

Social factors in a fully protected marine reserve: Awareness of and attitudes towards the Lamlash Bay no-take zone, Isle of Arran

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Rachel Bower

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1.0 Abstract

A survey of 828 respondents, including residents, visitors and businesses, examined awareness of and attitudes towards the Lamlash Bay no-take zone (NTZ), the Isle of Arran. Results suggest that awareness of the NTZ was generally high, although visitor awareness was lower than that of other respondent types. There was also evidence of confusion over what activities are allowed and banned within the marine reserve. Attitudes towards the NTZ were mainly positive and focused on environmental benefits, with negative attitudes focusing on fishing restrictions. Implications for COAST, the Lamlash Bay Implementation Group and management of the NTZ are discussed, including raising awareness, engaging stakeholders and overcoming negative perceptions, and improving links between conservation and tourism on Arran. Further efforts should be made to educate visitors to Arran about the marine environment, to encourage involvement and information sharing between stakeholders and to promote the NTZ as a potential source of benefits to industries such as tourism and fishing.

2.0 Introduction

As many global fisheries continue to decline, marine protected areas (MPAs), including fully protected no-take zones (NTZs), are becoming a widely used conservation and fisheries management tool (Halpern, 2003; UNEP, 2010; Zhou *et al.*, 2010). A vast literature suggests that well designed and managed protected areas can have dramatic benefits for marine habitats and species, and may also benefit fisheries through spill-over mechanisms (Roberts *et al.*, 2000; Halpern & Warner, 2002; Halpern, 2003; Hilborn *et al.*, 2004; Howarth *et al.*, 2011).

2.1 The Firth of Clyde and the Lamlash Bay no-take zone, Isle of Arran

The Isle of Arran lies in the Firth of Clyde, off the west coast of Scotland (figure 1). The Clyde has been heavily fished for over two centuries, with many of its stocks having reached collapse or near collapse by the 21st century (Thurstan & Roberts, 2010; Heath & Speirs, 2011). Today only two commercially viable fisheries remain,

for the Norway lobster, *Nephrops norvegicus*, and a scallop fishery for both the king or great scallop, *Pecten Maximus*, and the less valuable queen scallop, *Aequipecten opercularis* (Thurston & Roberts, 2010; Howarth *et al.*, 2011). Thurstan & Roberts (2010) describe the Clyde as approaching “the end point of overfishing, the point where nothing remains that is worth catching” (p. 12).

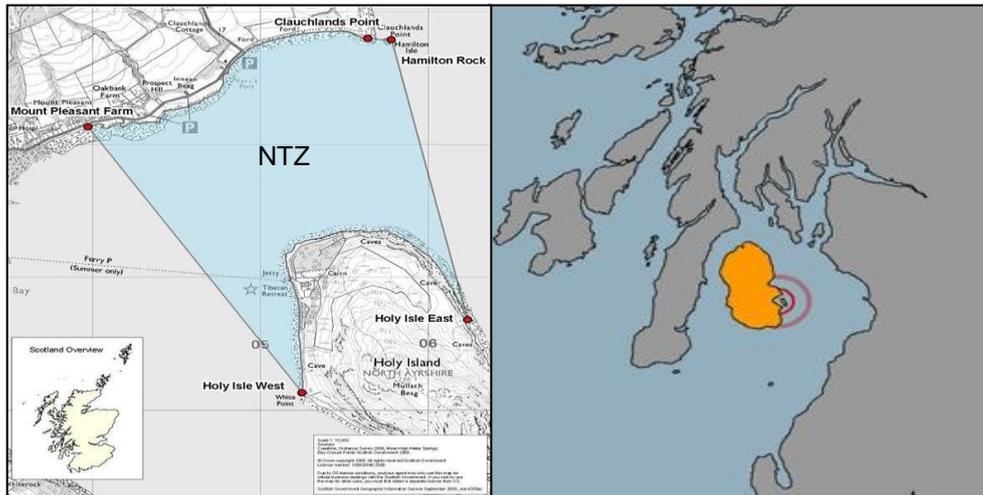


Figure 1. Site of the NTZ in Lamlash Bay and location of the Isle of Arran off the West coast of Scotland (from Coast, n.d.; Scottish Government, 2008).

A fully protected NTZ in Lamlash Bay, Isle of Arran, was passed by Scottish Parliament in September 2008, prohibiting all forms of fishing within its 2.67km² boundaries (COAST, n.d.). The NTZ, established under the Inshore Fishing (Prohibition on Fishing) (Lamlash Bay) (Scotland) Order 2008, was the first fully protected marine reserve in Scotland and only the second in the UK, after Lundy (Scottish Government, n.d.). A 1km² NTZ has since been designated at Flamborough Head, in 2010; the UK’s third (Natural England, n.d.).

The NTZ was designated in order to protect vital marine habitats from the damaging effects of bottom trawling and scallop dredging, and to allow fish and shellfish stocks to rejuvenate (COAST, 2005). Research to monitor the biological effects of the NTZ suggests greater abundances of juvenile scallops within the NTZ boundary than without, a finding attributed to a higher presence of macroalgae and maerl within the NTZ, providing a complex, 3D substrate for settlement (Howarth *et al.*, 2011).

The establishment of the Lamlash Bay NTZ followed over a decade of volunteer work by the local group Community of Arran Seabed Trust (COAST), including persistent lobbying, attendance at workshops, giving talks and presentations, attending shows, and appearing in various newspapers and on television and radio. COAST volunteers also run a website and produce a newsletter. COAST volunteers have also worked to create links between conservation and tourism on Arran, for example giving presentations to Visit Scotland, producing literature for Visit Arran, giving regular talks at a large hotel on the island and working in partnership with National Trust Scotland to run seashore walks.

The road to NTZ designation

Through contact with Members of Scottish Parliament, COAST made a petition to the Scottish Parliament in 2004. Further to this, the Lamlash Bay Working Group (later the Lamlash Bay Implementation Group) was formed, with involvement from Marine Scotland (previously SEERAD), Scottish Natural Heritage, the Clyde Forum, Clyde Fisherman's Association and COAST. The group worked to define and negotiate the area of the proposed MPA and NTZ. Discussions were held with fishermen in various locations including Glasgow, Arran, Campbeltown and Tarbert. A consultation period was held by the Scottish Government in spring 2008. Of 675 responses, over 99% were in favour of the NTZ (Scottish Government, 2008).

Following the Fisheries Order in September 2008, the Lamlash Bay Implementation Group oversaw management of the NTZ and was also involved in the production of the NTZ leaflet and interpretation boards. The proposed Community MPA in the rest of Lamlash Bay was not implemented despite widespread support. Marine Scotland Compliance is responsible for preventing fishing activities in the NTZ area.

2.2 Why study social impacts?

Closing an area to fishing benefits both target species and the wider ecosystem, promoting recovery of vital habitats via protection from physical damage by gears, and reduced mortality of non-target species (Bradshaw *et al.*, 2001; Zhou *et al.*, 2010; Howarth *et al.*, 2011). However, the marine environment represents a valuable resource. While most of the seabed within twelve miles of the shore is

owned and leased by the Crown Estate, fishing takes place under the ill-defined public right to fish, resulting in complex amalgamation of actual and perceived rights of access (The Crown Estate, n.d.; Appleby, 2008). Closing any area to the removal of resources is therefore likely to be controversial, highlighting differences between different stakeholders who hold different opinions about how the marine environment should or should not be managed and utilised. In short, the establishment of MPAs may become a struggle between conservation and some sectors of marine resource industries (Klein *et al.*, 2008).

Although biological benefits are the major objective of conservation measures, socio-economic factors and stakeholder attitudes are also crucial to the success of protected areas (Wahle *et al.*, 2003). If social factors are ignored, protected areas are less likely to be supported and successfully enforced; ultimately meaning conservation targets may not be reached (Jones, 1999; Suman *et al.*, 1999; Wahle *et al.*, 2003). Additionally, Klein *et al.* (2008) found that stakeholder driven design processes are able to meet both conservation and socio-economic objectives, so conservation aims need not be compromised. A clear process for research into socio-economic impacts of protected areas, using a range of assessment tools, should therefore be integrated throughout the design, implementation and management process (Hull *et al.*, 2010; Wahle *et al.*, 2003). This is of particular relevance to Scotland as it works towards the creation of a comprehensive network of MPAs, with the Marine (Scotland) Act (2010) including articles concerning research and socio-economic impact assessments with regards to marine planning and designation of MPAs. As Scotland's first (and currently only) fully protected marine reserve, the Lamlash Bay NTZ is a forerunner for future NTZs, MPAs and other spatial management measures and should endeavour to achieve best practice at all times. While public consultations were undertaken prior to its designation (COAST, 2005; Scottish Government, 2008), it is important that studies such as this be conducted regularly, so that findings can be incorporated into future management plans. COAST is currently campaigning for the creation of an MPA around the south of Arran. Therefore the results of this study will provide a useful indicator of public opinion concerning marine protection around Arran.

2.3 Aims of the study

- 1) To examine public awareness of the Lamlash Bay NTZ, including awareness of allowed/banned activities, understanding of its main purposes and awareness of wider marine conservation issues.
- 2) To examine attitudes towards the Lamlash Bay NTZ, including its perceived positive and negative impacts on residents and businesses. To assess interest in marine educational activities.
- 3) To set out the implications of findings for COAST, the Lamlash Bay Implementation Group, and management of the NTZ, including how to raise awareness of the NTZ and marine conservation in general, how to engage with all stakeholders and overcome negative attitudes and how to encourage further links between conservation, tourism and businesses on Arran. Findings should complement the existing programme of biological monitoring, contributing to the establishment of a robust, long term dataset covering all aspects of the NTZ.

3.0 Methods

Two surveys were created, one aimed at residents and visitors to Arran and the other at businesses. An online version was also created using Survey Monkey (www.surveymonkey.com), in which respondents were directed to relevant questions based on whether they were a resident, visitor or business. Surveys were carried out over the period August 1st – 25th and September 2nd – 4th 2011.

Surveys were conducted by opportunity sample at various locations around Arran including in Brodick (Tourist Office, The Auchrannie Resort, on-street), Lamlash (Lamlash Post Office and Lamlash Pier), COAST public consultations at Kildonan Hall and Kilmory Hall, and ferry crossings to and from Brodick. Surveys were also dropped off at businesses in Brodick, Lamlash, Whiting Bay, Kildonan and Blackwaterfoot; were distributed to students at Arran High School, Lamlash, by a student and teacher; and given to students attending a talk by COAST at the Arran Outdoor Centre, Lamlash. The online survey was promoted by email mail-shot to the COAST mailing list, using Mail Chimp (www.mailchimp.com). The survey was

also promoted using posters and leaflets, which were posted in Brodick, Lamlash, Whiting Bay, Kildonan and Blackwaterfoot, and emailed to businesses around the island.

Due to transport constraints, sampling was mainly limited to the busier, eastern side of Arran. While some sampling was carried out at other locations, response rates were not high and it was felt that it would be more productive to carry out opportunity samples in busier areas to increase sample size.

3.1 Survey design

See appendix one for a copy of both surveys. Table 1 outlines questions according to the aims of the study.

Table 1. Brief outline of survey questions

Aim	Questions
Demographics	<p>Q1 (Residents and visitors only) - Are you a resident, visitor, other?</p> <p>Q2/1 – Are you a member of the Community of Arran Seabed Trust (COAST)?</p> <p>Q5 (businesses only) – What kind of business do you run?</p> <p>Q11/16 - gender</p> <p>Q12/17- age</p> <p>Q13/18 - rating of income (does not meet your needs, just meets your needs, meets your needs with some left over for luxury items, allows you to buy lots of luxury items)</p>
Examine awareness of the NTZ	<p>Q3/2 (i) Are you aware of the no-take zone in Lamlash Bay? (ii) If you are a visitor, had you heard of the no-take zone before arriving on Arran? (iii)/(ii) If you have heard of the no-take zone, how did you learn about it?</p> <p>Q4/3 What activities are allowed in the no-take zone? (Choose from: Swimming, diving and snorkelling, recreational fishing, commercial fishing, boating, photography, collecting shellfish)</p> <p>Q5/4 What do you think is the main purpose of the no-take zone? (Choose responses from: To stop trawlers fishing in the area, to stop rod fishing in the area, to stop all fishing in the area)</p>
Examine attitudes towards the NTZ	<p>Q6/11 – Would you (and your friends/family) visit a marine interpretation centre on Arran if this was available?</p> <p>Q7/12 – Would you (and your friends/family) be interested in a guided rock pool excursion if this was on offer?</p> <p>Q8/13 – Please rank the following fishing methods in order of sustainability</p>

	<p>(1 = most sustainable, 5 = least sustainable): Spear gun fishing, lobster creeling/potting, scallop bottom dredging, rod and line fishing, otter trawling (a type of bottom trawl). (NB coding reversed for analysis)</p> <p>Q9/14 – What percentage of UK coastal waters do you think are currently protected from fishing by no-take zones?</p> <p>Q10/14 – What percentage of UK coastal waters do you think should be protected from fishing by no-take zones?</p> <p>Q16/8 (residents and businesses only) – 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 responses: Strongly agree, agree, neither agree or disagree, disagree, strongly disagree)</p> <p>Residents only</p> <p>Q14 (i) Do you think that the no-take zone has had/could have any positive impacts on Arran? (ii) If yes, please give a brief description of positive effects</p> <p>Q15 (i) Do you think that the no-take has had/could have any negative impacts on Arran? (ii) If yes, please give a brief description of negative effects</p> <p>Businesses only</p> <p>Q6 (i) Do you think your business benefits or could benefit directly or indirectly from the no-take zone? (ii) If yes, please give a brief description of positive effects</p> <p>Q7 (i) Do you think your business has been or could be negatively affected by the no-take zone? (ii) If yes, please give a brief description of negative effects</p> <p>Q9 (i) Do you refer to the no-take zone as part of your marketing effort (including website)? (ii) If yes, please describe how</p> <p>Q10 – How often do your guests/customers ask you about the no-take zone? Likert scale responses: Never, rarely, sometimes, often.</p>
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3.2 Analysis

Data was mainly categorical or ordinal, so parametric assumptions were not met. Additionally, Kolmogorov-Smirnov and Shapiro-Wilk tests were significant to at least $p = 0.001$ for all relevant variables, suggesting non-normal distributions. Non-parametric analysis was therefore used throughout. Table 2 outlines non-parametric analyses used.

Table 2. Non-parametric analysis

Analysis	Variables tested
Kruskal-Wallis	<ul style="list-style-type: none"> • Effect of respondent type on number of activities correct • Difference in median rankings of sustainability of fishing methods • Effect of respondent type on responses to “what percentage of UK coastal waters do you think is currently protected from fishing by NTZs?” • Effect of respondent type on responses to “what percentage of UK coastal waters do you think should be protected from fishing by NTZs?” <p>(If significant, Mann-Whitney tests with Bonferroni adjusted p values carried out to assess pair-wise comparisons)</p>

Mann-Whitney U	<ul style="list-style-type: none"> • Effect of gender on responses to “what percentage of UK coastal waters do you think is currently protected from fishing by NTZs?” • Effect of gender on responses to “what percentage of UK coastal waters do you think should be protected from fishing by NTZs?”
Wilcoxon Signed Ranks	<ul style="list-style-type: none"> • Difference in median responses to “what percentage of UK coastal waters do you think is currently protected from fishing by NTZs?” and “what percentage of UK coastal waters do you think should be protected from fishing by NTZs?”
Spearman’s Rho correlation	A correlation matrix was produced for all suitable variables. Salient correlations are reported in results.

4.0 Results and discussion

4.1 Demographics

846 surveys were collected in total. Eighteen were discarded as they were deemed too incomplete, giving a total sample size of 828. Table 3 shows demographic information overall and by respondent type.

Table 3. Age, rating of income and gender of respondents by group (For income 1 = does not meet your needs, 2 = just meets your needs, 3 = meets your needs with some left over for luxury items, 4 = allows you to buy lots of luxury items)

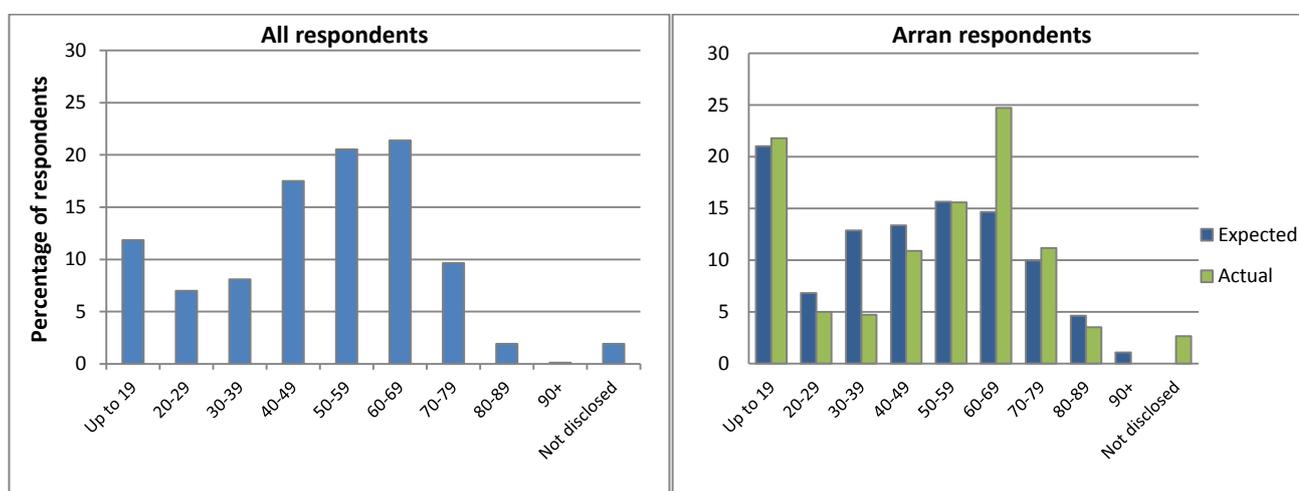
Group	Mean age	Mean rating of income	Male	Female	Gender undisclosed	Total
Businesses	48.83	2.43	36	30	2	68
Residents	46.45	2.26	129	162	3	294
Visitors	47.09	2.59	175	223	2	400
Other	49.81	2.36	29	37	0	66
Total	48.51	2.45	369	452	7	828

Table 4 shows number of survey responses by survey location. The total sample size of residents and businesses based on Arran was 340, representing 6.72% of Arran’s population (5,058), based on 2001 census data (General Register Office for Scotland, 2005). The remaining sample consisted of visitors to Arran, respondents from the category “other” and respondents of unknown location.

Table 4. Number of survey responses by location and respondent group

Location	Businesses	Residents	Visitors	Other	Total
Brodick	22	18	83	5	128
Ferry (Ardrossan to Brodick)	0	18	139	14	171
Ferry (Brodick to Ardrossan)	0	89	85	6	180
Holy Isle	1	0	0	0	1
Kildonan	1	7	9	0	17
Lamlash	14	127	54	3	198
Shiskine	1	0	0	0	1
Whiting Bay	7	0	0	0	7
Unknown	22	35	30	38	125
	68	294	400	66	828

Figures 2(i) and 2(ii) show expected and actual age profiles of (i) all respondents and (ii) just those from Arran (businesses and residents), based on 2001 census data (General Register Office for Scotland, 2005). For respondents from Arran, a higher number of responses than expected were obtained from 60-69 year olds, possibly because much sampling was carried out on weekdays. This would also explain why younger age groups were less well represented as people of these ages would be more likely to be at work/in education.



Figures 2(i) and 2(ii). Age profile of all respondents. Expected and actual age profile of residents and businesses based on Arran, based on 2001 census data (General Register Office for Scotland, 2005)

4.2 Are respondents aware of the NTZ?

71.74% of respondents were aware of the NTZ. 74.25% of males were aware of the NTZ, compared with 69.47% of females. Figure 3 shows responses by respondent type. 51.50% of visitors had heard of the NTZ, compared with 97.06% of

businesses, 93.20% of residents and 72.73% of “other” respondents. This suggests visitors were less aware of the NTZ than other respondent types. Of 206 (total n 400) visitors who were aware of the NTZ, 100 (48.54%) had heard of it before visiting Arran, 102 (49.51%) had not and four (1.94%) did not respond. Seventy two (8.70%) of respondents were members of COAST (34.95% of those who had heard of the NTZ). COAST supporters would be expected to have show greater awareness and more positive attitudes towards the NTZ than other respondents. However, since they make up a low percentage of the overall sample, this should not have biased results.

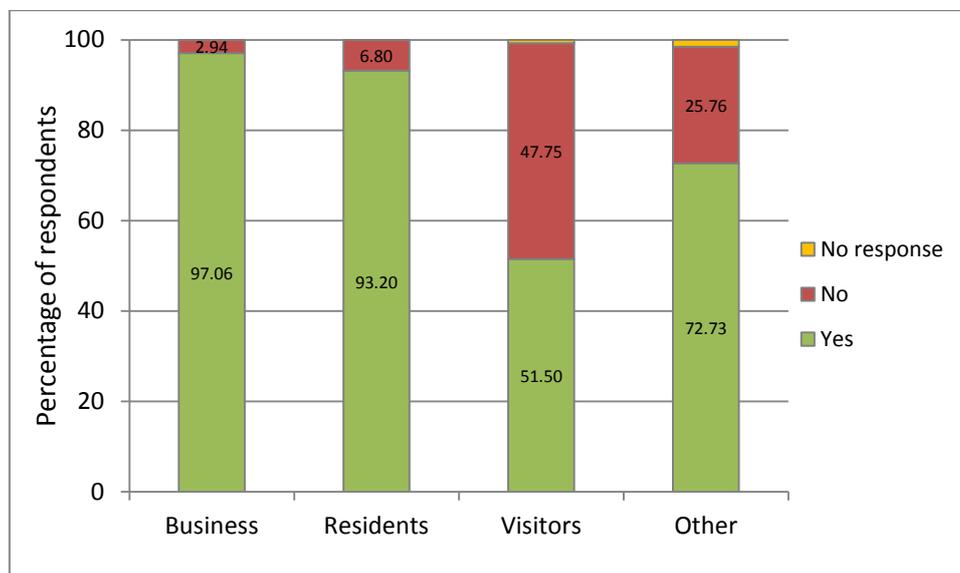


Figure 3. Responses to “Are you aware of the NTZ in Lamlash Bay?” by respondent type

Table 5 shows a further breakdown of where visitors were surveyed and what percentage at each location was aware of the NTZ. A higher percentage of visitors sampled while on Arran or when leaving Arran (58.22% and 58.82% respectively) were aware of the NTZ than those sampled when on their way to Arran (33.81%). This is encouraging, as it suggests that visitors are being informed about the NTZ while on Arran. However, many visitors are still unaware of the NTZ after their visit, suggesting the need for greater information provision.

Table 5. Visitor awareness of the NTZ by survey location

Location	N	Percentage at this location aware of NTZ
To Arran (Ferry Ardrossan to Brodick)	139	33.81
On Arran (various locations)	146	58.22
Leaving Arran (Ferry Brodick to Ardrossan)	85	58.82
Unknown	30	80
Total	400	-

4.3 Are respondents aware of which activities are allowed/banned in the NTZ?

Respondents were asked to indicate which of the following activities they believed are allowed in the NTZ:

- Swimming
- Diving & snorkelling
- Recreational fishing
- Commercial fishing
- Boating
- Photography
- Collecting shellfish

The correct responses are swimming, diving and snorkelling, boating and photography. Recreational fishing, commercial fishing and collecting shellfish are banned within the NTZ's boundaries (see figures 4(i) and 4(ii) for information boards displayed at the NTZ).



Figures 4(i) and 4(ii). Information boards displayed at Lamlash Pier, Clauchland's Point and in Coast leaflets

Figure 5 shows overall percentages of correct responses out of seven. 413 (50.48%) respondents indicated only the correct activities i.e. “scored” seven. However, 18.72% scored zero, suggesting a level of uncertainty about what is allowed/banned in the NTZ. This is an important finding, considering that concerns

have been raised in the past about how clear the signage for the NTZ is. 56.65% of males scored seven, compared with 45.35% of females.

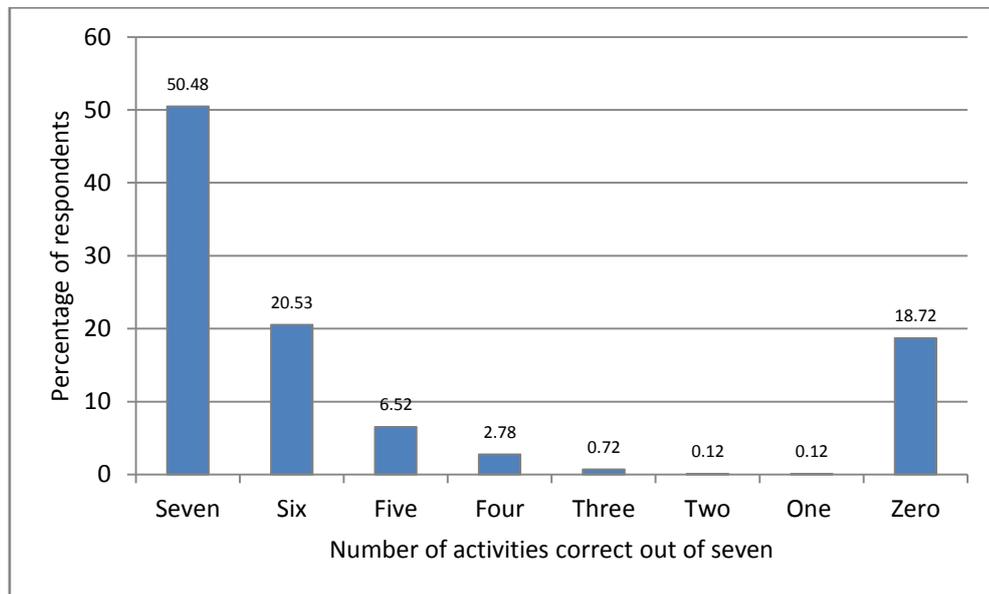


Figure 5. Percentages of correct responses out of seven to “What activities are allowed in the NTZ?” (Swimming, diving & snorkelling, boating, photography, recreational fishing, commercial fishing, collecting shellfish)

To examine which activities may be causing confusion, figure 6 shows responses by activity. 12.32% believed that recreational fishing is allowed compared with only 0.85% who believed that commercial fishing is allowed. Even amongst allowed activities, there was still some uncertainty. For example, 89 respondents (10.75%) believed that diving and snorkelling is not permitted.

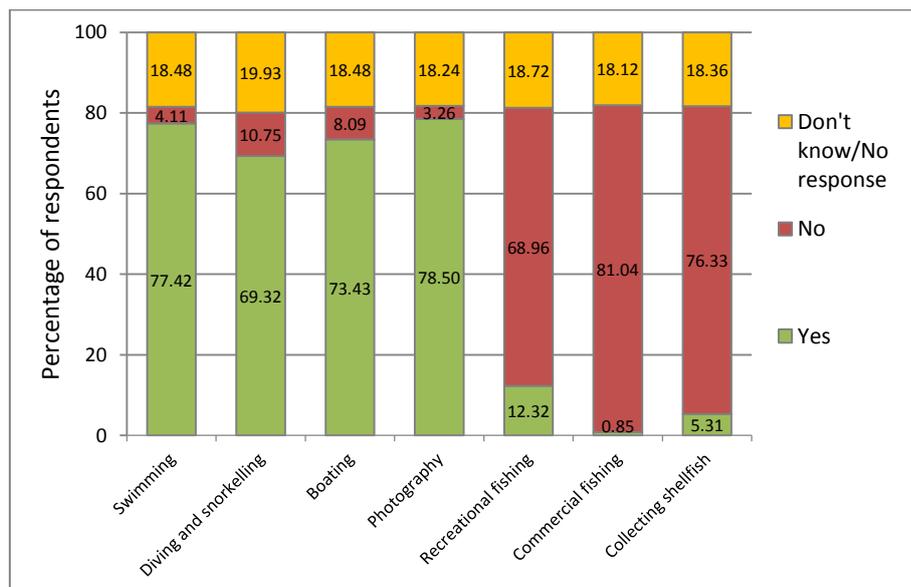


Figure 6. Responses, by activity, to “What activities are allowed in the NTZ?”

Figure 7 shows “all correct” responses (i.e. respondents who only indicated allowed activities) by respondent type. 69.12% of businesses gave the correct responses, compared with 58.50% of residents, 48.48% of “other” respondents and 41.75% of visitors. A Kruskal-Wallis test showed a significant effect of respondent type on number of correct responses, $H(3) = 57.02$, $p = <.001$. Mann-Whitney tests compared respondent group pairs, using the Bonferroni correction to adjust for repeated testing. A significant difference was found between businesses and visitors ($U = 8,528.5$, $p = <.001$), businesses and “other” ($U = 1,685$, $p = 0.005$) and residents and visitors ($U = 43,553$, $p = <.001$). No other pair-wise comparison was significant. This suggests, as we would expect given their lower awareness of the NTZ, that visitors were less aware than other respondent types of which activities are allowed/banned within its boundaries.

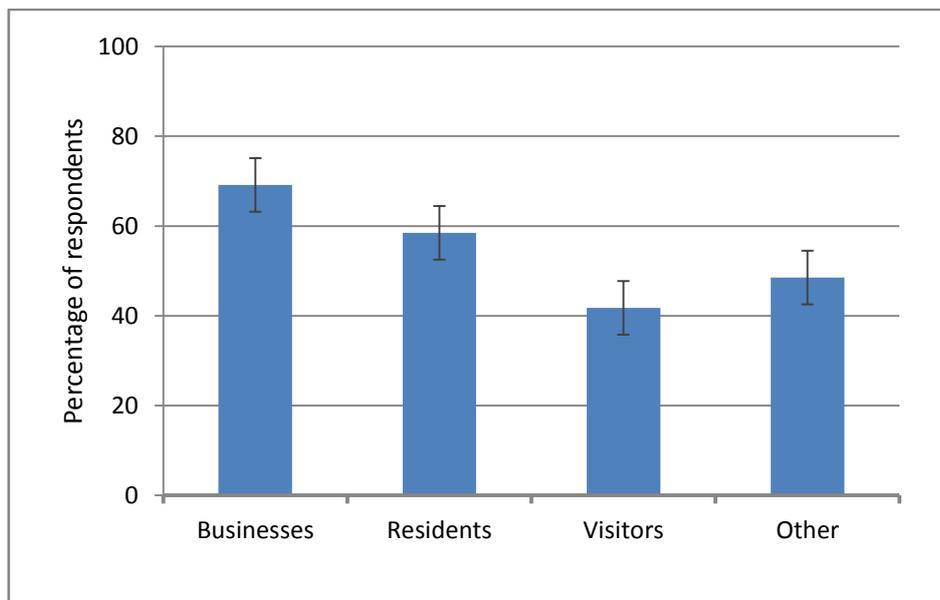


Figure 7. Percentage of “all correct” responses to “What activities are allowed in the NTZ?” by respondent type

4.4 What do respondents believe are the purposes of the NTZ?

Figure 8 shows responses to “what do you think is the main purpose of the Lamlash Bay NTZ?” Respondents were told to tick all options that applied. The most common response was “to allow marine life in the area to regenerate”, with 82.73% of respondents choosing this as one of their responses. Responses concerning fishing access were mixed, again suggesting uncertainty in this area. 28.86% of respondents agreed that a main purpose of the NTZ is “to help revitalise

the local fishing industry”. While some respondents were making a link between the NTZ and possible fisheries benefits, this does suggest that more could be done to educate people about these benefits, as this may increase support for the NTZ.

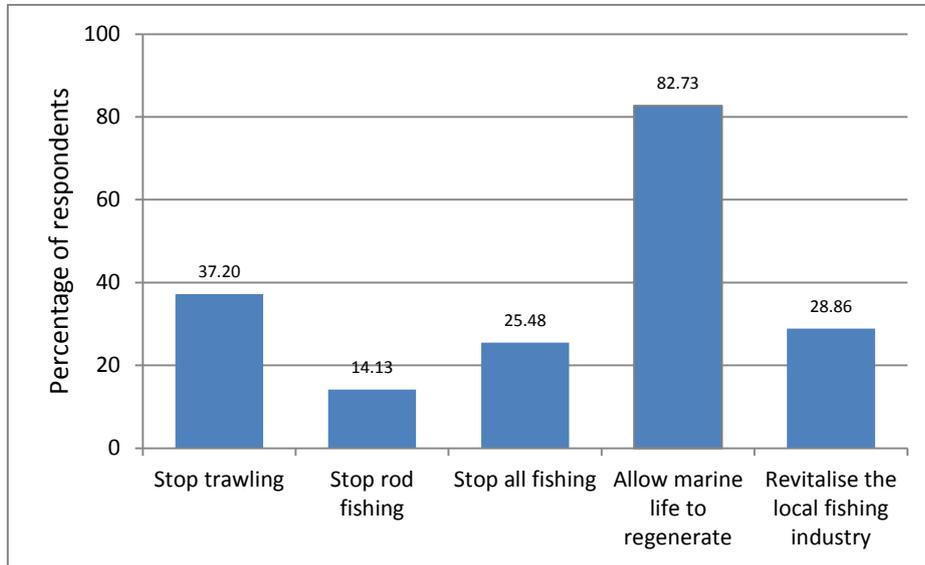


Figure 8. Responses to “What is the main purpose of the NTZ in Lamlash Bay?”

4.5 Do respondents show awareness of wider marine conservation issues?

4.51 Sustainability of fishing methods

Respondents were asked to rank, in order, the sustainability of five fishing methods (spear gun fishing, lobster creeling and potting, scallop bottom dredging, rod and line fishing and otter trawling) (figure 9). Responses suggest that rod and line fishing was considered most sustainable and scallop bottom dredging least sustainable. A Kruskal-Wallis test showed a significant difference between median rankings of fishing methods, $H(3) = 1933.47$, $p = <.001$. Mann-Whitney tests with adjusted p values showed all pair-wise comparisons to be significant at the $<.001$ level.

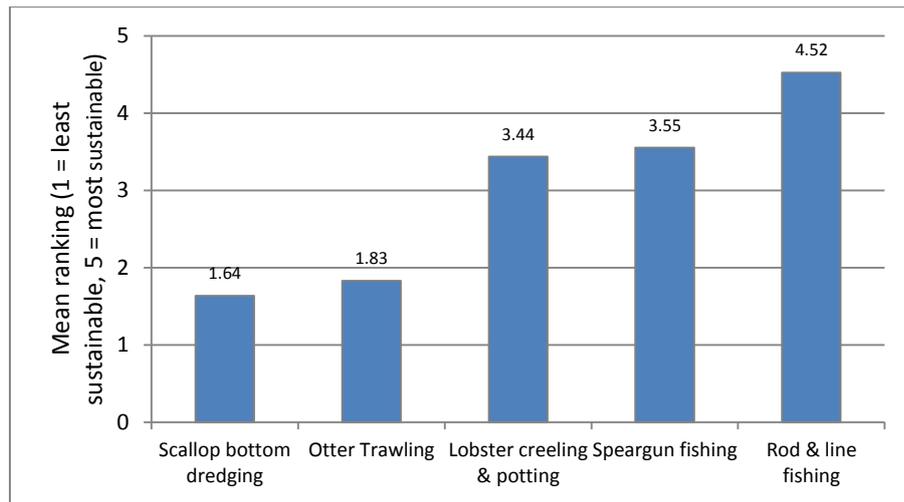


Figure 9. Mean ranking of sustainability of fishing methods, where 1 = least sustainable and 5 = most sustainable)

Responses suggest that respondents did differentiate between different gears, showing some awareness of the damaging effects of gears such as dredges and trawlers. It would have perhaps been more appropriate to rank gears in order of how damaging they are, as sustainability is a subjective concept. However, it would then be necessary to differentiate between damage to populations and damage to habitats since, for example, spear gun fishing is damaging to fish populations but may not destroy habitats.

4.52 Are respondents aware of UK NTZ coverage?

There are currently three NTZs in UK coastal waters (i.e. within the UK’s exclusive economic zone (EEZ)), at Lundy Island in the Bristol Channel (3.3km²), Flamborough Head in the North Sea (1km²) and Lamlash Bay (2.7km²) (UK MPAs, n.d.). The total area of the UK EEZ (excluding overseas territories) is 773,767km² (Sea Around Us, n.d.), therefore total NTZ coverage is approximately 0.001%¹.

Respondents were asked what they believed current NTZ coverage to be and what they believed it should be (figure 10). The mean response to “what percentage of UK coastal waters do you think is currently protected from fishing by NTZs?” was 9.22%. The mean response to “what percentage of UK coastal waters do you think should be protected from fishing by NTZs?” was 44.50%. 25.60% and 26.45% of respondents did not respond/did not know respectively. The average difference between responses (i.e. “should” less “current”) was 33.79. A Wilcoxon signed

¹Calculated by author

ranks test showed a significant difference between responses to the two questions, $Z = 19.77$, $N - \text{Ties} = 538$, $p = <.001$.

Mann-Whitney tests also showed a significant effect of gender on responses to both questions, with females giving a significantly higher mean response to both ($U = 39, 42.50$, $p = .001$ and $U = 34,797$, $p = <.001$ respectively).

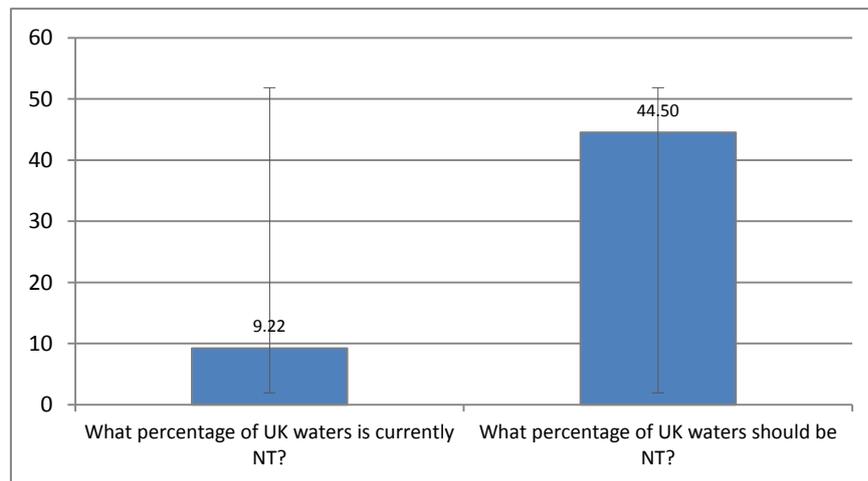


Figure 10. Mean responses to “What percentage of UK coastal waters do you think are currently protected from fishing by NTZs?” and “What percentage of UK coastal waters do you think should be protected from fishing by NTZs?”

However, responses to both questions ranged from 0-100%, reflected by the standard error bars. Closer examination of the range of responses to “what percentage is currently NT?” (figure 11) shows that 10.99% of respondents believed that NTZ coverage is $<1\%$ (8.94% if “zero” responses are omitted), with the modal response range being 1-5% (36.23% of respondents). If the no response category is omitted, the modal response range to “what percentage should be NT?” was 41-60% (20.41% of respondents). This suggests that, although exact knowledge was low, many respondents correctly believed that only a low percentage of UK waters are fully protected from fishing.

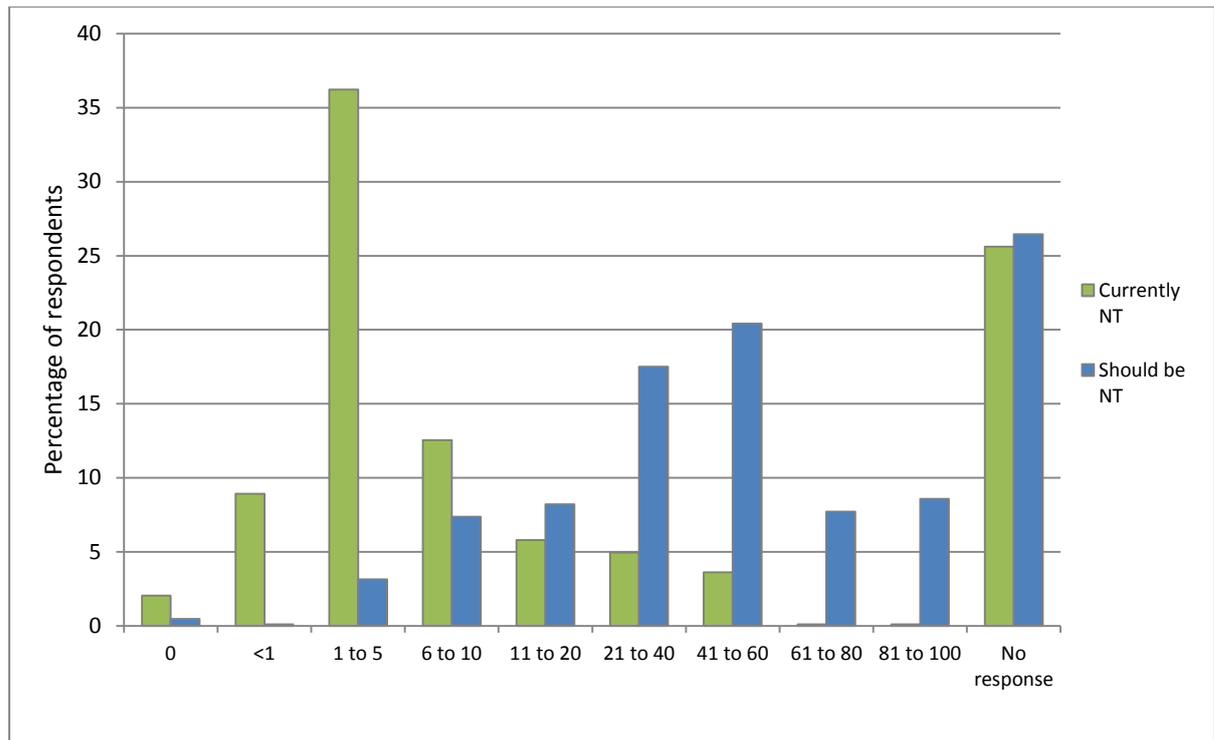
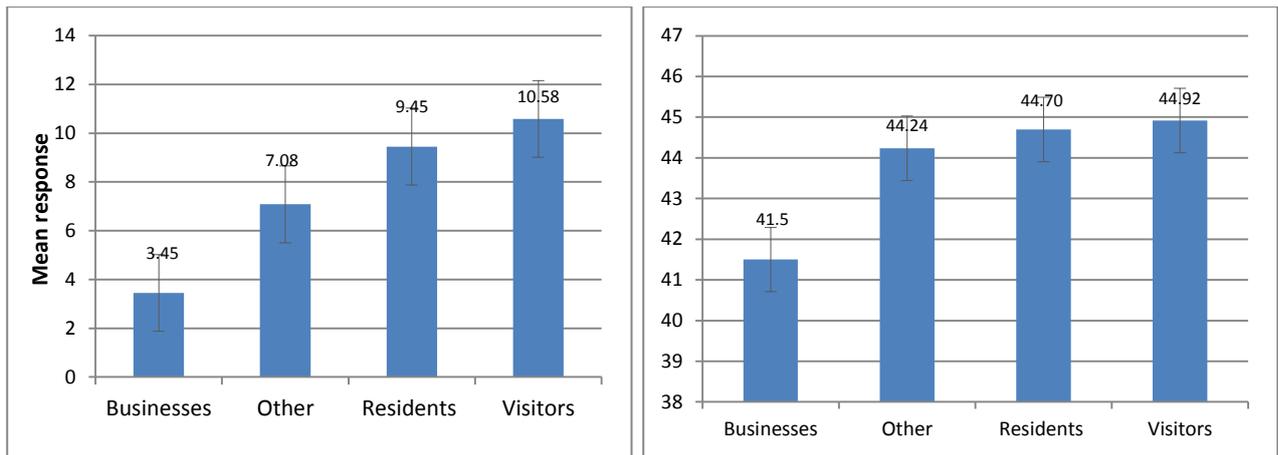


Figure 11. Range of responses to “What percentage of UK coastal waters do you think are currently protected from fishing by NTZs?” and “What percentage of UK coastal waters do you think should be protected from fishing by NTZs?”

Spearman’s rho showed a significant positive correlation between responses to these questions, $r = .410$, $p = <.001$. It could be that respondents were simply inclined to give either lower or higher responses for both questions. Alternatively, respondents who had a better idea of current NTZ coverage may also have been more conservative with their responses to the second question.

Figures 12(i) and 12(ii) show mean responses by respondent type. Results suggest that visitors gave the highest mean response to both questions, again as would be expected given their lower awareness in previous questions. A Kruskal-Wallis test showed a significant effect of respondent type on responses to “what percentage is currently NT?” $H(3) = 36.98$, $p = <.001$. Mann-Whitney tests with an adjusted p value showed a significant difference in mean response between businesses and residents ($U = 3,781.50$, $p = <.001$), businesses and visitors ($U = 4,387$, $p = <.001$) and visitors and “others” ($U = 5,872$, $p = .002$). No other pair-wise comparison was significant. While responses to “what percentage do you think should be NT?” showed a similar pattern, there was no significant difference in mean responses.



Figures 12(i) and 12(ii). Mean responses by respondent type to (i) “What percentage of UK coastal waters do you think are currently protected from fishing by NTZs?” and (ii) “What percentage of UK coastal waters do you think should be protected from fishing by NTZs?”

There was no significant difference between mean responses by residents and visitors on either question, suggesting that Isle of Arran residents (excluding island based businesses) are no more aware of UK NTZ coverage than a wider population. While this may be true, a sampling issue may also have influenced this result. Responses to both questions show a significant negative correlation with age (table 6), suggesting that older younger respondents tended to give higher responses. As the sample of residents contained a higher proportion of younger respondents than visitors, due to sampling at Arran High School and Arran Outdoor Centre (25.17% of residents aged 0-19, compared with only 5.75% of visitors), the mean response by residents may have been skewed upwards.

Table 6. Spearman’s rho correlation matrix: Age*Currently NT*Should be NT

	Age	Currently NT	Should be NT
Age		-.261, p = <.001	-.092, p = .025
Currently NT	-.261, p = <.001		.410, p = <.001
Should be NT	-.092, p = .025	.410, p = <.001	

4.6 Attitudes towards the NTZ

Residents of Arran were asked whether they thought the NTZ has had/could have any positive or negative impacts on the island (figure 13). 53.04% of respondents agreed the NTZ has/could positively affect Arran, compared with 7.48% who disagreed. 39.49% did not respond. 6.78% of respondents agreed that the NTZ has/could negatively affect Arran, compared with 51.64% who disagreed. 41.59% did not respond.

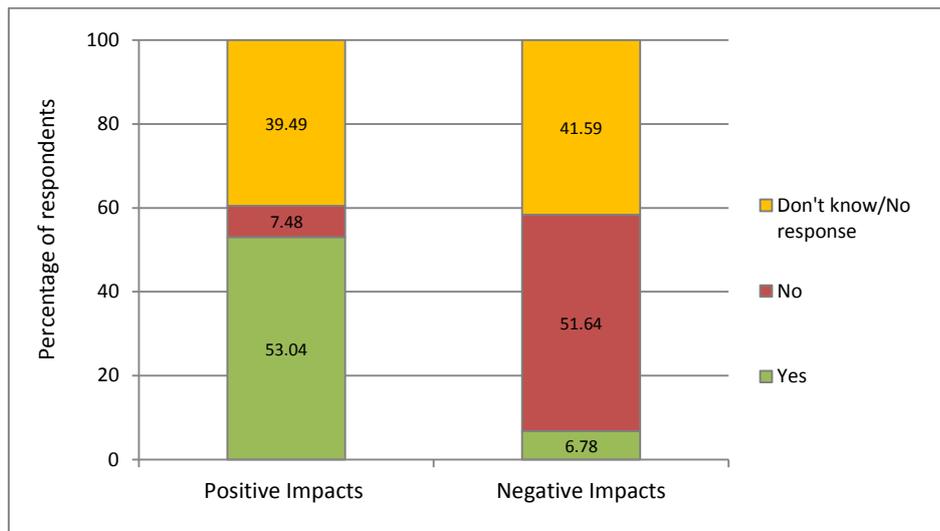


Figure 13. Responses to “Do you think that the NTZ has had/could have any positive impacts on Arran?” and “Do you think the NTZ has had/could have any negative impacts on Arran?”

Respondents were asked to give more detail with an open ended response if they answered “yes” to either question. Perceived positive impacts have been grouped under two headings, environmental and non-environmental. As table 7 shows, responses mainly focused on the environmental benefits of the NTZ. A lower number of respondents also mentioned further benefits such as increased tourism and improving the reputation of Arran.

Table 7. Perceived positive impacts of the NTZ on Arran

Factor	n respondents
Environmental factors	
Positive impacts on sea life/the seabed	99
Increased environmental awareness/community involvement	48
Provides a precedent for further NTZs/marine conservation	21
Positive impacts on other wildlife	2
Total	170
Non-environmental factors	
Raises the profile/creates a good image of Arran	42
Increases tourism/encourages visitors	23
Fisheries benefits/will be able to serve local fish	14
More space for/encourages other activities	5
Encourages research	3
Improves the aesthetic of the bay	1
Has prevented expansion of fish farms	1
Total	89
Overall total	259

Table 8 shows perceived existing or potential negative impacts of the NTZ on Arran. Negative impacts were mainly related to restrictions on fishing, with community conflict and enforcement also cited.

Table 8. Perceived negative impacts of the NTZ on Arran

Factor	n respondents
NTZ has limited fishing	9
NTZ has limited fishing (but this is necessary)	3
Conflict within the community	3
Problems with enforcement	1
Reduced visitors (e.g. anglers)	1
Confusion over boards has reduced business	1
Total	18

Figure 14 shows Likert scale responses by residents and businesses to “Overall, I think that the NTZ in Lamlash Bay is a good thing”. 78.68% of respondents strongly agreed/agreed with this statement, 5% neither agreed nor disagreed, 1.32% strongly disagreed/disagreed and 15% did not respond. This suggests a high level of support for the NTZ amongst Arran residents. There was a significant positive correlation between age and responses to this question ($r = .311$, $p = <.001$), suggesting that older respondents were more likely to have a positive attitude towards the NTZ.

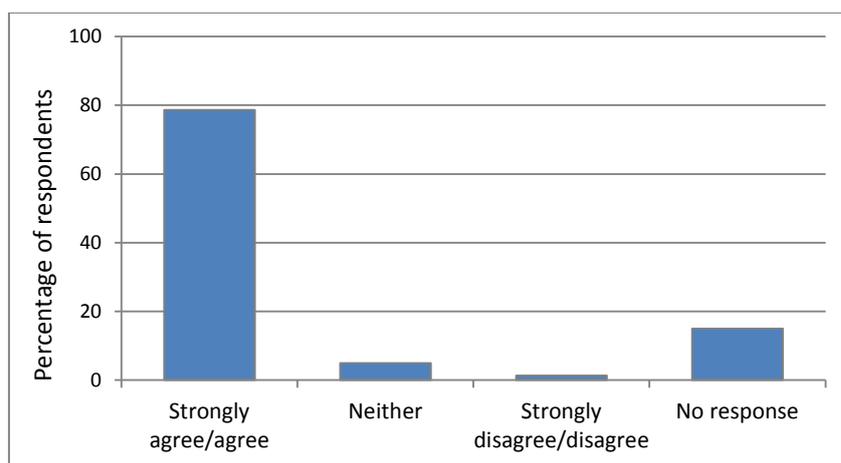


Figure 14. Likert scale responses to “Overall, I think that the NTZ in Lamlash Bay is a good thing” (Response options: strongly agree, agree, neither agree or disagree, disagree, strongly disagree)

4.7 What are the attitudes of businesses towards the NTZ?

Sixty eight businesses were surveyed in total. Businesses were asked whether they mention Lamlash Bay NTZ in their marketing etc and whether their guests/customers ever ask them about the NTZ. Table 9 shows responses organised by business categories. Note that five businesses fell into both the accommodation and food categories, hence a total of 73. Fifty six businesses were based on Arran, while twelve were not, or of unknown location. Fifteen businesses said they mention the Lamlash Bay NTZ in their marketing, 44 that they do not and 9 did not respond to this question.

Table 9. Businesses by category and mentions of NTZ in marketing

Category	n	n which mention NTZ in marketing	Median response to “do guests/customers ever ask you about the NTZ?”
Retail	19	1	1
Accommodation	19	1	2
Food	9	0	2
Outdoor activities	6	6	3
Fisher/sea angling/fishery association	4	1	4
Environmental organisation	2	2	3
Events	1	1	4
Photography	1	0	1
Other	5	3	1
Unknown	7	0	1
Total	73	15	2

Figure 15 shows Likert scale responses to “How often do your guests/customers ask you about the NTZ?”. The modal response was “never” (42.37% of respondents). 18.64% answered “rarely”, 27.12% “sometimes” and 11.86 “often”.

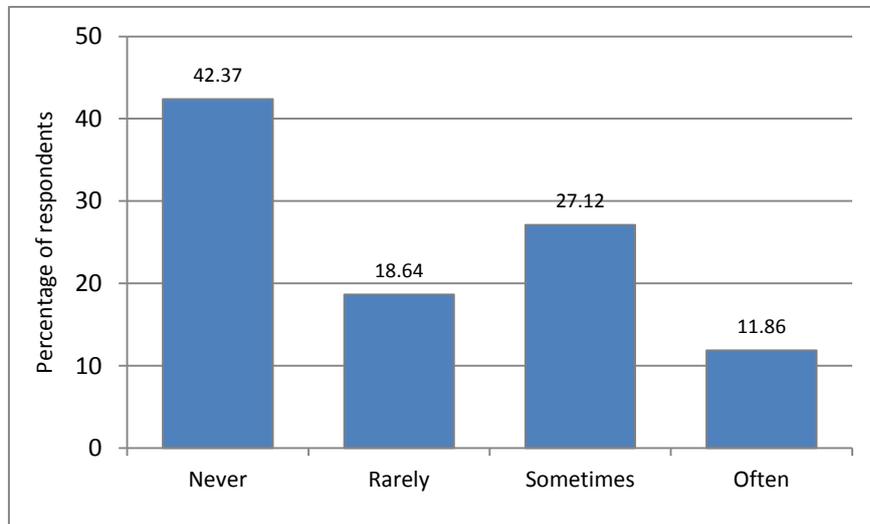


Figure 15. Likert scale responses to “How often do your guests/customers ask you about the Lamlash Bay NTZ?” (Response options: strongly agree, agree, neither agree or disagree, disagree, strongly disagree)

Respondents were asked whether they believed the NTZ has had/could have any positive or negative impacts on their business (figure 16). 36.76% of respondents agreed that the NTZ could positively impact their business, compared with 52.94% who believed it could not. 2.94% believed that the NTZ could negatively impact their business, compared with 85.29% who believed it could not. Positive impacts included increased numbers of visitors to Arran and therefore increased business, more wildlife to show to customers and the possibility of serving local fish in the future. Negative impacts were related to loss of business due to limited fishing access.

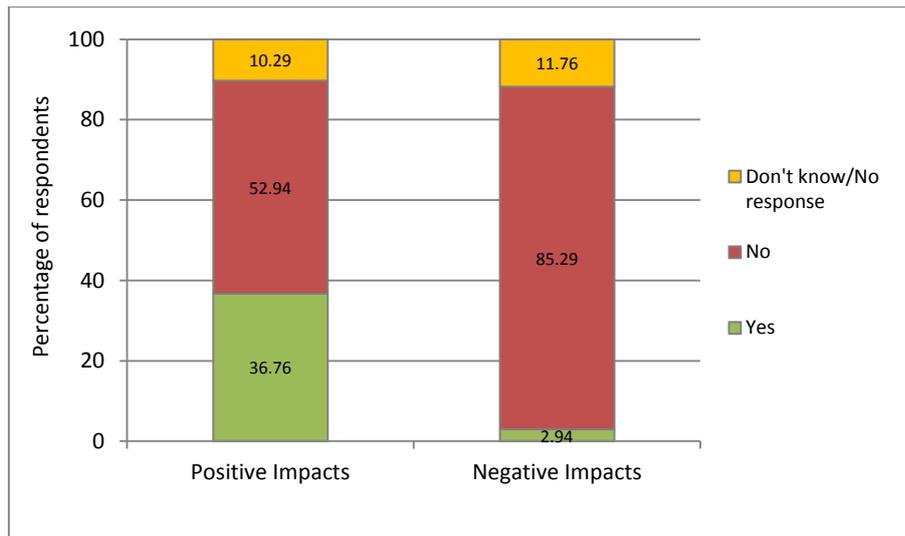


Figure 16. Responses to “Do you think that the Lamlash Bay NTZ has/could positively impact your business?” and “Do you think that the Lamlash Bay NTZ has/could negatively impact your business?”

Responses to these questions suggest that potentially mutually beneficial links between COAST and island businesses are not being exploited as well as they might be. For example, if hotels mention the NTZ they can promote COAST’s work, but also potentially increase business from people interested in the environment.

4.8 Are respondents interested in learning more about the NTZ and the marine environment?

Respondents were asked whether they would visit a marine interpretation centre on Arran, and whether they would be interested in guided rock pool tours (figure 17). 78.99% of respondents indicated that they would visit a marine interpretation centre, compared with 19.08% who would not. While COAST regularly has displays and tanks containing examples of marine fauna at events on Arran, and some information at the Brodick Tourist Office, there is no permanent, dedicated education centre. The high level of interest indicated by this question suggests that a marine interpretation centre would be an excellent way to educate both residents and visitors about the NTZ and the diverse sea life around Arran.

66.11% of respondents said they would be interested in guided rock pool excursions, while 30.07% said they would not. The lower level of interested in rock pooling may be because this activity is less accessible, for example for those with limited mobility. Although data was not collected on this, younger respondents or

families would probably be more interested in this activity than older respondents. COAST has already run a number of “Seashore Scrambles”. Attendance has been varied, ranging from approximately 60 people at one event (run in conjunction with National Trust for Scotland), with approximately ten on average. Numerous factors, such as site, season, weather and marketing will all affect attendance of scrambles.

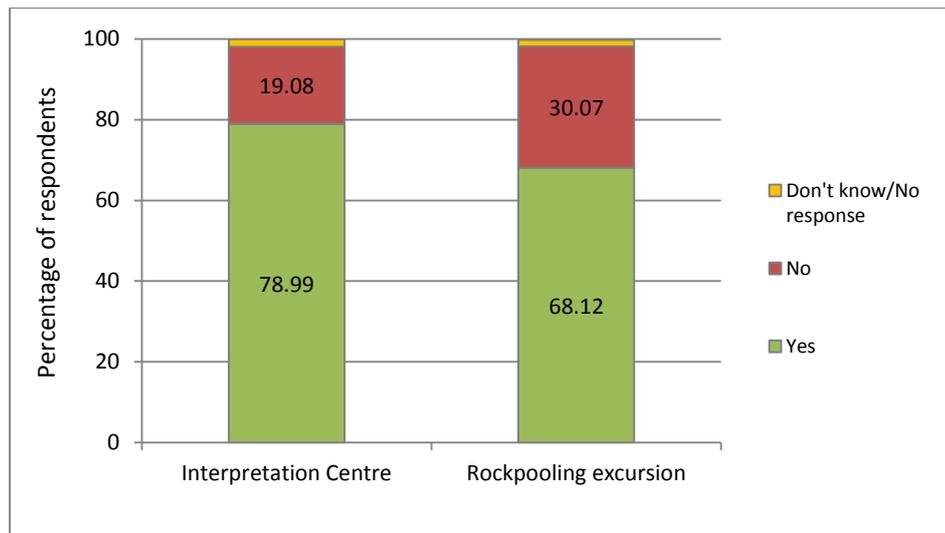


Figure 17. Responses to “Would you be interested in visiting a marine interpretation centre on Arran if this was available?” and “Would you be interested in a guided rock pool excursion if this was on offer?”

5.0 Limitations of the study

The current study focused on attitudes and awareness of the NTZ, rather than an assessment of its economic impacts. Future research could assess to what extent the NTZ has “added value” to Arran, and whether there has been any significant economic impact, either positive or negative, on the population. This should consider the extent to which the NTZ impacts on income from fisheries, including creeling and sea angling. In particular, when considering the possible implementation of an MPA around the south of Arran, an assessment of current spatial use of these waters should be made, in addition to ecological mapping.

Sampling was mainly carried out on the east side of the island and sample size represented a small proportion of Arran’s population, meaning that results may not be representative of Arran as a whole. However, as previously discussed, it was felt that sampling in busier areas was important to increase sample size.

While effort was made to actively encourage involvement from all stakeholders, sampling biases may have had some impact on results. Although results suggest a great deal of support for the NTZ, it was often difficult to gain responses from those who may hold more negative views of the NTZ. However, results are still useful as an indicator of awareness and attitudes of the general population of and visitors to Arran.

Social desirability bias, the over-reporting of accepted attitudes and behaviours, is an issue with any survey (Nancarrow and Brace, 2000). In this case, people may have given more positive responses, as being “environmentally minded” could be seen as a socially desirable trait. However, the high proportion of no response/don’t know responses and the fact that many respondents stated that they knew very little about marine conservation suggests a willingness to admit low awareness.

6.0 Conclusions

The main findings of the study will now be outlined with reference to the original aims.

6.1 Examine awareness of the Lamlash Bay NTZ

Overall, just under 75% of respondents were aware of the NTZ. Visitors were less aware of the NTZ than other respondent types, with those sampled on their way to Arran showing lower awareness than those sampled on or leaving Arran. Similarly, businesses and residents were more aware than visitors of which activities are allowed/banned within the NTZ. However, there was a fairly high level of uncertainty overall, with recreational fishing and diving and snorkelling causing particular confusion. Most respondents agreed that agree that a main purpose of the NTZ is to allow marine life to regenerate, with fewer respondents making a link between the NTZ and possible fisheries benefits.

In terms of more general marine conservation issues, respondents differentiated fishing gears in terms of sustainability, showing some awareness of the damaging effects of gears such as dredges and trawlers. Precise knowledge of UK NTZ was,

as expected, limited, with many respondents giving no response. However, the modal response range was 1-5%, so there was a general awareness that coverage is low. On average, respondents believed that 44.50% of UK coastal waters should be protected by NTZs.

6.2 Examine attitudes towards the Lamlash Bay NTZ

Overall, support for the NTZ from residents was high. Many residents believed the NTZ has had/could have a positive impact on Arran. The focus here was mainly on environmental factors, such as the recovery of marine species and habitats, although some respondents cited tourism and fisheries benefits. A small number of respondents believed the NTZ has had/could have a negative impact on Arran, with issues raised including limits on activities, confusion over these limits, community conflict and problems with enforcement. Interest in a marine interpretation centre and guided rock pool excursions was high, but attendance would vary greatly by season.

Over half of businesses surveyed did not think that the NTZ has/could have any positive impacts on them, although only two out of 68 businesses believed they could/have been negatively impacted. Few businesses mention the NTZ in their marketing (those that do tended to be outdoor activity related) and most said that customers rarely or never ask them about the NTZ.

6.3 Implications for COAST, the Lamlash Bay Implementation Group and management of the NTZ

6.31 Raising awareness of the NTZ and marine conservation

COAST, as a mainly voluntary community organisation, has maintained a high local profile and encouraged community involvement. Results suggest that awareness of the NTZ was higher among residents than other respondent types. While boards and leaflets do provide some information, there is still a tendency for sea life to be out of sight out of mind, as both the diverse nature of the waters off Arran and the impacts of fishing are not visible to the general public. A dedicated marine interpretation centre would be an ideal way to educate people both about the NTZ and wider marine conservation issues, but this would be expensive to

implement. In the meantime, alternative options could be considered, for example improvement of displays at the Brodick tourist office and a continued presence at island events.

The issue of confusion over activities allowed/not allowed in the NTZ must also be addressed, as this may negatively affect some island businesses and contribute to negative attitudes.

6.32 Engaging with all stakeholders and overcoming negative attitudes

While attitudes towards the NTZ were generally positive, negative opinions must not be ignored and a practice of gaining feedback from all stakeholders maintained (bearing in mind that the current study may have been limited in this aspect). In order to engage and maintain the support of the whole community, there must be complete transparency of research concerning the NTZ.

6.33 Encouraging further links between conservation, tourism and businesses on Arran

Tourism represents a major source of income and employment on Arran, with many tourists visiting to enjoy the island's natural environment (Craigforth, 2007; AEP, 2011). Results suggest that, while outdoors and/or conservation businesses were well engaged, mutually beneficial links between COAST and businesses on the island are not yet being fully exploited. COAST should be in direct contact with as many businesses as possible, making sure that owners have information and leaflets to give to their guests/customers, and encouraging them to see the NTZ as a "selling point".

To conclude, results suggest that awareness of the Lamlash Bay NTZ is generally high and attitudes positive. However, further efforts could be made to educate visitors to Arran, to encourage involvement and information sharing between stakeholders and to promote the NTZ as a potential source of benefits to industries such as tourism and fishing. While the current study has focused on attitudes and awareness of the existing NTZ, it also has implications for the proposed MPA around the south of Arran, which should include an assessment of spatial uses and

expected short and long term socio-economic impacts. In particular, it highlights the importance of on-going public consultation and awareness raising, clear signage and interpretation panels, and the engagement of businesses and stakeholders in the management of MPAs.

Acknowledgements

With many thanks to all respondents, Sally Campbell, Andrew Binnie, Howard Wood, Sharron, Martin, Hannah, Harvey and Amelia at the Invermay Guest House, Jenny Meade, Jim Henderson, COAST supporters for distributing surveys (especially Rob Ingham), Jane Macbeth at Arran High School, Richard Smalls of the Auchrannie Resort, Claire Richardson of Visit Arran, staff at Visit Arran, Brodick Tourist Information, Lamlash Post Office, Lamlash Co-op and the Auchrannie Resort.

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Residents and Visitors Survey

THE UNIVERSITY *of* York

This survey is for residents and visitors to the Isle of Arran. Please do not complete this survey if you own a business on Arran. Thank you for agreeing to complete this survey. Your responses are confidential and will be used for research purposes only.

1) Are you a (please tick):

Resident Visitor Other (please specify)

.....

2) Are you a member of the Community of Arran Seabed Trust (COAST)?

Yes No

3) (i) Are you aware of the no-take zone in Lamlash Bay?

Yes No

(ii) If you are a visitor, had you heard of the no-take zone before arriving on Arran?

Yes No

(iii) If you have heard of the no-take zone, how did you learn about it?

.....

4) What activities are allowed in the no-take-zone? (Please tick all that apply)

Swimming

Boating

Diving and snorkelling

Photography

Recreational fishing

Collecting shellfish

Commercial fishing

5) What do you think is the main purpose of the no-take zone in Lamlash Bay? (Please underline all that apply)

To stop trawlers fishing in the area

To allow marine life in the area to regenerate

To stop rod fishing in the area

To help revitalise the local fishing industry

To stop all kinds of fishing in the area

6) Would you (and your friends/family) visit a marine interpretation centre on Arran if this was available?

Yes No

7) Would you (and your friends/family) be interested in a guided rock pool excursion if this was on offer?

Yes No

8) Please rank the following fishing methods in order of sustainability (1 = most sustainable, 5 = least sustainable)

Spear gun fishing

Rod and line fishing

Lobster creeling/potting

Otter trawling

Scallop bottom dredging

9) What percentage of UK coastal waters do you think are currently protected from fishing by no-take zones?

.....

10) What percentage of UK coastal waters do you think should be protected from fishing by no-take zones?

.....

11) What is your gender?

Male Female

12) What is your age?

.....

13) Would you say that your income (Please underline your answer)

Does not meet your needs?

Just meets your needs?

Meets your needs with some income leftover for luxury items?

Allows you to buy lots of luxury items?

If you are a resident of Arran, please complete questions 14-16

14) (i) Do you think that the no-take zone has had any positive impacts on Arran?

Yes No

(ii) If yes, please give a brief description of positive effects

.....
.....
.....

15) (i) Do you think that the no-take zone has had any negative impacts on Arran?

Yes No

(ii) If yes, please give a brief description of negative effects

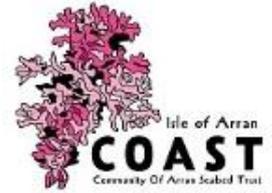
.....
.....
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16) Do you agree or disagree with the following statement? (Please underline your answer)

“Overall, I think that the no-take zone in Lamlash Bay is a good thing”

Strongly agree Agree Neither agree or disagree Disagree Strongly disagree

Thank you again for taking part. The Lamlash Bay no-take zone, Scotland’s first, was established in 2008 in order to protect crucial marine habitats and regenerate fish and scallop populations. If you would like more information about the Lamlash Bay no-take zone please visit www.arrancoast.com



Business Survey

THE UNIVERSITY *of* York

This is a survey for business owners on Arran. Please do not complete this survey if you do not own a business or if you are visiting Arran. Thank you for agreeing to complete this survey. Your responses are confidential and will be used for research purposes only.

17) Are you a member of the Community of Arran Seabed Trust (COAST)?

Yes No

18) (i) Are you aware of the no-take zone in Lamlash Bay?

Yes No

(ii) If you have heard of the no-take zone, how did you learn about it?

.....

19) What activities are allowed in the no-take zone? (Please tick all that apply)

- | | |
|------------------------|----------------------|
| Swimming | Boating |
| Diving and snorkelling | Photography |
| Recreational fishing | Collecting shellfish |
| Commercial fishing | |

20) What do you think is the main purpose of the no-take zone in Lamlash Bay? (Please underline all that apply)

- | | |
|--|--|
| To stop trawlers fishing in the area | To allow marine life in the area to regenerate |
| To stop rod fishing in the area | |
| To stop all kinds of fishing in the area | To help revitalise the local fishing industry |

21) What kind of business do you run? (Please name your business if possible)

.....
.....

22) (i) Do you think your business benefits or could benefit directly or indirectly from the no-take zone?

Yes No

(ii) If yes, please give a brief description of positive effects

.....
.....

23) (i) Do you think your business has been or could be negatively affected by the no-take zone?

Yes No

(ii) If yes, please give a brief description of negative effects

.....
.....

24) Do you agree or disagree with the following statement? (Please underline your answer)

“Overall, I think that the no-take zone in Lamlash Bay is a good thing”

Strongly agree Agree Neither agree or disagree Disagree Strongly disagree

25) (i) Do you refer to the no-take zone as part of your marketing effort (including website?)

Yes No

(ii) If yes, please describe how

.....

26) How often do your guests/customers ask you about the no-take zone? (Please underline your answer)

Never

Sometimes

Rarely

Often

27) Would you (and your friends/family) visit a marine interpretation centre on Arran if this was available?

Yes No

28) Would you (and your friends/family) be interested in a guided rock pool excursion if this was on offer?

Yes No

29) Please rank the following fishing methods in order of sustainability (1 = most sustainable, 5 = least sustainable)

Spear gun fishing

Rod and line fishing

Lobster creeling/potting

Otter trawling

Scallop bottom dredging

30) What percentage of UK coastal waters do you think are currently protected from fishing by no-take zones?

.....

31) What percentage of UK coastal waters do you think should be protected from fishing by no-take zones?

.....

32) What is your gender?

Male Female

33) What is your age?

.....

34) Would you say that your income (Please underline your answer)

Does not meet your needs?

Just meets your needs?

Meets your needs with some income leftover for luxury items?

Allows you to buy lots of luxury items?

Thank you again for taking part. The Lamlash Bay no-take zone, Scotland's first, was established in 2008 in order to protect crucial marine habitats and regenerate fish and scallop populations. If you would like more information about the Lamlash Bay no-take zone please visit www.arrancoast.com