Waterfowl hunters' motivations and barriers to participation in a citizen science project

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Abstract

A citizen science project using hunters to provide information on waterbird demographics was recently restarted in the UK. Hunters were encouraged to submit one wing from each duck or goose that they had harvested during the hunting season, from which the species, sex and age of the birds were determined from plumage characteristics. With knowledge of bias and error in the wing sampling process, these data can be used to infer the age and sex ratios in the national bag, and potentially in their populations, for species included in the surveys. In order to ensure high participation levels, members of the UK's largest hunting organisation – the British Association for Shooting and Conservation (BASC) – were surveyed to identify motivations for taking part, as well as any constraints preventing entry to the survey. Hunters who confirmed that they had contributed to the wing survey reported being motivated by selfless rewards such as "for the good of science and conservation". When asked about future participation, however, hunters that cited extrinsic, reward-driven motivations such as "to protect my sport" were significantly more likely to report that they would take part in the future. The most commonly reported constraint was that species included in the survey were not being harvested, but the next two most commonly reported constraints were a lack of storage space and inability to use or access shared domestic storage space. Results of this study will be used to tailor wing survey recruitment and reporting messages, in order to encourage greater recruitment and retention of survey participants.

Key words: participatory science, parts collection survey, waterfowl hunting, wing survey.

Citizen science, in which non-professionals collect and in some cases analyse data, has long been used to inform scientific research, but has recently received renewed attention (Ryan *et al.* 2018). Structured citizen science projects probably started with the Christmas Bird Counts in the USA in the early 1800s (Droege 2007), although it is likely that citizens have been involved in gathering data such as meteorological and biodiversity

records over much longer periods. In the past 20 years, citizen science has increasingly been recognised as making important contributions to research (Cooper *et al.* 2014; McKinley *et al.* 2017), often providing good quality (Aceves-Bueno *et al.* 2017), cost-effective data (Aceves-Bueno *et al.* 2017), though there can be challenges in making a robust analysis of unstructured citizen science data (Kamp *et al.* 2016; Van Strien *et al.* 2013).

Motivations for taking part in citizen science vary, and often multiple reasons are cited. One way of classifying motivations is by applying Self-Determination Theory (Deci & Ryan 1985; Ryan & Deci 2000). This proposes that there is a continuum between individual self-autonomy (intrinsic motivation) and controlled regulation (extrinsic motivation). Intrinsic motivators in citizen science include drivers such as pleasure and learning (Land-Zandstra *et al.* 2016) or contribution to science or conservation (Curtis 2015; Raddick *et al.* 2010), whereas extrinsic motivators include external incentives such as financial (Crowston & Prestopnik 2013) or game rewards (Bowser *et al.* 2013) and improving career prospects (Geoghegan *et al.* 2016). It is also clear that these motivations can change through time (Rotman *et al.* 2014a).

Hunters have a role to play as citizen scientists by providing information on hunting activity and effort. Waterfowl wings submitted by hunters from shot birds can be identified based on plumage characteristics to species, age and sex class, which given knowledge about the potential bias and errors in gathering the sample, can be used to infer information about these ratios in species populations as a whole (Harradine & Clausager 1990). For example, sex and age class data gathered from wings has been found to correlate with Eurasian Wigeon *Mareca penelope* productivity data determined through field observations and from ringing data (Mitchell *et al.* 2008). They have also been used to estimate survival rates in juvenile Eurasian Teal *Anas crecca* (Guillemain *et al.* 2009) and to assess productivity in eight duck species (Christensen & Fox 2013). However, there are known to be biases in sex and age ratios inferred from hunter collected wings, including over-representation of male wigeon when shooting over decoys (Christensen & Fox 2013), and higher proportions of juveniles than found in ringing samples (Guillemain *et al.* 2013; Mitchell *et al.* 2008).

A wing survey ran in the UK from 1968, and peaked at almost 6,500 wings per year in 1996, but stopped in 2002 due to lack of funding. It resumed in 2017, when hunters were asked to submit one wing voluntarily from each duck or goose that they shot during the 2017/18 season and has continued since. A total of 104 wings were received in winter 2017/18, from an estimated total harvest of approximately 1 million ducks and geese (Aebischer 2019). The objective of this survey therefore is to increase hunters' engagement with the wing survey by identifying motivations and barriers to participation. Information gained will then be used to tailor recruitment and reporting messages, as well as to adapt the collection protocols in order to reduce and eradicate constraints wherever possible.

Materials and methods

The British Association for Shooting & Conservation (BASC) is the largest shooting organisation in the UK, and has a tradition of representing waterfowl hunters (wildfowlers), as well as other game hunters. Members can join as individuals, or through membership of an affiliated hunting club or syndicate. BASC has > 155,000 memberships, of which *c.* 9,000 are from affiliated wildfowling clubs. There is no requirement for clubs to affiliate to any other membership organisation in the UK and so, although it is likely that BASC represents the majority of hunters shooting migratory waterfowl, it is not possible to estimate accurately the extent of this coverage. For further information see Ellis (2014).

In March 2019, following the second (2018/19) winter of renewed wing surveys, an online survey invitation was emailed to all 3,206 members of wildfowling clubs affiliated to BASC where members were aged over 18 years and had given consent to be contacted. This was not a random sample of the total members in this category (7,726), but it was considered to be representative. An additional sample of 8,000 members was randomly selected from the wider membership (of > 155,000), but excluding those members from affiliated wildfowling clubs. Email invitations included a personalised URL that enabled us to determine demographic data (age, gender, location and membership of clubs) from our in-house Customer Relations Management (CRM) software without asking for this information in the survey. A reminder email was sent to all non-respondents two weeks after the initial invitation. The effect of the timing of survey response was examined using a logistic regression with age (as a continuous variable), gender (male/female), increasing education (none/GCSE or O-level/AS or A-level/university level, included as a continuous variable), whether they took part in the wing survey (yes/no) and whether they would take part in the future (yes/no) as explanatory variables.

The survey (see Appendix 1) was hosted on SurveyMonkey and consisted of up to 15 questions, with logic to skip questions if respondents had not heard of the wing survey. The first part of the survey explored awareness of the survey, future intentions and the motivations and constraints surrounding the choice of whether to take part. The second part of the survey focused on additional demographic data (age, gender, participation in forms of hunting, education and profession) and engagement with various social-media platforms.

Respondents could choose multiple options to describe their hunting activity from a list of commonly recognised shooting disciplines, including duck- and goose-focused disciplines such as wildfowling (see Ellis 2014) and inland duck or goose shooting. However, several other disciplines such as rough shooting, walked-up shooting and driven game shooting focus on gamebirds (Common Pheasant *Phasianus colchicus*, Grey Partridge *Perdix perdix* and Red-legged Partridge *Alectoris rufa*) but include the possibility of shooting ducks and geese. To account for this, a

dichotomous variable was created, reflecting whether or not the respondents indicated that they took part in disciplines which, although not focused on shooting ducks or geese, did provide an opportunity to do so.

Participation in the 2018/19 wing survey was assessed with a simple yes/no (coded as "1", "0") response. However, intent to participate in the future included an additional option of "don't know". Responses of "don't know" were re-coded as "no" ("0") to provide a binary variable on intent to take part in future wing surveys, which is assumed to be more precautionary.

Respondents who indicated that they had heard of the wing survey and had taken part in the previous year were asked to select as many responses as appropriate from a list of intrinsic and extrinsic motivation factors. Respondents who had heard of the survey but not taken part were similarly asked to select options from a list of constraints. The options for motivations and constraints were developed from consultations with known participants and non-participants, with a text box also provided for additional comments in case any had been missed.

Logistic regression analysis was used to determine factors affecting current participation and hunters' perception of their future participation in wing surveys. Whether or not participants shot ducks and geese, their age, gender and level of education were included as potential explanatory variables for current participation.

The effect of constraints, motivations and demographics on intent to participate in the future were first examined with three partial models, with intent to participate as a binary dependent variable. The demographic model included age as continuous variable, gender, whether they were a duck or goose shooter as a binary variable, and increasing education as a continuous variable. The constraint and motivation models included each of the terms listed in Section 3 of the questionnaire survey (see Appendix 1), as binary variables (no/yes coded 0/1). Significant terms from the partial models were then used to parameterise a single, full model (Loyd & Miller 2010), using backward stepwise elimination of non-significant terms. Collinearity was tested for by calculating the variance inflation factor (VIF) for each term, with a VIF of > 5 assumed to indicate presence of collinearity.

Results

Responses were received from 1,346 of the 11,206 members contacted (12% response rate) with 64% responding to the first invitation email and the remaining 36% responding to the reminder. There was no significant difference between respondents to the initial and second email in terms of age, gender, education, whether they took part, or whether they planned to participate in future wing surveys (Table 1). Respondents' demographics (Table 2) were consistent with average member demographics as captured through our membership database, with 96% male, and an average age of 53 years. Thirty-four per cent possessed a university degree (or higher) as their highest level of education, and a further 15% had a college qualification or equivalent. Thirty-two per cent of participants pursued more than one form of hunting, with 17% focusing on driven game

Table 1. The effect of demographic factors and current and future participation on the timing of response to the survey (*i.e.* on the first or second reminder). *P* values were not significant in each case.

	β	**Wald**	**Odds ratio**	***P* value**
Age	0.01	1.01	1.006	0.315
Gender	0.22	0.25	1.243	0.803
Education	0.01	0.14	1.011	0.886
Current participant	–0.12	–0.50	0.888	0.617
Future participant	–0.15	–0.83	0.858	0.408

Table 2. Summary data for participants and non-participants in the winter 2018/19 wing survey.

	Took part in 2018/19 wing survey		**All respondents**
	Yes	**No**	
Age	58	52	53
Male (%)	99	96	96
Education (%)			
High school or equivalent	25	30	28
College or equivalent	15	16	15
University education	40	34	34
None of the above	20	15	15
% shooting ducks/geese	87	50	52

shooting and 15% on duck and goose shooting (either inland or on the coast).

Motivations and barriers to past participation

Overall, 46% of respondents had heard of the wing survey, but only 18% had taken part in the previous season (2018/19). Of those who had heard of the survey, 67% had heard about it through the BASC membership magazine, 28% through their club and 23% through the BASC website. Only 4% and 1% had heard of the survey through Facebook and Twitter, respectively.

Forty-five per cent of respondents that had heard of the survey intended to take part next season (2019/20).

The main motivations for taking part (Fig. 1) were both intrinsic motivations: "to support science and conservation" (68%), and "to support the sport" (58%). The highest-ranked extrinsic motivation was "to avoid restrictions on my sport" (46%). Motivations were grouped according to whether they were intrinsic or extrinsic, and overall 93% of participants were motivated by at least one intrinsic factor, with 57% motivated by at least one extrinsic factor. The top three constraints on taking part in the wing survey were "not shooting the target species" (30.6%), "having storage but not being allowed to use it" (15.0%) and "not having storage" (13.8%).

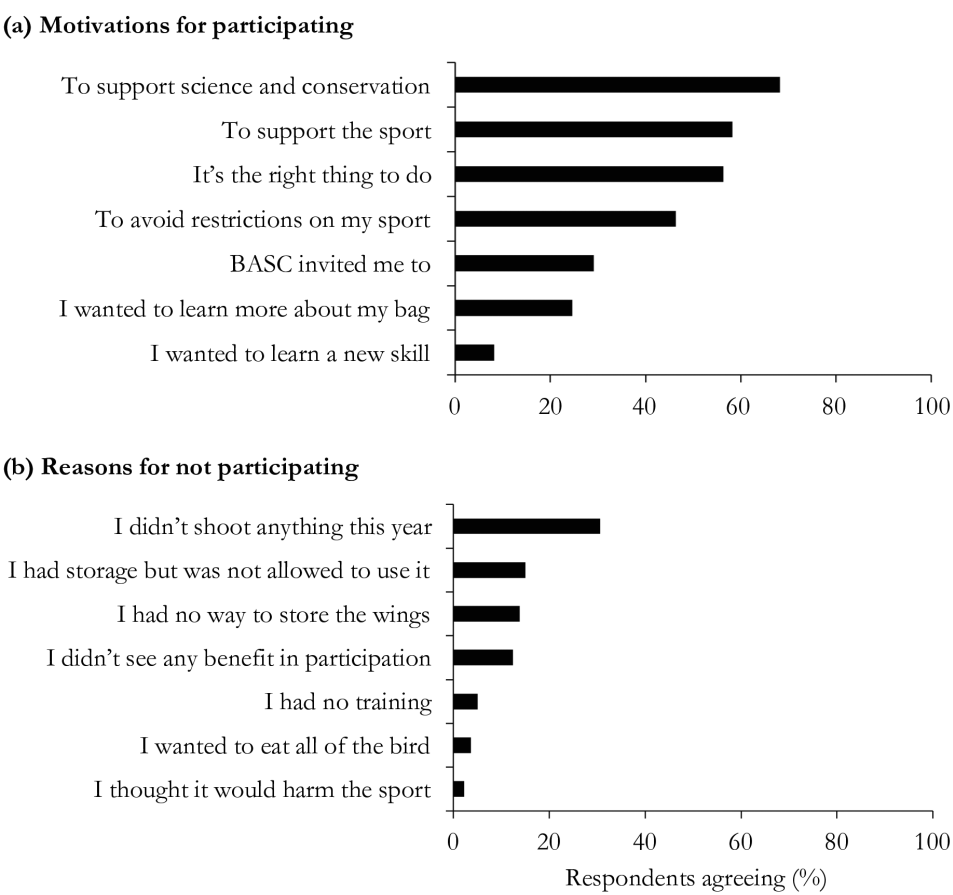

Figure 1. Percentage of respondents who said that they agreed with statements in the two main parts of the survey, indicating: (a) motivations for taking part in the 2018/19 wing survey (n = 110), and (b) reasons for not taking part in the 2018/19 wing survey (n = 493).

The only factors significantly associated with past participation were whether or not the respondent shot ducks and geese (β = 1.94, $P < 0.001$) and age (β = 0.02, $P = 0.003$), with duck and goose shooters being seven times more likely to take part than those not shooting ducks and geese. Gender (β = 14.4, n.s.), and education (compared to university education, no education β = –0.07, n.s.; high school β = –0.43, n.s.; college β = –0.13, n.s.) were not significantly associated with past participation.

Future intentions

Overall, 45.4% of respondents who had heard of the survey reported that they intended to take part in the future, with 13.3% reporting that they would not, and 75% of participants in 2018/19 reported their intention to take part in 2019/20. Age was the only factor in the demographic partial model found to have a small, significant negative effect on intent to take part in the future (β = –0.001, $P = 0.041$). Neither gender (β = 1.53, n.s.) nor increasing education (β = –0.14, n.s.) were found to have a significant effect on the likelihood of future participation (Table 3).

The effect of motivations to take part in the previous wing survey on future intent to participate found that the intrinsic motivations "BASC asked me to" and "to support the sport" were both significant. However the extrinsic motivation "to avoid restrictions" proved more important with respondents holding this belief being 3.8 times more likely to report future intent to take part. The motivations "because it's the right thing to do", "to support science and conservation", "to learn a new skill" and "to learn more about my bag" were all not significant predictors of intent to participate in the future (Table 3).

The final partial logistic model explored the effect of constraints on the intent to participate in the future. This found that "I saw no benefit", "I had storage but was not allowed to store the wings" and "I did not shoot any of the target species" were all significant constraints on future participation. The belief that "it could be harmful to the sport" was the most important constraint on future participation, with respondents being 4.5 times less likely to take part in the future.

The full logistic regression model (Table 3) included all significant terms from the partial models on the intent to take part in future wing surveys. "BASC asked me to" was the only intrinsic motivation to remain significant, along with the extrinsic motivation "to avoid restrictions". There was a significant negative relationship between future participation and those who selected "I saw no benefit". Analysis of the variance inflation factors showed a degree of collinearity in the final terms. However, elimination of collinear terms did not change the magnitude or direction of effects.

Discussion

This survey suggests that participants in the BASC wing survey are more likely to assign intrinsic motivations to past participation, whereas intent to participate in the future is driven more by extrinsic and self-serving factors. This information will be used in recruiting messages for the wing survey by

Table 3. Logistic regression models predicting future participation in the wing survey. All terms shown in the partial models, but only significant terms shown for the full model.

	Partial models				Full model			
	β	**Wald**	**Odds ratio**	***P* value**	***β***	**Wald**	**Odds ratio**	***P* value**
Demographics								
Age	–0.01	–2.05	0.987	0.041				
Gender	1.53	1.39	4.637	0.163				
Education	–0.14	–1.79	0.873	0.073				
Motivations								
It's the right thing to do	0.49	1.17	1.631	0.241				
BASC asked me to	1.21	2.01	3.351	0.045	1.37	2.37	3.948	0.018
To support the sport	0.93	1.85	2.543	0.064				
To support science and conservation	–0.35	–0.76	0.702	0.450				
To avoid restrictions	1.25	2.15	3.489	0.032	1.94	4.21	6.924	< 0.001
To learn about my bag	0.87	1.36	2.379	0.174				
Constraints								
It could be harmful to the sport	–2.43	–2.30	0.087	0.022				
I had no storage	–0.08	–0.28	0.926	0.781				
I saw no benefit	–1.27	–4.02	0.280	<.001	–0.73	–2.41	0.480	0.016
I had storage but was not allowed to use it	–0.91	–3.31	0.404	<.001				
I wanted to eat the whole bird	–0.23	–0.49	0.791	0.626				
I had no training	–0.56	–1.31	0.565	0.191				
I did not shoot any of the target species	–0.74	–3.68	0.478	<.001				

focusing on the importance of the wing survey in providing demographic data to ensure the long-term sustainability of the sport. The results will also be used in reporting/retention messages focusing on acknowledging the importance of the data provided in serving the greater scientific good and the learning opportunities for members.

The response rate to this survey was low compared to previous membership surveys (Ellis 2020), but respondents were representative of typical members in terms of age, gender and participation in sporting activities. Respondents to this survey were generally more qualified than average members of BASC, and the UK population in general, where only 27% have a university degree or equivalent. This is consistent with other surveys (Tolonen *et al.* 2006) and, whilst this could have implications for communications and messaging, there was no evidence that it impacted on people's willingness to take part in the past or the future.

Studies of other citizen science schemes have found that participants commonly report retrospectively on being motivated by intrinsic values such as "to help wildlife in general" and "to contribute to scientific knowledge" (Curtis 2015; Geoghegan *et al.* 2016). At the same time, extrinsic motivations have long been recognised as an important part of citizen science projects ranging from certificates of participation (Dickinson *et al.* 2012) to leaderboards and "gamification" (Bowser *et al.* 2013; Iacovides *et al.* 2013). Traditionally, however, they have been viewed as mechanisms to draw people in to a citizen science project with an emphasis on developing intrinsic motivation over time to ensure long-term participation (Cialdini 2008; Tiago *et al.* 2017), as the initial focus on extrinsic drivers wanes in importance (Rotman *et al.* 2014a, b). This suggests that there may also be a degree of *post-hoc* rationalisation when citizen scientists are asked to explain retrospectively why they participated, although shame has not been commonly found to be a motivator of pro-social activities (de Hooge *et al.* 2007).

Relying on extrinsic motivations can lead to issues with data quality if there is some incentive to cheat (Crowston & Prestopnik 2013). In the context of this citizen science framework, however, the extrinsic reward that is driving participation is continued opportunities to hunt and it is unclear how hunters could attempt to cheat to achieve this. A potential mechanism would be to withhold species, age or sex classes that hunters feel may have been overharvested. However, anecdotal information from the wing survey, in terms of hunter-submitted age, sex and species identifications along with wings suggests that hunters may have limited ability to classify accurately certain species age classes, and also to identify female ducks to species. Surveys of waterfowl hunters in Kansas, USA, similarly found misidentification of sex for some species (Ahlers & Miller 2019). It therefore seems that any potential mechanism for cheating by attempting to alter species, age or sex ratios would be likely to fail.

The most important constraint to taking part in the wing survey was lack of access to storage. Attempts therefore will be made to promote the availability of distributed

freezers around the UK, allowing hunters to deposit wings without needing to buy additional personal storage space, or negotiate space with other freezer users. Additionally the use of digital photos and prepaid envelopes will also be explored. Previous attempts at requesting hunters to air dry wings prior to storage have met with poor levels of success, presumably due to relatively high levels of humidity in the UK and high winter temperatures.

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Appendix 1. Waterfowl hunters' motivations and barriers to participation in a citizen science project.

SURVEY QUESTIONS

Section 1: About your shooting

1. In a typical year, which of the following do you take part in? (*Please tick all that apply*)
   a) Driven, predominantly game (including duck)
   b) Walked-up, predominantly game (including duck)
   c) Coastal wildfowling (duck/goose/wader shooting on foreshore)
   d) Inland duck (*e.g.* flight ponds/marshes) and goose shooting
   e) Deer stalking (red deer)
   f) Deer stalking (other deer species)
   g) Air gun shooting of live quarry
   h) Avian pests (*e.g.* woodpigeons)/predators (*e.g.* corvids)
   i) Mammalian pests (*e.g.* rabbits)/predators (*e.g.* foxes)
   j) Clay pigeon
   k) Target shooting: air gun
   l) Target shooting: black powder
   m) Target shooting: small bore rifle
   n) Target shooting: full bore rifle
   o) Beating/picking up
   p) None of the above

2. Which of these is your primary shooting activity? (*Please choose only one*)
   a) Driven, predominantly game (including duck)
   b) Walked-up, predominantly game (including duck)
   c) Coastal wildfowling (duck/goose/wader shooting on foreshore)
   d) Inland duck (*e.g.* flight ponds/marshes) and goose shooting
   e) Deer stalking (red deer)
   f) Deer stalking (other deer species)
   g) Air gun shooting of live quarry
   h) Avian pests (*e.g.* woodpigeons)/predators (*e.g.* corvids)
   i) Mammalian pests (*e.g.* rabbits)/predators (*e.g.* foxes)
   j) Clay pigeon
   k) Target shooting: air gun
   l) Target shooting: black powder
   m) Target shooting: small bore rifle
   n) Target shooting: full bore rifle
   o) Beating/picking up
   p) None of the above

Section 2: Awareness of the survey

3. Had you previously heard of BASC's duck, goose and woodcock wing survey? (*Please choose one answer*)
   a) Yes
   b) No

4. How did you hear about it? (*Please tick all that apply*)
   a) BASC staff member
   b) BASC website
   c) In BASC's Shooting & Conservation magazine
   d) In another shooting magazine
   e) Through a wildfowling club
   f) Word of mouth
   g) Facebook
   h Twitter
   i) Other (*please specify*)

5. Will you take part in the duck, goose and woodcock wing survey next year? (*Please choose one*)
   a) Yes
   b) No
   c) Don't know

6. Have you already taken part in the duck, goose and woodcock wing survey? (*Please choose one answer*)
   a) Yes (*Go to 7*)
   b) No (*Go to 8*)

Section 3: Your reasons for taking part

Thank you very much for your participation in the wing survey. Please help us encourage others to do so by telling us what your motivations were for taking part.

7. Why did you take part in the wing survey? (*Please tick all that apply*)
   a) It's the right thing to do
   b) BASC invited me to
   c) To support the sport
   d) To support science and conservation
   e) To avoid restrictions on my sport
   f) I wanted to learn a new skill
   g) I wanted to learn more about my bag
   h) Other (*please specify*)

   Go to 9

Section 3: Your reasons for not taking part

Please help us encourage participation in the survey telling us whether there were any constraints preventing you from taking part.

8. Why didn't you take part in the wing survey? (*Please tick all that apply*)
   a) I had no way to store the wings
   b) I thought it would harm the sport
   c) I didn't see any benefit in participation
   d) I was not able to store the wings at home
   e) I wanted to eat all of the bird
   f) I had no training
   g) I didn't shoot anything this year
   h) Other (*please specify*)

9. If you have any suggestions about how we could encourage participation in the wing survey, please let us know here:

Section 4: About you

10. Do you receive the following as part of your BASC membership? (*Please choose all that apply*)
    a) BASC Fast Tracks (email newsletters and alerts)
    b) BASC's Shooting & Conservation magazine

11. How would you describe where you live? (*Please choose one*)
    a) Mainly urban
    b) Mainly rural

12. Which of the following categories best describes your highest level of academic education? (*Please choose one*)
    a) GCSEs or O-Levels
    b) AS or A-Levels
    c) University education
    d) None of the above

13. Do you have any skills-based/vocational qualifications specialising in a technical or practical field? Examples might include apprenticeships, NVQs or diplomas. (*Please choose one*)
    a) Yes
    b) No

14. Which of the following do you regularly use? (*Please choose all that apply*)
    a) Facebook
    b) Twitter
    c) Instagram
    d) LinkedIn
    e) YouTube

15. Which of the following categories best describes your employment status? (*Please choose one*)
    a) Self employed
    b) Employed, working full time
    c) Employed, working part time
    d) Not employed, looking for work
    e) Not employed, not looking for work
    f) Retired
    g) Not able to work
    h) Prefer not to answer

16. Which of the following best describes your type of occupation? (*Please choose one*)
    a) Manager
    b) Professional
    c) Technician or associate professional
    d) Clerical support worker
    e) Service and sales worker
    f) Skilled agricultural, forestry or fishery worker
    g) Craft and related trades worker
    h) Plant and machine operator or assembler
    i) Other practical occupation
    j) Civil service occupation

You have now reached the end of this survey. Thank you very much for taking part: your feedback will help us to improve.

If you have any questions about the wing survey, please email science@basc.org.uk to contact the science team.

