

Aim	Questions
Demographics (see Appendix A for full questions)	Q1. Are you a: Resident/Visitor/Other Q2. If you are an Arran resident, click on the town/village you live closest to Q3. What is your age? Q4. What is your gender? Q5. What is the highest level of education you have completed? Q6. What is your profession? Q7. Do you own a business on Arran? Q7a. What kind of business do you run?
Investigate attitudes of Arran residents to determine whether they are different from the rest of Scotland These questions were taken directly from the survey by Marine Scotland (2019) (see Appendix A for full questions)	Q8. Which of the following are you most concerned about in the marine environment globally? Q9. If there are any Scottish marine animals that you are concerned about for the future, please type in here (Open question) Q10. In the past year, do you think the health of Scotland's seas has… (Likert scale: Improved/Stayed the same/Worsened) Q10a/b. You said that you think the health of Scotland's seas has worsened/improved in the past year. Why do you think this? (Open question) Q11. Our marine environment provides a number of services and benefits. Which of the following do you think are most important? Q12. How much knowledge do you think you have about each of the following sectors or industries in Scotland's marine environment? (Likert scale: Know very well, Know a fair amount, Know just a little, Heard of, know almost nothing about, Not heard of) Q13. How important or not do you feel these sectors or industries are to Scotland in terms of their economic value? (Likert scale: Very important, Quite important, Not very important, Not important at all, Don't know) Q14. To what extent do you agree or disagree with the following statements? (Likert scale: Strongly agree, Tend to agree, Neither agree nor disagree, Tend to disagree, Strongly disagree, Don't know)

Examine awareness and attitudes towards NTZ for comparison to 2011 These questions were taken directly from the survey by Bower (2011)	Q15. Are you aware of the No-Take Zone (NTZ) in Lamlash Bay which was established in 2008? (Yes/No) Q16. How did you learn about the Lamlash Bay NTZ? (Open question) Q17. If you are a visitor, had you heard of the Lamlash Bay NTZ before arriving on Arran? (Yes/No) Q19. Do you think that the no-take zone has had any positive impacts on Arran? (Yes/No) Q19a. If yes, please give a brief description of positive effects (Open question) Q20. Do you think that the no-take zone has had any negative impacts on Arran? (Yes/No) Q20a. If yes, please give a brief description of negative effects (Open question) Q21 Do you agree or disagree with the following statement? "Overall, I think that the No-Take Zone in Lamlash Bay is a good thing" (Likert scale: Strongly agree, Agree, Neither agree nor disagree, Disagree, Strongly disagree)
Examine awareness and attitudes towards MPA (adapted from questions above)	Q22. Are you aware of the South Arran Marine Protected Area (MPA) which has been in force since 2016? (Yes/No) Q23. How did you learn about the South Arran MPA? (Open question) Q24. If you are a visitor, had you heard of the South Arran MPA before arriving on Arran? (Yes/No) Q26. Do you think that the South Arran MPA has had any positive impacts on Arran? (Yes/No) Q26a. If yes, please give a brief description of positive effects (Open question) Q27. Do you think that the South Arran MPA has had any negative impacts on Arran? (Yes/No) Q27a. If yes, please give a brief description of negative effects (Open question) Q28. Do you agree or disagree with the following statement? "Overall, I think that the South Arran MPA is a good thing" (Likert scale: Strongly agree, Agree, Neither agree nor disagree, Disagree, Strongly disagree) Q29. Which of the following marine life do you think the South Arran MPA was set up to protect? (see Appendix B)
Probe understanding of NTZ and MPA	Q18. In your own words, please explain what you understand a NTZ is (Open question) Q25. In your own words, please explain what you understand a MPA is (Open question)
Awareness of Octopus centre (see Appendix C)	Q30. Are you aware of the Community of Arran Seabed Trust (COAST) Marine Visitor Centre – The Octopus Centre - which opened in 2018? (Yes/No) Q30a. Have you visited the centre? (Yes/No)
Questions for businesses (see Appendix D)	Q31. Do you feel that a more productive marine environment positively benefits your business? (Yes/No) Q31a. If yes, please give a brief description of the positive effects (Open question)

Table 2: Survey distribution methods

Distribution method	Details
Facebook	Arran Community Forum, Isle of Arran: Outdoor Forum, Isle of Arran, Discover Arran, What's Happening On Arran (WHOA), Crofters Larder. Posts were updated weekly and encouraged others to share.
Instagram	Created an account (@marineattitudesarran) to post images and graphics (see Appendix E) to encourage people to respond to the survey. Reached out to other users (particularly businesses) to share on their accounts. Posts were updated weekly and encouraged others to share.
Local news	Article about the research, including link and QR code to survey in both the Arran Banner (https://www.arranbanner.co.uk/2020/07/24/get-involved-in-students-marine-research-survey/) and The Voice for Arran (http://voiceforarran.com/issue-113/help-needed-with-marine-research/).
Through businesses	Two of VisitArran's weekly round-up to local businesses included a link to the survey and a poster with QR code (see Appendix F) to share with customers.

2.2 Analysis

Quantitative data were summarised using descriptive statistics which enabled comparison to the other previous survey results. There was inadequate data reported in the previous studies to allow statistical comparison. In this study, data were primarily ordinal and nominal and so non-parametric. This was further confirmed by Kolmogorov-Smirnov and Shapiro-Wilks tests, all significant to $p < .001$. Therefore, Kruskal-Wallis tests were used to investigate the effect of resident age and respondent group on responses, which if significant were explored using pair-wise Mann-Whitney U tests with Bonferroni adjusted p values. This was done for the Marine Scotland questions which had a Likert scale, but not for the questions about the NTZ and MPA as these were largely binary responses or open text. Statistical analysis was performed using IBM Statistical Product and Service Solutions (SPSS) (Version 26). Open text responses were analysed in NVivo (Version 12) using a thematic analysis approach – where several iterations of coding reveal dominant themes in respondents' answers (Maguire and Delahunt, 2017).

3 Results and Discussion

3.1 Demographics

Altogether, 412 surveys were collected. Responses were rejected if they were deemed too incomplete, which left 314 that were suitable for analysis. The demographics of the respondents are laid out in Table 3 – over half (59.2%) were residents, and the remainder, visitors or 'other'. There were fewer respondents from both male and younger age groups.

Table 3: Demographic information of suitable survey respondents

	Residents	Visitors	Other	Total
Total	**186**	**95**	**33**	**314**
Gender				
Male	76	39	13	**128**
Female	109	55	19	**183**
Gender Undisclosed	1	1	1	**3**
Age				
18-24	5	5	0	**10**
25-34	23	13	2	**38**
35-44	22	20	6	**48**
45-54	31	26	6	**63**
55-64	58	22	7	**87**
65+	47	9	12	**64**
Business Owners				
	50	2	5	**57**

3.1.1 Arran residents

The sample size of residents (n = 186) produces an error margin of 7% at 95% confidence limits, assuming an 18+ population size of 3924 (National Records of Scotland, 2011). The sample was considered broadly representative of the Arran population, although, the youngest and oldest age groups were underrepresented, while higher than expected response rates were seen in the 25-34 and 55-64 age groups (Figure 3). Similarly, male

respondents were underrepresented, and more females responded than anticipated (Figure 4). The survey was conducted remotely, making it difficult to rectify underrepresentation, although this was addressed by using multiple social media platforms and encouraging male responses in the final week. There was a higher proportion of respondents from Brodick, Whiting Bay, and particularly Lamlash (Figure 5).

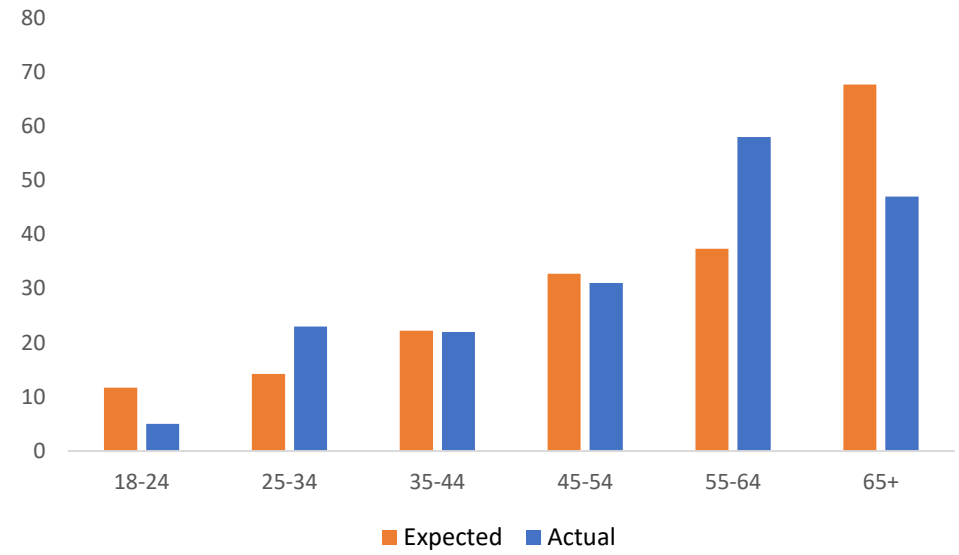

Figure 3: Expected number of resident responses from each age category against actual numbers. Expected values were calculated using population characteristics from census data (National Records of Scotland, 2011) and the sample size. Base: Arran residents (n = 186)

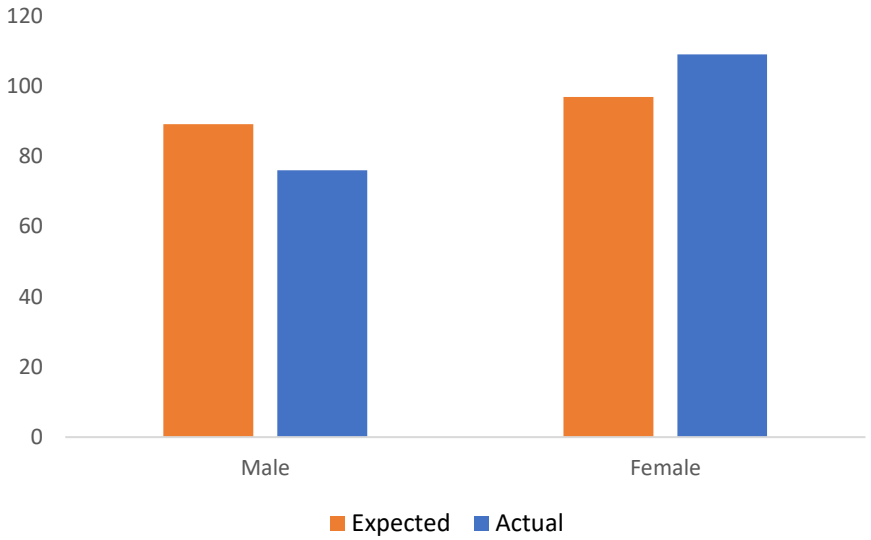

Figure 4: Expected number of resident responses of each gender against actual numbers. Expected values were calculated using population characteristics from census data (National Records of Scotland, 2011) and the sample size. Base: Arran residents (n = 186)

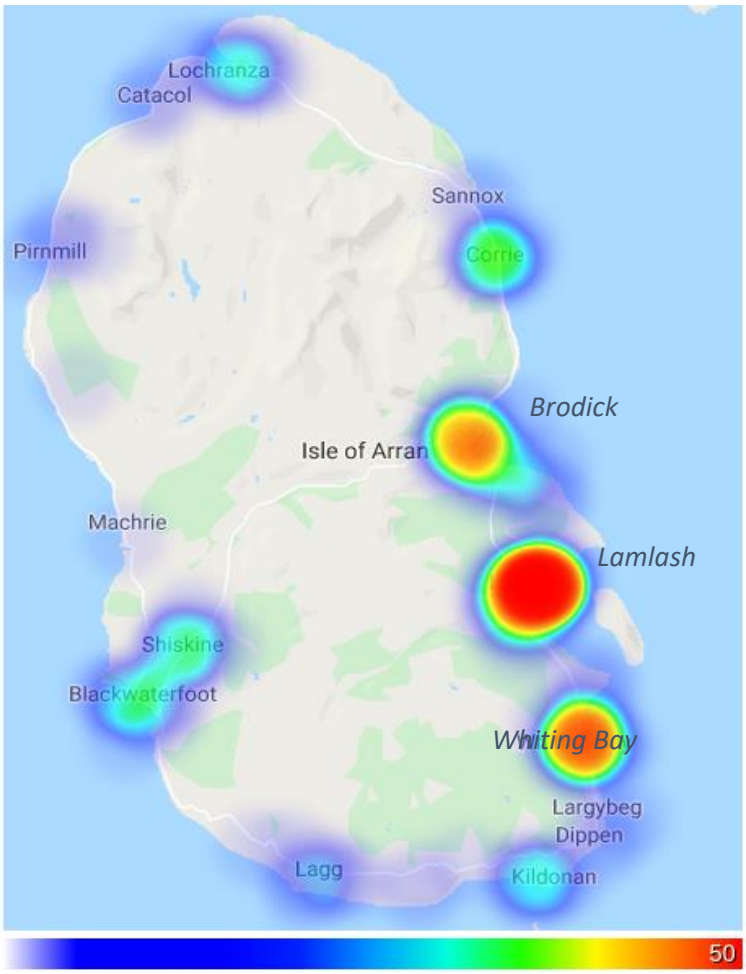

Figure 5: Heat map of where residents that completed the survey were from. Hotspots are seen over Brodick, Lamlash and Whiting Bay.

3.2 Are attitudes of Arran residents towards the marine environment different to those of the rest of Scotland?

3.2.1 Concerns for the marine environment

Respondents were asked to choose their highest concerns for the marine environment globally. Arran residents' top concerns were 'Litter', 'Overfishing' and 'Reduction in marine biodiversity'. Those that chose 'other' cited concerns including aquaculture and coastal erosion. The result was similar to that of Marine Scotland's results, although 6-18% more Arran residents chose the top three concerns (Figure 6).

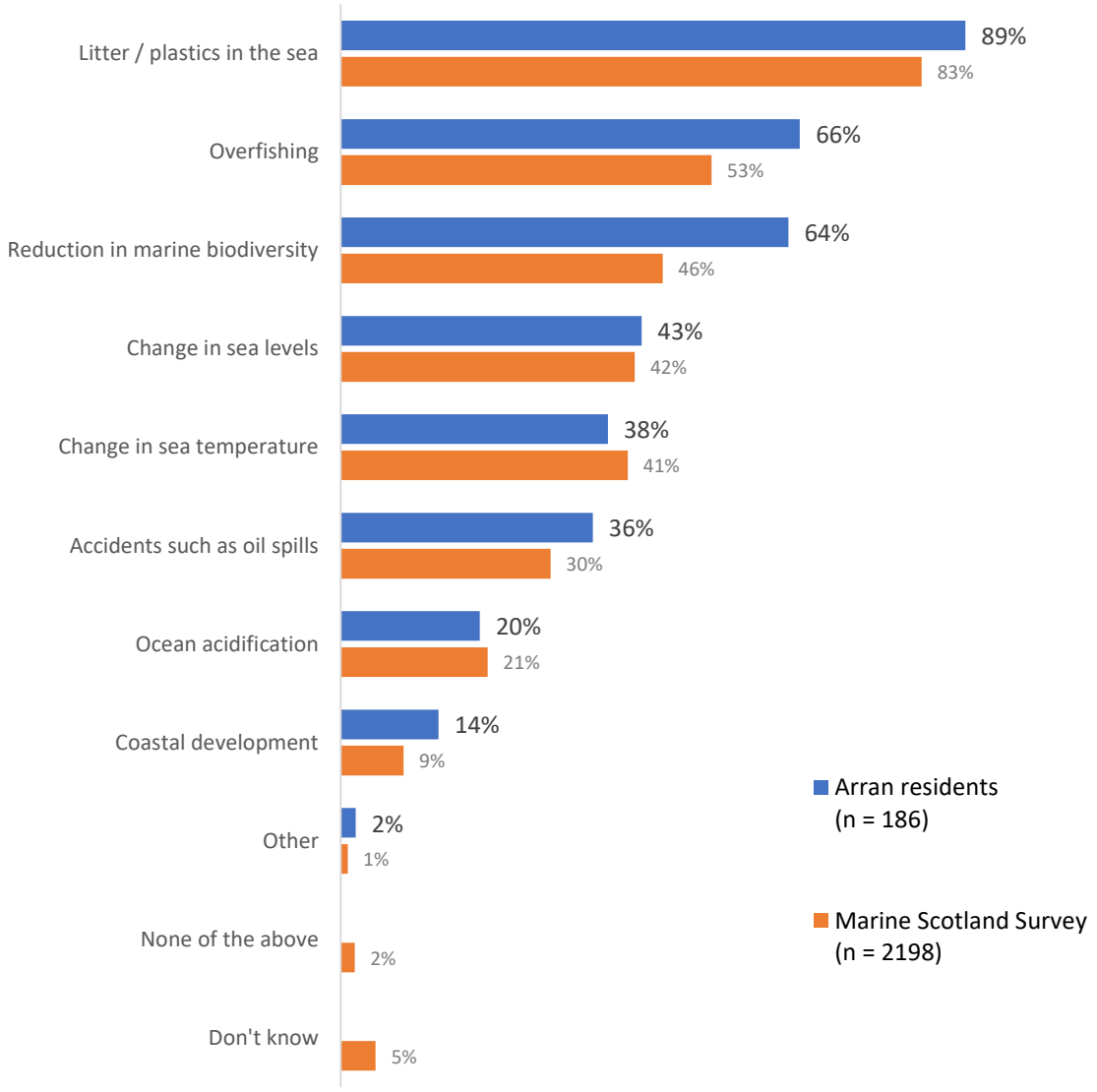

Figure 6: Arran residents highest concerns for the marine environment globally. Responses were compared to those from the Marine Scotland survey in orange.

3.2.2 Perceptions of the health of Scottish seas

Respondents were then asked their perceptions of the health of Scottish seas. Just under a quarter (24.7%) of Arran residents consider the health of Scottish seas to have worsened, whereas 17.2% believe it has improved (Figure 7). Comparatively, 31% of Scottish residents perceived the seas to have a worsened, and 8% thought it had improved (Marine Scotland, 2019). Statistical analysis showed there was no effect of resident age or respondent group on response.

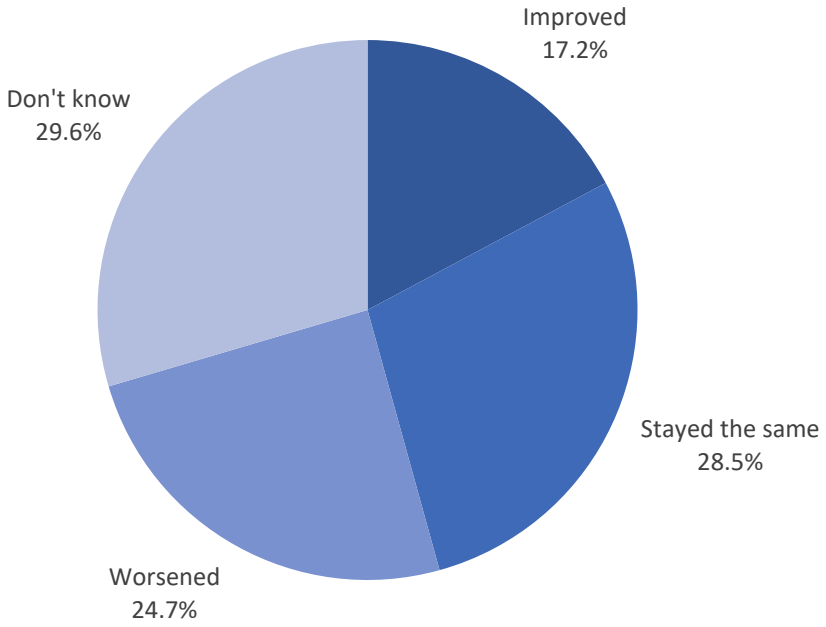

Figure 7: Arran residents' perceptions of the health of Scottish seas.
Base: Arran residents (n = 186)

Thirty-two residents believed the health of the seas has improved, and 40.6% attributed this to the introduction of protected areas, and 36.4% specifically mentioned the Lamlash Bay No-Take Zone. After this, 28.1% of respondents suggested that COVID-19 restrictions, resulting in fewer tourists and reduced marine traffic, have led to improvements. Of the 46 37 residents that believed the health of Scottish seas has worsened, 39.1% quoted fish farming as the main cause. Then, 32.6% attributed declining health to pollution from plastics or land runoff, and 30.4% to overfishing. In comparison, Scottish residents believed pollution, notably plastic, is the main driver in ocean health decline.

3.2.3 Important services and benefits from the marine environment

When asked which benefits and services from the marine environment are most important, the top three chosen by Arran residents were: 'Habitats'; 'Renewables' and 'Health and well-being'. Notably, 'Health and well-being' ranks highly when compared to the Marine Scotland survey (Figure 8). It is possible that current COVID-19 lockdown conditions have highlighted

the value of the marine environment for well-being, thus influencing residents' responses. However, the Marine Scotland survey also noted that those from the 'Highlands and Islands' were more likely to engage with the marine environment, and local communities benefitted most from access to it for their physical and mental well-being (Marine Scotland, 2019).

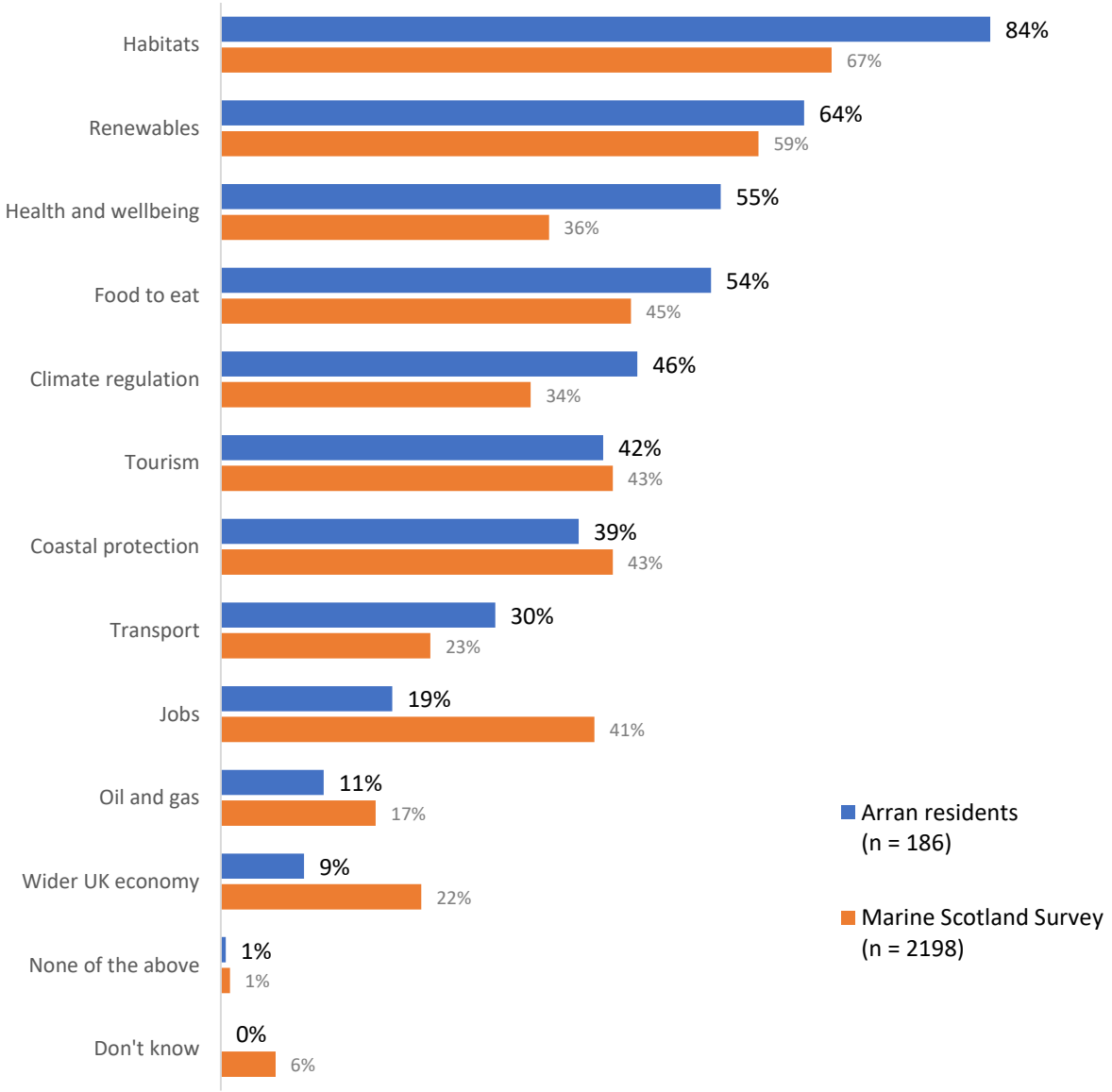

Figure 8: Most important goods and services chosen by Arran residents. Responses were compared to those from the Marine Scotland survey in orange.

3.2.4 Knowledge of marine sectors

Residents were asked about their knowledge of specific marine sectors. 'Coastal tourism' was the sector most residents knew best, and the least known sectors were 'Military' and 'Construction' (Figure 9). In comparison to Scottish residents, a higher percentage of Arran residents had a better knowledge across all sectors except 'Non-renewable energy', and fewer residents (2-5%) selected 'Don't know' or 'Not heard of'. Notably, fish farming was the second best-known sector among Arran residents, and a greater proportion said they knew this sector very well, compared to Scottish residents (35% vs 14%). A Kruskal-Wallis test suggested that resident age had an effect on response ($H(5) = 13.34$, $p = .020$), however, post-hoc tests were not significant to Bonferroni adjusted p values.

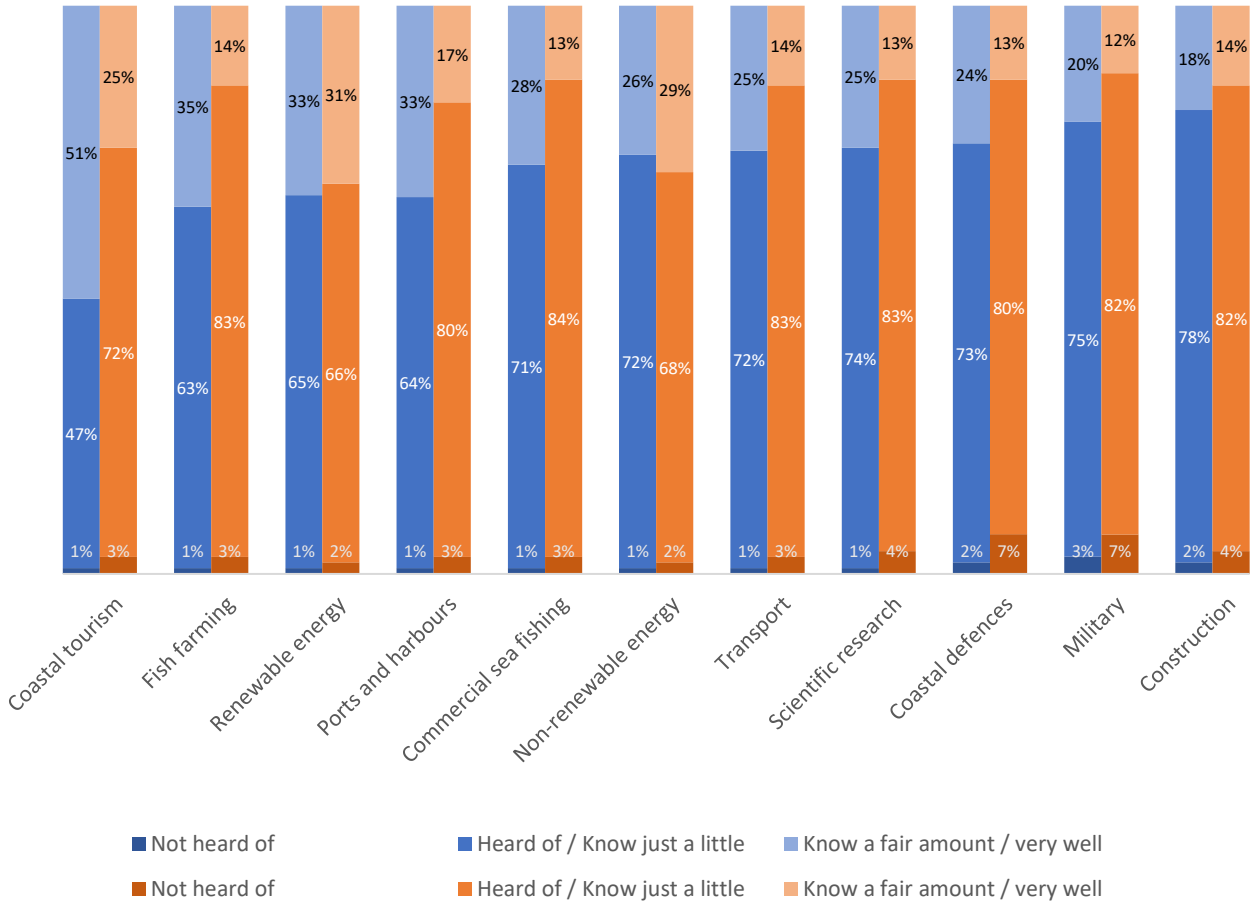

Figure 9: Arran resident responses to how much knowledge they have on different marine sectors in blue (n = 186), compared to those from the Marine Scotland survey in orange (n = 2,198).

3.2.5 Economic importance of marine sectors

When asked how economically important marine sectors were, Arran residents considered nearly all of them important, apart from the 'Military' sector (Figure 10). The top three sectors matched results from the Marine Scotland survey but ordered differently. The fish farming sector was ranked lower by Arran residents compared to the Marine Scotland survey. Additionally, statistical analysis revealed that respondent group had an effect on how important this sector was ranked ($H(2) = 12.47$, $p = .002$). Post hoc tests revealed this to be between residents and visitors ($U = 6259$, $p < .001$), where visitors ranked the fish farming sector of higher economic importance.

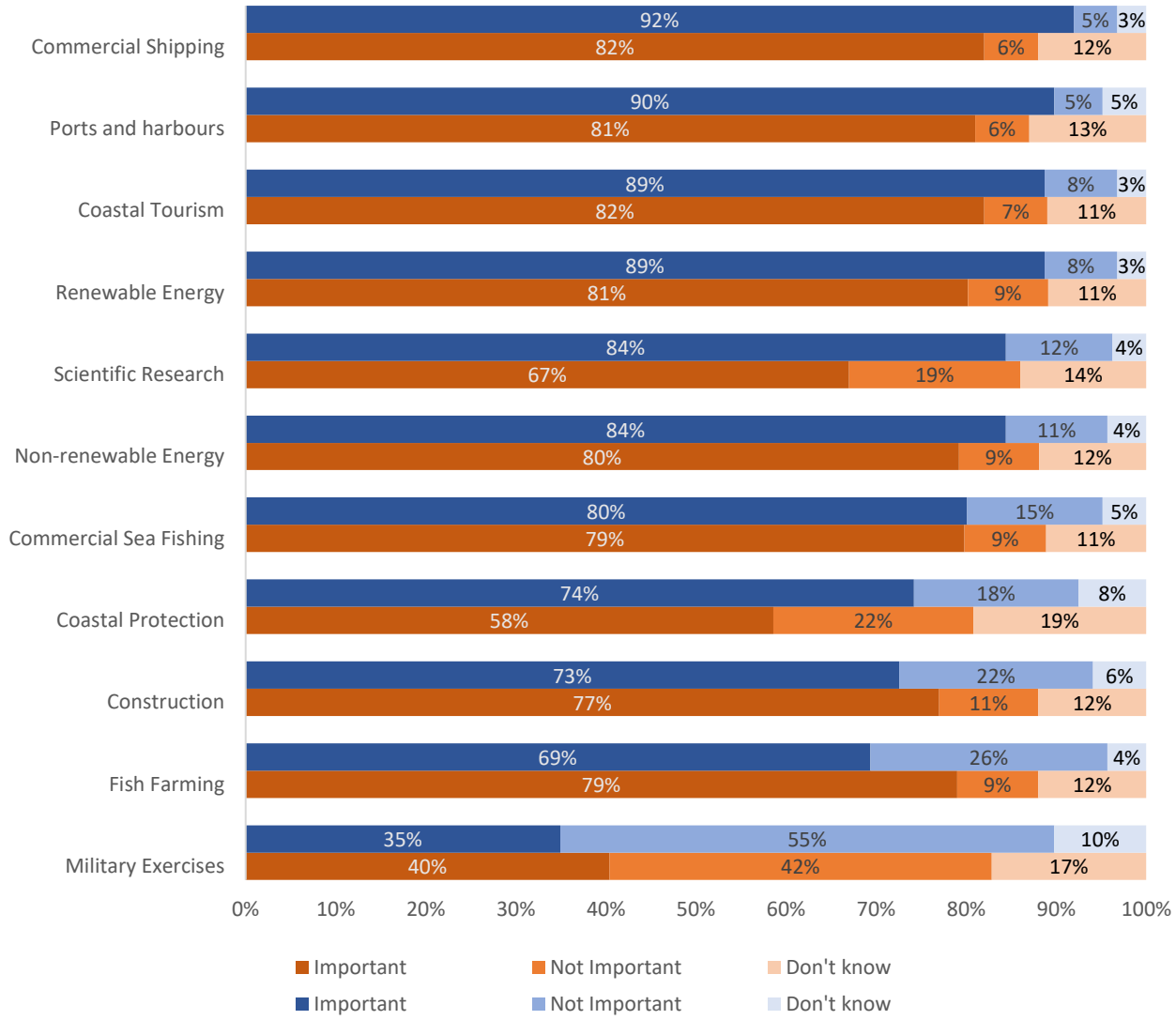

Figure 10: Arran resident responses to how important economically the given marine sectors are in blue (n = 186), compared to those from the Marine Scotland survey in orange (n = 2,198).

To allow comparison to the Marine Scotland survey, the scores 'very important' and 'important' were combined. When this is distinguished, the top three sectors that Arran residents considered 'very important' economically were: 'Renewable energy' (55%), 'Coastal tourism' (51%) and 'Scientific research' (49%). It was unsurprising that coastal tourism was considered very important as this is a large contributor to the island's economy (VisitScotland, 2019). However, it was unexpected that nearly half of Arran residents think scientific research is very important in terms of economic value.

3.2.6 Opinions on current and future protection of Scottish seas

This question asked respondents their opinion on a set of statements (Figure 11). Residents very strongly felt that government and businesses need to do more to protect the marine environment, and 74% do not think that enough is being done to protect the Scottish marine environment. Resident age had a significant effect on response to "I feel I have the knowledge I need to protect the marine environment" ($H(5) = 12.65$, $p = .027$). Post-hoc testing identified this to be between 55-64 and 65+ age groups ($U = 784$, $p = .001$) where the older age group were more likely to agree with the statement. However, compared to Scottish residents overall, fewer Arran residents disagreed with this statement (25% vs 40%). Resident responses were mostly consistent with results from the Marine Scotland survey, although Arran residents had stronger feelings about most statements. Notably, 66% of Arran residents agreed they can personally make a difference to improve the marine environment compared to 42% of Scottish residents, and fewer disagreed (4% vs 23%).

Statements

1. Government needs to do more to protect the marine environment
2. Business needs to do more to protect the marine environment
3. I need to do more to protect the marine environment
4. I can personally make a difference to improving the Scottish marine environment
5. I feel I have the knowledge I need to protect the marine environment
6. I feel I can influence choices that are made that impact the marine environment
7. Enough is being done to protect the Scottish marine environment

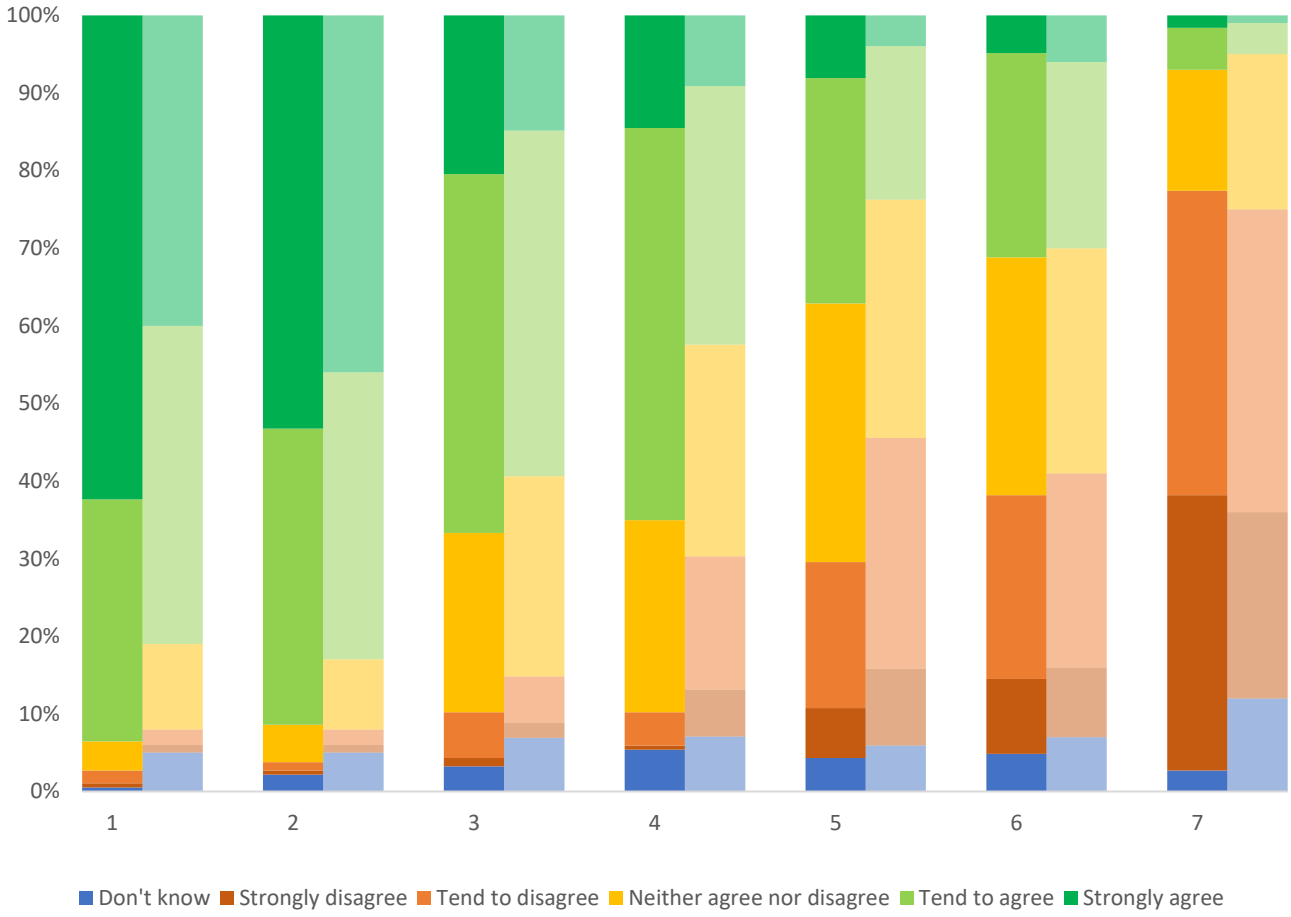

Figure 11: Resident responses on a Likert scale from "Strongly disagree" to "Strongly agree" to a set of statements (n = 186). This was compared to results from the Marine Scotland survey, on the right in the lighter shade (n = 2,198).

3.2.7 Do Arran residents have different attitudes about the marine environment?

Comparison of Arran resident responses to those from Marine Scotland highlighted differences in attitudes towards the marine environment. Arran residents appeared to be more optimistic about the health of Scottish seas as 17.2% felt it had improved compared to 8% of Scottish residents. However, 28.1% of residents with this view believed

improvements were due to COVID-19 restrictions, so these results may not reflect attitudes under normal circumstances. Indeed, a survey by the Arran Recovery Group (2020) showed that, during the pandemic, optimism for the environment had increased but predicted this to fall post-lockdown. Yet arguably, Arran residents could have a more positive outlook because, locally, there have been improvements to the marine environment due to the protected areas, as demonstrated by scientific research (see **Box 1**). Interestingly, 49% of Arran residents considered scientific research 'very important' in terms of economic value and ranked this sector higher than Scottish residents. It could be that Arran residents recognise this as important in raising the profile of Arran, which increases tourism, or that research can influence sustainable fishing practices making them more economically stable.

A key difference between the surveys was attitudes towards fish farming. Arran residents indicated they had a better knowledge of this sector, but ranked it of lower economic importance, compared to Scottish residents. It is possible that the greater awareness of fish farming amongst Arran residents is because they are engaged with the current campaign against open-cage salmon farm expansion in the region. Research suggests that when individuals engage in pro-environmental activities, it can lead to the adoption of other such behaviours (Truelove et al., 2014). For example, volunteers on environmental stewardship programmes were more likely to engage in other pro-environment behaviours, including environmental advocacy (Ryan et al., 2001). Furthermore, knowledge of particular issues correlates with levels of concern (Gelcich et al., 2014). COAST share news articles and research that highlight the environmental impacts of salmon farms, such as the effect of sea-lice on wild salmon populations (Hoyle, 2017). This could account for the increased knowledge and concern for the detrimental impacts of this sector, as shown by over a third

of Arran residents (39.1%) who believed the health of Scottish seas had worsened because of fish farming. In turn, this could account for residents' attitudes towards the economic importance of fish farming – perhaps understanding the environmental costs means this sector is considered less economically important.

3.3 Have awareness and attitudes towards the Lamlash Bay No-Take Zone (NTZ) changed since 2011?

Overall, 95.2% of respondents were aware of the Lamlash Bay NTZ, an increase of 23.5% compared to 2011. Awareness was higher among residents than visitors (Figure 12), and of the visitors that had heard of the NTZ, 71.6% had heard of it before they visited Arran. All business owners on Arran were aware of the NTZ. These results follow a similar pattern to those from 2011, but awareness was higher across all groups in this survey. This was most significant for visitors where awareness increased from 51.5% in 2011 to 85.3%. A large proportion (22.7%) of respondents said they learned of the NTZ through COAST.

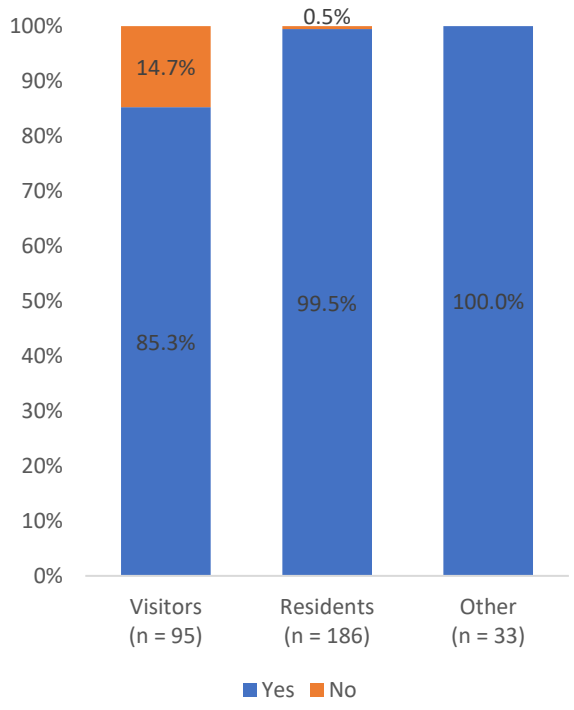

Figure 12: Awareness of Lamlash Bay NTZ across the different groups in 2020.
Base: All respondents (n = 314)

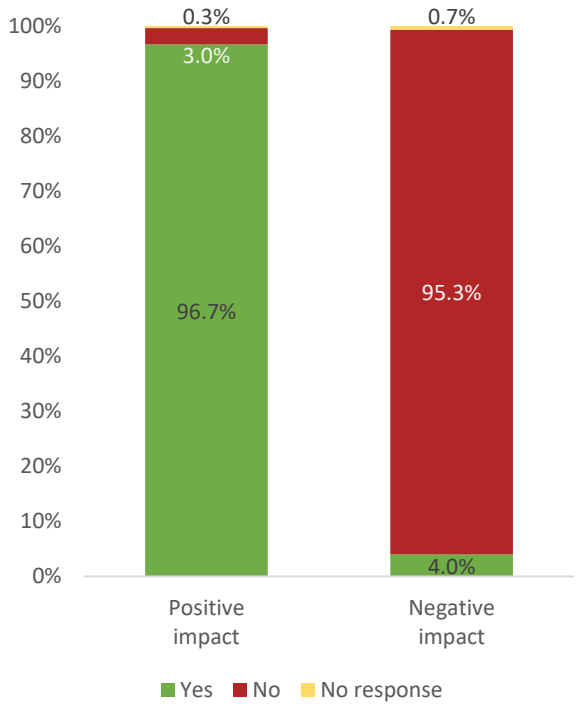

Figure 13: Opinions of respondents in 2020 on whether Lamlash Bay NTZ has had positive or negative impacts.
Base: Respondents aware of NTZ (n = 299)

Respondents aware of the NTZ were asked questions to determine current attitudes towards it. Of 299 respondents, the majority (96.7%) believed the NTZ has had positive impacts, while 4.0% believed it has had negative impacts (Figure 13). Nine respondents (3.0%) believed the impacts of the NTZ have been both positive and negative. Generally, attitudes towards the NTZ were positive, and this is further demonstrated in Figure 14, where 88.0% of respondents strongly agreed that 'overall, the NTZ is a good thing'. In the 2011 survey, perceptions were also largely positive towards the NTZ; 53% believed it had had a positive impact and 6.8% negative, although, ~40% of respondents said they did not know. This difference is probably due to different survey design: in this survey, those who were unaware of the NTZ were not asked this question, however, in 2011 all respondents were asked these questions likely leading to higher 'don't know'/no response rates in that year. Nevertheless, since most respondents from this survey (95.2%) were aware of the NTZ, and so asked this question, it can still be seen that fewer respondents were unsure of the impacts of the NTZ than in 2011.

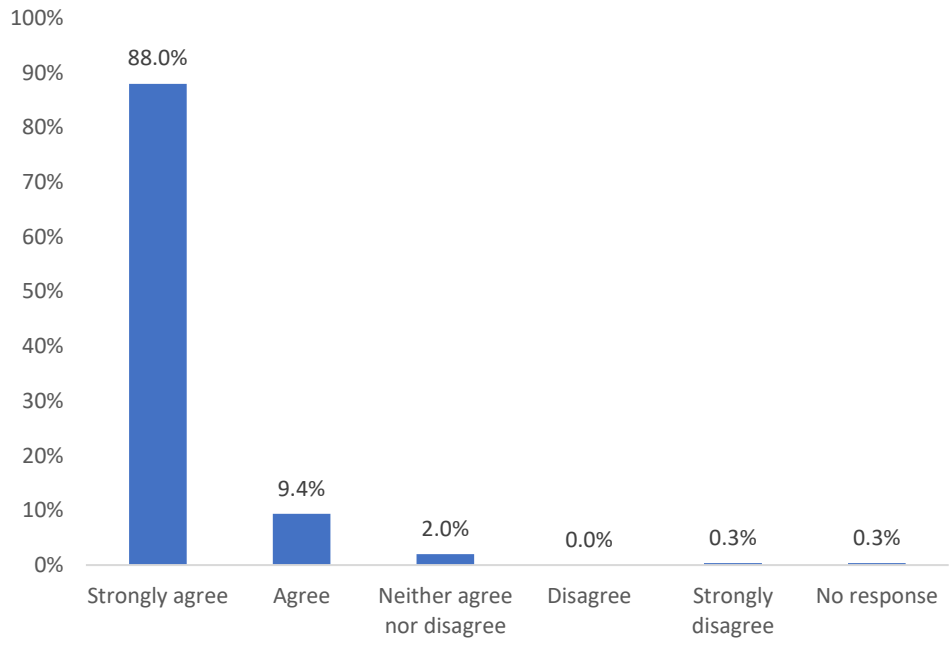

Figure 14: Opinions of respondents in 2020 on whether overall Lamlash Bay NTZ is a good thing. Base: Respondents aware of NTZ (n = 299)

Those who thought the NTZ has had positive impacts were asked to describe what these were. Many responses (63.0%) mentioned benefits to marine life and biodiversity, but some also mentioned several socio-economic benefits including increased tourism (13.1%), opportunities for education (10.4%) and raising the profile of Arran (9.3%). Eleven respondents thought the NTZ has had negative impacts, while 18.2% quoted impacts on local fishing, 63.6% said these were community tensions. These were the two main issues from the previous survey, except more respondents (21.4%) quoted reduction to fishing over community tensions (5.4%) in 2011.

To investigate understanding of the NTZ, respondents were also asked to explain what the Lamlash Bay NTZ is in their own words. There were 285 responses to this question which were summarised into themes (Table 4). Answers fell into two broad categories: use of the NTZ and the purpose of the NTZ. Most respondents (42.8%) said the NTZ was an area where all types of fishing were prohibited. Then, 29.5% said any extractive activities were banned, either of living creatures or inorganic material, and 13.3% suggested that any disturbance to the area, for example dropping anchor, was not allowed. A few respondents (12.6%) believed some forms of fishing were allowed, which suggests some confusion about permitted activities in the NTZ. The most quoted purpose of the NTZ was to regenerate the marine environment (20.4%), and some respondents recognised the area as a place for research (3.9%), or protection of nursery/breeding grounds for marine species (2.5%).

Table 4: Emergent themes in respondents' explanations of what the Lamlash Bay NTZ is

Theme	Example	n
Use of NTZ		
No fishing of any kind	*"An area where no fishing of any type is allowed"*	122
No extractive activities	*"Absolutely nothing can be removed from that area"*	84
No disturbance to area	*"boats cannot weigh anchor within the zone"*	38
Fishing restrictions	*"No commercial or net fishing is allowed. Some hand line fishing is permitted"*	36
Allowed activities	*"… diving, snorkelling, kayaking and boating can still occur"*	6
Purpose of NTZ		
Regeneration of the marine environment	*"To allow the marine world to repair and flourish"*	58
Protection	*"protect and preserve marine life and habitat"*	17
Area for research	*"A totally protected area being used for research"*	11
Nursery/breeding ground	*"a 'nursery' for rejuvenation of species"*	7

Comparison to the 2011 survey shows that awareness of the Lamlash Bay NTZ has increased, as expected since the NTZ has been in force for over a decade. Awareness increased most significantly in visitors which could be attributed to some businesses using it in marketing, as found in the previous survey (Bower, 2011). The continued engagement by COAST could also be credited with the rise in awareness – many respondents had learned of the NTZ through COAST, some from the community meetings before the NTZ was established and others from the new Octopus Centre.

Though support was high for the NTZ in 2011, the results of this study suggest it has increased. It is worth considering that respondents were mostly supporters of the NTZ due to self-selection bias (Dewaele, 2018). However, it is also suggested that acceptance of MPAs

increases over time (Voyer et al., 2012; Kelleher and Recchia, 1998), which could be the case here. For example, fewer respondents quoted restrictions to fishing as a negative impact of the NTZ than in 2011, suggesting residents and visitors have become accustomed to the restrictions. Furthermore, nearly all (97.3%) of respondents aware of the NTZ agreed that 'overall, the NTZ is a good thing', compared to just under 80% in 2011.

3.4 Awareness and attitudes towards the South Arran Marine Protected Area (MPA)

Awareness of the South Arran MPA was lower than that of the NTZ; overall, 207 respondents (65.9%) were aware of the MPA (Figure 15). Again, residents had a higher awareness than visitors, of which 58.9% had not heard of the MPA. Of the visitors that had heard of the MPA, 76.9% had heard of it before they came to Arran. Business owners had the highest awareness of the MPA (82.4%), as expected, following the results of the previous survey (Bower, 2011).

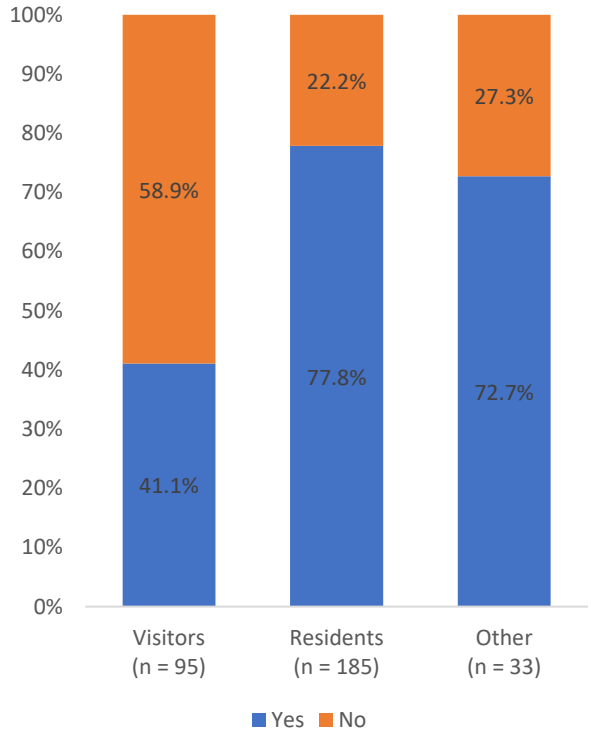

Figure 15: Awareness of South Arran MPA across the different groups.
Base: All respondents (n = 314)

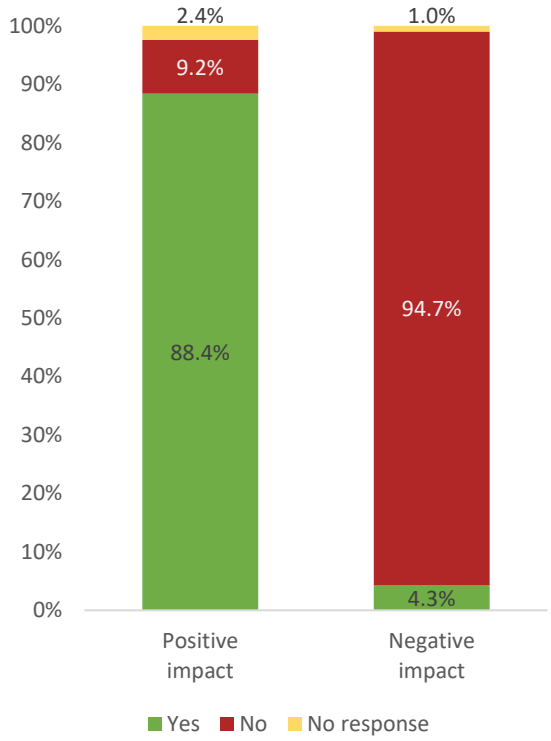

Figure 16: Opinions of respondents on whether the South Arran MPA has had positive or negative impacts.
Base: Respondents aware of MPA (n = 207)

Those aware of the MPA were asked if they thought it has had any positive or negative impacts. Most respondents (88.4%) believe the MPA has had a positive impact and 4.3% negative (Figure 16). Seven respondents (3.4%) believed the MPA has had both positive and negative impacts. Again, most respondents (90.8%) agreed that 'overall, the South Arran MPA was a good thing' (Figure 17).

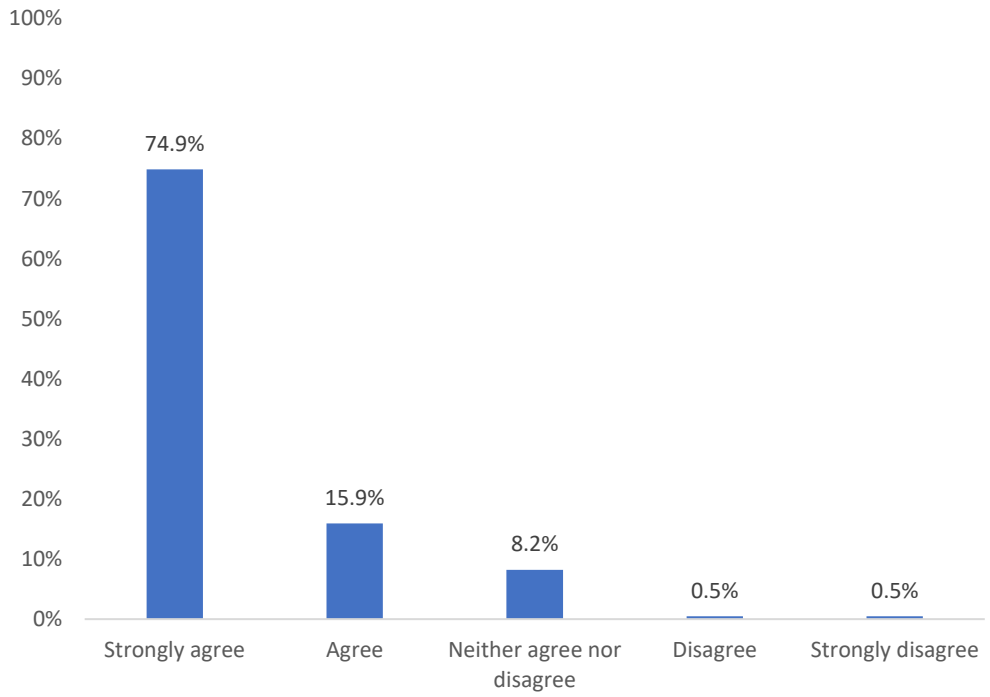

Figure 17: Opinions of respondents on whether overall the South Arran MPA is a good thing. Base: Respondents aware of MPA (n = 207)

Many of the positive impacts described by respondents were similar to those for the NTZ and predominantly included benefits for the marine environment (44.3%) and raising awareness of the issues facing it (12.6%). Negative impacts stated were again the resulting tensions within the community (33.3%), and one respondent said the MPA has had a negative effect on some businesses.

When asked to explain what the South Arran MPA was, 178 respondents gave answers which have been summarised in Table 5. It is understood by 44.4% of respondents that the MPA is an area where certain fishing methods are restricted, and 7.9% believed there was no form

of commercial fishing allowed within the MPA. This suggests that some respondents believed the MPA to have higher levels of protection than it does. In comparison, there were a few respondents who believed the NTZ had lower levels of protection than there are as 12.6% of respondents believed some form of fishing is allowed in the NTZ. A few respondents (3.9%) also demonstrated an understanding of the zoning system within the MPA. However, there also appeared to be some confusion about what the MPA is, as some explanations were vague, and 9.5% of respondents indicated they did not know how to explain it.

Table 5: Emergent themes in respondents' explanations of what the South Arran MPA is

Theme	Example	n
Use of MPA		
Fishing restrictions	*"Where certain types of fishing are banned"*	79
No commercial fishing	*"Commercial fishing is not allowed in the area"*	14
Restricted activities	*"An area in which activity is restricted"*	13
Zoned area	*"certain fishing and dredging activities are not permitted in different areas"*	7
Purpose of MPA		
Protection of the marine environment	*"Protect the sea and sea bed"*	60
Don't know		17

The South Arran MPA has been in force for four years, similar to the age of the NTZ during the 2011 survey, but awareness of the MPA across all groups was slightly lower than that of the NTZ in 2011. This could be because the NTZ had more publicity during campaigning and when it was established due to its uniqueness as Scotland's first NTZ. It could also be argued that the MPA is less impactful on the Arran community and visitors as it does not restrict recreational activities and its influence extends further from the coastline. Furthermore,

visitors may engage more with the NTZ compared to the MPA as a tourist attraction, for example, as a dive site. Nevertheless, there is a high awareness of the South Arran MPA, particularly among residents and business owners. Moreover, this study has shown that awareness of the NTZ has increased since the 2011 survey, and so would suggest the same could happen for the MPA, particularly with continued community engagement by COAST.

In summary, community-led conservation on Arran appears to have influenced attitudes of residents that are distinguishable to those of the rest of Scotland. Not only this, but community outreach may have also encouraged residents to engage with further pro-environmental campaigns, namely against the expansion of open-cage salmon farming in the region. Awareness of the Lamlash Bay NTZ has increased since 2011, notably in visitors, and support remains high. This could be attributed in part to the continued community engagement by COAST. While lower than that of the NTZ, awareness and support for the South Arran MPA were also high, and the results of this survey indicate this could also increase over time. The limitations of this study, discussed below, restrict generalisation of these results; however, the key findings demonstrate the successes of COAST's community-led conservation efforts on Arran are not only ecological but social too.

4 Limitations

The questionnaire design had some flaws, mainly that it was too long. If completed fully, respondents were asked around 39 questions, where generally 20 questions are advised (Deutskens et al., 2004). Studies suggest that longer surveys have a lower response and higher abandonment rates (Deutskens et al., 2004). To combat this, the survey flow was used to skip questions if respondents answered a certain way, yet there was still a high number of incomplete surveys from this study. Moreover, the large number of questions resulted in a large volume of results and restricted more in-depth analysis.

The survey was distributed and completed online, so there is an inherent bias towards those that have access to the internet (Bethlehem, 2010). In Scotland, 87% of households have access to the internet, and 35% of adults 60+ do not use the internet (The Scottish Government, 2019), which could account for the underrepresentation of the 65+ age category in this survey. Those who completed the survey were self-selected, incurring possible bias which prohibits generalisation of the results. Furthermore, some responses were clearly influenced by the effects of COVID-19, so it is possible results do not reflect attitudes under normal circumstances. Despite the limitations, this study presents some key findings which can be used as a basis for more in-depth investigation.

5 Future work

Some areas of this study could warrant further investigation. First, as highlighted above, Arran residents considered scientific research 'very important' economically, and further investigation is needed to discern how and why residents believe this. Secondly, the Marine Scotland survey distinguished regions of Scotland, including the "Highlands and Islands". Participants from this region had higher levels of knowledge of marine sectors and more strongly believed that not enough was being done to protect the marine environment (Marine Scotland, 2019). It would be interesting to compare the results from this survey to those of respondents from the "Highlands and Islands" region in the Marine Scotland survey to explore if any attitudes are particular to the Isle of Arran. It also would be interesting to investigate if perceptions of the benefits and negative impacts of the NTZ and MPA vary between different areas of the island. It is possible that northern and western towns, which are more removed from the protected areas, do not realise some of the benefits such as increased tourism. This could also be applied to businesses in different areas of the island. Finally, as mentioned above, the effects of COVID-19 were seen to influence responses. This considered, comparison between this and future studies could determine if the pandemic did indeed influence respondent attitudes and perceptions or not.

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Appendix A: Survey distributed to residents and visitors

Q1 Are you a:

- Resident on Arran
- Visitor to Arran
- Other (please specify

  _____

Q2 If you are an Arran resident, please click on the map the town/village you live closest to

Q3 What is your age?

- 18-24
- 25-34
- 35-44
- 45-54
- 55-64
- 65+

Q4 What is your gender?

- Male
- Female
- Prefer not to say

Q5 What is the highest level of education you have completed?

- Primary Education
- Secondary Education up to 18 years
- Further Education (HNC, HND or Diploma of Higher Education)
- Undergraduate Degree
- Post-graduate Degree
- Prefer not to say

Q6 What is your profession?

_____

Q7 Do you own a business on Arran?

- Yes
- No

Q7a What kind of business do you run? (Please name your business if happy to do so)

_____

Q8 Which of the following are you most concerned about in the marine environment globally? You can pick up to FOUR.

- Change in sea levels
- Change in sea temperature
- Accidents such as oil spills
- Ocean acidification
- Overfishing
- Litter / plastics in the sea
- Reduction in marine biodiversity / loss of marine species
- Coastal development
- None of the above
- Don't know
- Other

_____

Q9 If there are any Scottish marine animals that you are concerned about for the future, please type in here.

_____

Q10 In the past year, do you think the health of Scotland's seas has… (Select one)

- Improved
- Stayed the same
- Worsened
- Don't know

Q10a You said that you think the health of Scotland's seas has worsened in the past year. Why do you think this?

_____

Q10b You said that you think the health of Scotland's seas has improved in the past year. Why do you think this?

_____

Q11 Our marine environment provides a number of services and benefits. Which of the following do you think are most important? You can choose up to 5 priorities

- Oil and Gas
- Renewable Energy
- Food to eat
- Coastal protection
- Climate regulation
- Health and well-being
- Tourism, leisure and recreation
- Transport and shipping
- Habitats for marine plants and animals
- Providing jobs
- Supporting the wider UK economy
- None of the above
- Don't know

Q12. How much knowledge do you think you have about each of the following sectors or industries in Scotland's marine environment?
[1] Know very well [2] Know a fair amount [3] Know just a little [4] Heard of, know almost nothing about [99] Not heard of

- Commercial sea fishing
- Farming of fish and shellfish
- Non-renewable energy such as oil and gas
- Renewable energy such as wind, waves, tide
- Transportation of goods / commercial shipping
- Coastal tourism / recreation / cruises
- Coastal protection such as seawalls
- Scientific research such as marine biology
- Ports and harbours
- Military exercises such as by the Royal Navy
- Construction such as shipbuilding

Q13. How important or not do you feel these sectors or industries are to Scotland in terms of their economic value? By economic value we mean generating tax revenue, creating and providing jobs.
[1] Very important [2] Quite important [3] Not very important [4] Not at all important [99] Don't know

- Commercial sea fishing
- Farming of fish and shellfish
- Non-renewable energy such as oil and gas
- Renewable energy such as wind, waves, tide
- Transportation of goods / commercial shipping
- Coastal tourism / recreation / cruises
- Coastal protection such as seawalls
- Scientific research such as marine biology
- Ports and harbours
- Military exercises such as by the Royal Navy
- Construction such as shipbuilding

Q14. To what extent do you agree or disagree with the following statements?
[1] Strongly agree [2] Tend to agree [3] Neither agree nor disagree [4] Tend to disagree [5] Strongly disagree [99] Don't know

- Enough is being done to protect the Scottish marine environment
- I need to do more to protect the marine environment
- Government needs to do more to protect the marine environment
- Business needs to do more to protect the marine environment
- I can personally make a difference to improving the Scottish marine environment
- I feel I have the knowledge I need to protect the marine environment
- I feel I can influence choices that are made that impact the marine environment

Q15 Are you aware of the No-Take Zone (NTZ) in Lamlash Bay which was established in 2008?

- Yes
- No

Q16 How did you learn about the Lamlash Bay NTZ?

_____

Q17 If you are a visitor, had you heard of the Lamlash Bay NTZ before arriving on Arran?

- Yes
- No
- I am not a visitor

Q18 In your own words, please explain what you understand a NTZ is

_____

Q19 Do you think that the no-take zone has had any positive impacts on Arran?

- Yes
- No

Q19a If yes, please give a brief description of positive effects

_____

Q20 Do you think that the no-take zone has had any negative impacts on Arran?

- Yes
- No

Q20a If yes, please give a brief description of negative effects

_____

Q21 Do you agree or disagree with the following statement?

“Overall, I think that the No-Take Zone in Lamlash Bay is a good thing.”

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

Q22 Are you aware of the South Arran Marine Protected Area (MPA) which has been in force since 2016?

- Yes
- No

Q23 How did you learn about the South Arran MPA?

_____

Q24 If you are a visitor, had you heard of the South Arran MPA before arriving on Arran?

- Yes
- No

Q25 In your own words, please explain what you understand an MPA is

_____

Q26 Do you think that the South Arran MPA has had any positive impacts on Arran?

- Yes
- No

Q26a If yes, please give a brief description of positive effects

_____

Q27 Do you think that the South Arran MPA has had any negative impacts on Arran?

- Yes
- No

Q27a If yes, please give a brief description of negative effects

_____

Q28 Do you agree or disagree with the following statement?

“Overall, I think that the South Arran MPA is a good thing.”

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

Q29 Which of the following marine life do you think the South Arran MPA was set up to protect? (Please tick all that apply)

- Otters
- Seals
- Whales, dolphins and porpoises
- Seabirds
- Maerl beds
- Kelp forests
- Seagrass beds
- Other seabed habitats
- Commercial fish and shellfish species
- All seashore and seabed habitats and marine life within the MPA
- Don't Know
- Other (Please specify)
  _____

Q30 Are you aware of the Community of Arran Seabed Trust (COAST) Marine Visitor Centre – The Octopus Centre - which opened in 2018?

- Yes
- No

Q30a Have you visited the centre?

- Yes
- No

The final questions are for those who own a business on Arran

Q31 Do you feel that a more productive marine environment positively benefits your business?

- Yes
- No

Q31a If yes, please give a brief description of the positive effects

_____

Appendix B: What respondents believe the South Arran MPA was set up to protect

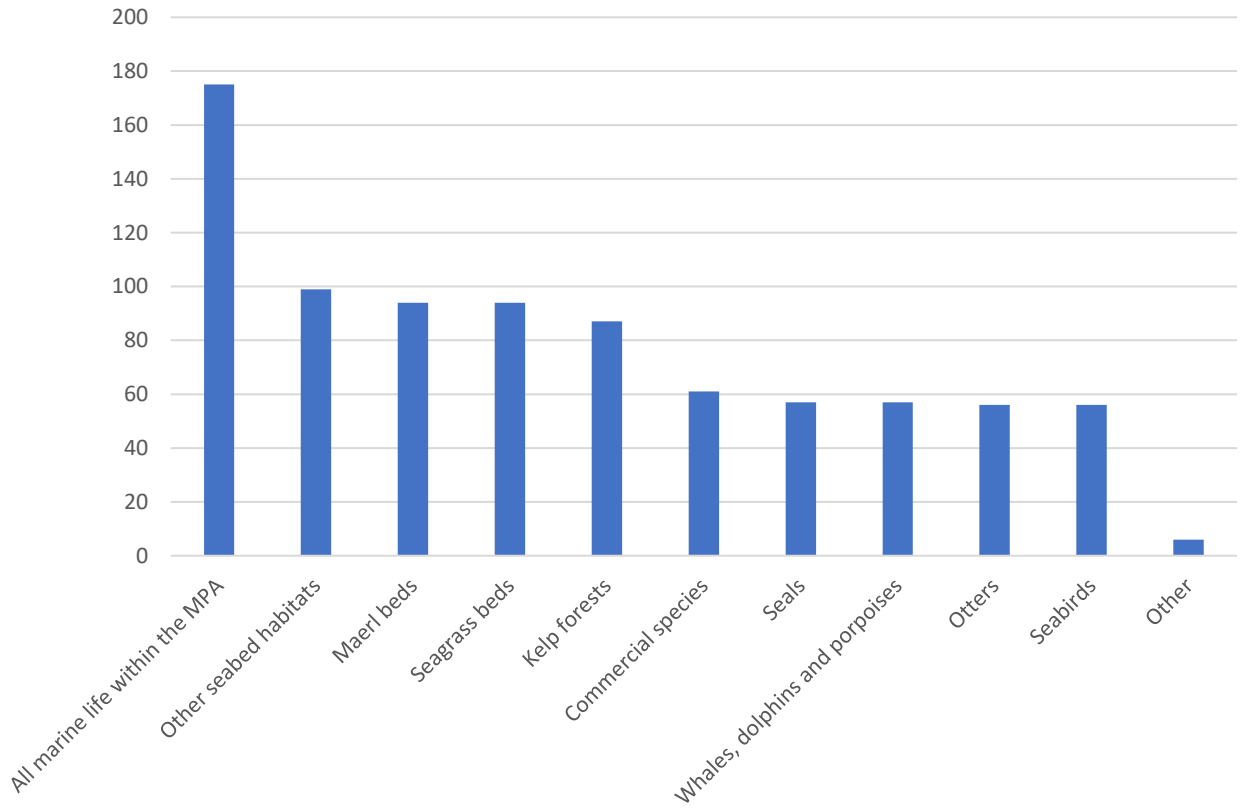


Figure A 1: What respondents believe the South Arran MPA was set up to protect.
Base: All respondents (n = 314)

Appendix C: Awareness of COAST Octopus Centre

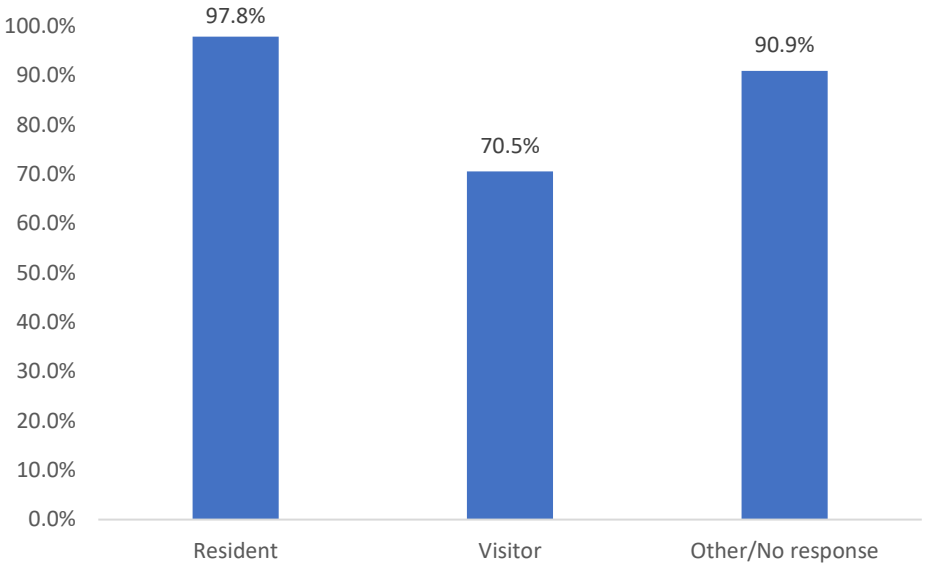


Figure A 2: Percentage of respondents that had heard of the Octopus Centre. Overall total is 278 (88.5%).
Base: All respondents (n = 314)

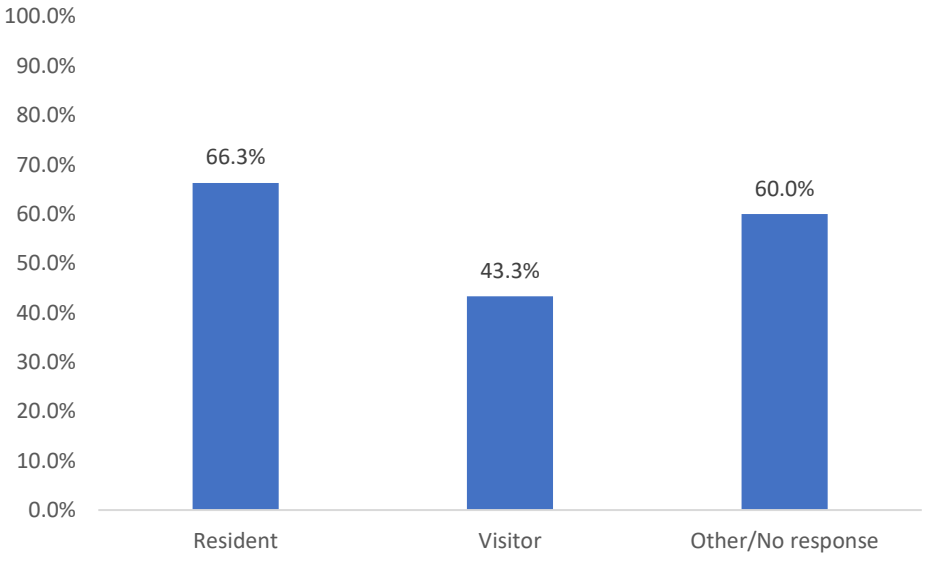


Figure A 3: Percentage of respondents aware of Octopus Centre who have visited.
Base: Respondents aware of Octopus Centre (n = 278)

Appendix D: Responses of Business Owners

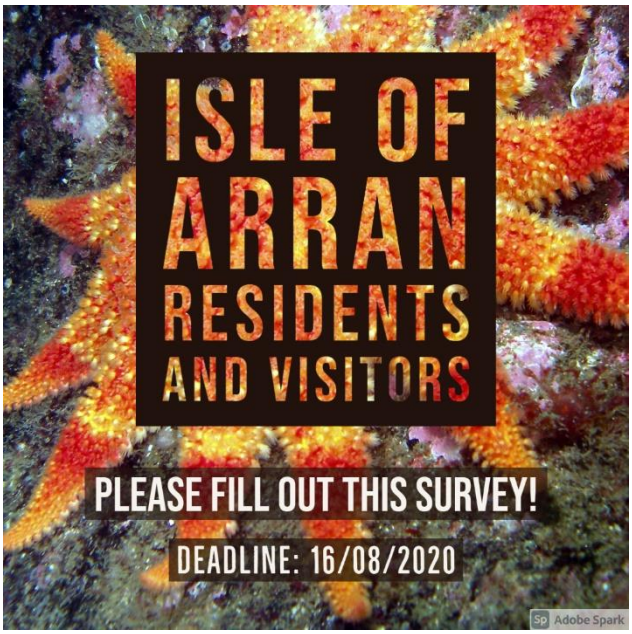
Table A 1: Does a productive marine environment benefit business? Response by business type.

		Does a productive marine environment benefit your business?	
Business Type	**n**	**Yes**	**No/No response**
Accommodation	18	16	2
Agriculture	3	0	3
Food	8	5	3
Outdoor activities	3	3	0
Retail	7	4	3
Trade/Services	16	3	13
Unknown	3	2	1

Table A 2: Explanation of positive effects of a productive marine environment on businesses by business type

Business type	Explanation of positive effects to their business of a productive marine environment
Accommodation	*"Attracts visitors and interest in the area"* *"COAST offers education and nature activities- this attracts families on holiday"*
Food	*"there is a benefit in having locally and ethically sourced food"*
Outdoor activities	*"It attracts wildlife and [diversity] to the shore which attracts people"*
Retail	*"Healthier seas for people to enjoy will bring more visitors"*
Trade/Services	*"Increase in tourism"* *"Arran's natural environment is crucial to all livelihoods on Arran"*
Unknown	*"Improves interest of the area"*

Appendix E: Graphics used on social media to promote the survey



Appendix F: Poster distributed to businesses to promote the survey to visitors

ISLE OF ARRAN SURVEY: MARRINE ATTITUDES

RESIDENTS & VISITORS

Are you interested in Arran's marine environment?

Please take part in this survey by visiting: https://bit.ly/2B4W2Tr or by scanning the QR code to be taken straight to it

If you have any questions please contact:
Lucy Howarth-Forster at lhf510@york.ac.uk

This link is also available on the Arran Community Forum facebook page