



Gender differences in birding specialization from 25 countries: effects are large in skill/knowledge and minimal in commitment

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Abstract

This study investigates gender differences in birding specialization, a leisure activity characterized by three dimensions: skill/knowledge, behavior, and psychological commitment. We used data from a worldwide survey during December 19th 2020 and April 16th 2021 from 25 countries and psychometrically validated instruments. A total of 4006 people (2737 men, 1269 women; mean age 50.13 years, $SD=16.5$) participated in the study. Meta-analytical tools were used to analyze the results. Men reported higher levels of skill/knowledge (effect size $d=0.75$), behavior ($d=0.43$), and psychological commitment ($d=0.18$) than women. Gender-related differences in skill/knowledge correlated with gender equality indices, indicating that differences between men and women are large in more gender-equal societies. Gender-related behavioral differences reflect societal constraints on women's leisure due to care responsibilities, while men's higher skills could be related to competitive tendencies in birding. The results align with the “gender-equality paradox,” suggesting greater gender differences in contexts of higher societal equality. Recommendations for future research include considering initiation age of the leisure activity, lifetime leisure/recreational experience, and societal factors influencing gender-specific participation in cognitive leisure activities.

Keywords Birdwatching · Nature-related recreation · Outdoor recreation · Leisure · Gender-equality paradox

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Birding as a recreation specialization

Birding is a popular leisure activity both for men and women. It can be carried out year-round, and bird species are widely distributed, often easy to observe, and birding can be done alone or in companion with the family or friends (Oddie, 2002). However, there can be gender-related differences in birding specialization (Cooper & Smith, 2010). Birding specialization is based on the concept of recreation specialization (Bryan, 1977). The concept of recreation specialization was developed by Bryan (1977) in a study of trout fishermen. Bryan (1977, 2000) conceptualized recreation specialization as a career path model, starting with the beginner or casual, over intermediate to the advanced recreationist (Scott & Lee, 2010). This career path model was later confirmed, e.g., in birders in Germany by using propensity score matching techniques (Randler, 2023). In general, recreation specialization contains three major dimensions (Bryan, 1977; McFarlane, 1994; Randler et al., 2023; Scott & Lee, 2010). First, skill/knowledge can be acquired and increased during a leisure career (Randler,

2023). In birding, skill/knowledge refers to the number of bird species a person can identify by sight and sound. Second, leisure behaviours can be acquired by variables, such as the number of field trips, the replacement value of the equipment, and/or the number of species on a life list. However, also some other behavioural aspects related to the specialization of birding may be important, such as the decision and motivation to go birding even during adverse weather conditions (Tryjanowski et al., 2025). Third, psychological involvement describes the commitment someone is investing in this activity. This commitment is related to the construct of centrality to one's lifestyle (i.e., how important birding can be for a person, Kyle et al., 2007). These three dimensions refer to the distinct but related facets of recreation and birding specialization (Lee & Scott, 2004; Randler et al., 2023). Such a three-dimensional model has been shown first by Lee and Scott (2004) for birding, and it was recently confirmed for eight languages (Randler et al., 2023). This indicates that the psychometric quality of the questionnaires is sufficiently established. Convergent validity for the skill/knowledge dimension construct has been found by Randler and Heil (2021), who compared the self-assessment with a test.

Gender differences in birding

There are differences between men and women in birding specialization in all three dimension (skill, behavior and psychological commitment, see above; and Appendix 1). Firstly, men reported being able to identify more species by visual cues and traits compared to women (Kacal, 2018; Schneider & Salk, 2002), and similarly, men reported to be able to identify more species by sound than women (Kacal, 2018; Schneider & Salk, 2002). Studies that summed up visual and acoustic identification skills with a self-assessment on the novice- expert scale showed higher levels of skill/knowledge in men (Lee et al., 2015; Moore et al., 2008; Randler, 2021; Randler et al., 2022; Randler & Großmann, 2022; Rutter et al., 2021). Concerning skill/knowledge the studies show a clear pattern with men scoring higher in skill/knowledge compared to women. No study reported women scoring higher than men.

Secondly, the general scales on behavior showed that men score higher on the engagement level (Randler, 2021; Rutter et al., 2021). The behavior scales contain different items that are related to birding. Usually, men reported more trips and more days spent birding (Kacal, 2018; Lee et al., 2015; Randler et al., 2022; Randler & Großmann, 2022; Sali et al., 2008a,b; Schneider & Salk, 2002), but not all studies reported differences (Moore et al., 2008). Concerning international birding trips, there were no differences between

men and women (Sali et al., 2008a,b) but male Israeli birders reported more overseas trips (Kacal, 2018). Concerning equipment costs, there were no differences between men and women (Lee et al., 2015), while Moore et al. (2008) and Kacal (2018) reported higher replacement values of the equipment in men. Men reported more years spending in watching wildlife (Schneider & Salk, 2002) or birding (Boxall & McFarlane, 1993; Moore et al., 2008). Men were more often listers than women (Goodfellow, 2017; Kacal, 2018), meaning that they systematically record the bird species they have observed and keep lists about the number of species they have seen at a special place, during a given time or in their lifetime. The studies concerning behavior tend to assign more behavioral components to men, but studies are equivocal.

Thirdly, psychological commitment was measured using facets of personal commitment, behavioral commitment or involvement. Men showed higher scores than women in psychological commitment (Kacal, 2018; Randler, 2021; Randler et al., 2022; Rutter et al., 2021; Schneider & Salk, 2002). Personal commitment was higher in men (Moore et al., 2008) as was behavioral commitment (Moore et al., 2008). Some studies reported an equal commitment (Randler & Großmann, 2022; different sample than Randler, 2021, see above), an equal score in behavioral and personal commitment in an ABA sample (members of the American Birding Association; Lee et al., 2015), or when using an involvement score (Janeczko et al., 2021). Men were more engaged in competitive birding, women more in birdwatching (Cooper & Smith, 2010). These studies show that men and women differ least in the psychological aspect of commitment, which is supported by analyses of effect sizes.

Fourthly, gender differences have been studied in many areas of life. Men and women differ in many social and personality traits, and these traits are explained by biological and/or social factors. The different theoretical frameworks that have been mostly used to explain differences between men and women are oriented on the one side on the evolutionary heritage (Buss, 1988), and on the other side in social factors (Eagly & Wood, 1991). More recently, Costa et al. (2001) noted that these apparently contradictory explanations – biological versus social – are not mutually exclusive. Therefore, learned or acquired social roles should modify biological patterns. Many studies are inconclusive, and do not distinguish between biological explanations and social-environmental explanations (Lippa, 2010). Hence, in-born differences, and socially-endorsed-views impact on the self-construal of genders in distinct ways (Cross & Madson, 1997; Krasnova et al., 2017). For example, testosterone as a basic biological variable, may drive status seeking behavior, and might therefore be responsible for the competitive environment in men (Knight et al., 2022; Mazur & Booth,

1998). In turn, the ethics of care might be socially endorsed in women (Glenn, 2010).

One point that has been put forward, e.g., in personality psychology, is the gender paradoxon. The greater the level of gender equity in a society or nation, the larger the observed effect sizes, meaning the differences in a specific trait between men and women were more pronounced. At first glance, this may seem counterintuitive, but a recent meta-analysis reported a similar pattern: gender differences tend to increase as living conditions improve, including factors like economy, gender equality, and education (Herlitz et al., 2024; Stoet & Geary, 2018). This result is consistent with the resource hypothesis proposed by Falk and Hermle (2018), which states that higher levels of economic development and gender equality are associated with more pronounced gender differences in preferences. Such differences only occur when both women and men have adequate access to resources that enable them to independently develop and express their intrinsic preferences.

In this study, we provide new insights into the analysis of gender differences in birding specialization because this study is based on a sound psychometric measurement of birding specialization, including skill/knowledge, behavior and psychological commitment (Lee & Scott, 2004; Randler et al., 2023). Furthermore, the study addresses a range of countries that had not been studied previously, including some countries from the global South. This kind of worldwide study is important because gender differences in a recreational activity can be tied to societal inequalities between men and women. Nationwide indicators from gender equity were used to analyze the effect sizes in gender differences. Firstly, we hypothesized that there are gender-related differences in birding specialization, and these can be related to differences in skill/knowledge, behavior and commitment. Based on the earlier studies, we predicted that men will be more skillful, invest more time on birding, and being more commitment to birding than women. Secondly, we hypothesized that there will be country-level differences in birding specialization between men and women, following the gender equality paradoxon. We predicted that gender differences should be higher in countries with a higher gender-equity.

Materials and methods

Participants and data collection

Data about birders were collected on a worldwide scale during December 19th, 2020, and April 16th, 2021, referring to their pre-pandemic birding behavior. Participants were recruited via many channels, e.g., using announcements

placed on the webpages of large bird- and nature-related organizations, scientific ornithological unions, societies or bird clubs. Mailing lists were used by organizations when available, and clubs were asked for participation by using postings on their websites or by distribution the link on their mailing lists. In addition, more than 100 international Facebook groups with a relation to birdwatching were used to post information about the study. Data was collected by using the Online Research Tool, the SoSciSurvey. The first page of the survey displayed the aims of the study. Further, a formal informed consent was requested with participants actively clicking on “yes” to start the study. Participants could stop at any time without consequences. The study was granted permission by the ethics committee of the Poznań University of Life Sciences [27.4.2020, waiver, following the Act on the Protection of Animals used for Scientific or Educational Purpose in Poland]. The data was collected fully anonymous and is available on the OSF: <https://osf.io/cbwxh/>.

Questionnaires

Demographics

Demographic questions included age in years, gender (man, woman, diverse, prefer not to answer) and country of actual residence. Further, people were asked whether regularly submit bird observations to web-based citizen science platforms, such as eBird (Sullivan et al., 2009, 2014), observing or ornitho. Answers provided were almost daily, several times per week, weekly, monthly, less than monthly, and never.

Birding specialization

Birding specialization was developed and refined by Lee and Scott (2004) in English. The scale was subsequently translated into many languages (Randler et al., 2023). The measurement consists of 9 items: three ask for the skill/knowledge dimension (how many bird species one can identify by sight; how many bird species one can identify sound; and a self-assessment of birding skills), two ask for the behavior dimension (number of field trips; and number of field days), four ask about the dimension “centrality to lifestyle and psychological commitment”.

Gender indices on the national level

As a proxy for gender equity, we analyzed three established measurements for gender equity. Firstly, we used the Global Gender Gap Index (GGGI) from the world economic forum

(World Economic Forum, 2022). The Global Gender Gap Index benchmarks the current state of gender parity across the four key dimensions: Economic Participation and Opportunity, Educational Attainment, Health and Survival, and Political Empowerment (World Economic Forum, 2022). Secondly, we used the Gender Inequality Index (GII) given in the Human Development Report (HDR; United Nations, 2021). The Gender Inequality Index measures three dimensions: reproductive health, empowerment and the labor market (Human Development Report; United Nations, 2021). Thirdly, we used the Gender Development Index given in the HDR. The Gender Development Index (GDI) measures three basic dimensions of human development: health, measured by female and male life expectancy at birth; education, measured by female and male expected years of schooling for children and female and male mean years of schooling for adults ages 25 years and older; and command over economic resources, measured by female and male estimated earned income (United Nations, 2021).

Statistical analysis

The questions about birding specialization received support for a configural factorial invariance between countries, but not for metric and scalar invariance (Randler et al., 2023). We therefore decided to analyze differences and relationships related to this construct by using a meta-analytical procedure. The means and standard deviation for each of the three dimensions of specialization (skill/knowledge, behavior, psychological commitment) for men and women, and for every country were calculated in the meta-analytical procedure. In the meta-analysis, Cohen's d was calculated as a measure of effect size. Cohen's d of 0.2, 0.5, and 0.8 are considered small, medium, and large, respectively (Andrade, 2020). Effect sizes for every country were obtained separately and employed in the meta-analysis. We used random effects models with restricted maximum likelihood estimates (REML) when testing gender differences in the three dimensions of birding specialization, and in the question about the submissions of bird data to web-based platforms. To compare the different effect sizes, paired t -tests were used. These scores were metric by definition because they are standardized effect sizes. To assess gender-related predictors, we combined the GDI, GII, and the GGGI into a factor score derived from an exploratory factor analyses to reduce the dimensions and the number of statistical tests. All three indicators loaded onto the same factor component (factor loadings are GDI: 0.720, GII: -0.873, GGGI: 0.836). This composed factor was used as a predictor in the meta-regression where the effect sizes (standardized mean differences between men and women) were the

dependent variables. All statistical analyses were carried out with SPSS 29.

Results

A total of 4006 people (2737 men, 1269 women; mean age 50.13 years, $SD = 16.5$) from 25 countries participated in the study (Table 1, Appendix 2). The mean age of participants varied between countries (Table 1). In most countries, most birders were men, except in South Africa, Russia and the USA where more participants were women (Table 1).

Concerning the skill/knowledge dimension, skill/knowledge was significantly higher in men compared to women ($d = 0.752$; 95% CI 0.62; 0.88; $Z = 14.381$, $p < .001$; Fig. 1), with men scoring higher on skill/knowledge. Similarly, concerning behavior, men scored higher on this dimension compared to women, thus, men spent more days in the field and did more birding trips than women, with a mean effect size of $d = 0.429$ (95% CI 0.33; 0.53; $Z = 8.534$, $p < .001$; Fig. 2). Finally, mean effect size for psychological commitment was $d = 0.175$ (95% CI 0.03; 0.32; $Z = 2.438$, $p < .015$; Fig. 3), indicating that birding is more central to lifestyle in men than in women. Rate of submission of bird observations to web-based platforms, like eBird or iNaturalist were higher in men than in women with $d = 0.422$ (95% CI 0.31; 0.54; $Z = 7.282$, $p < .001$). When comparing the effect sizes with each other, effects sizes of skill/behavior were significantly larger than those of behavior ($T = 3.635$, $p = .001$) and commitment ($T = 8.307$, $p < .001$). Effect sizes of behavior, in turn, were stronger than in commitment ($T = 3.265$, $p = .003$). Thus, effect sizes were in descending order: skill/knowledge, behavior, and psychological commitment.

According to the meta-regression analysis, neither behavior (Wald $\chi^2 = 0.486$, $p = .486$) nor commitment (Wald $\chi^2 = 0.481$, $p = .488$) showed a significant relationship between the effect sizes and gender equality. However, concerning skill/knowledge, there was a significant relationship between higher gender equality and higher effect sizes (Wald $\chi^2 = 4.202$, $p = .04$), thus, in more equal societies, gender differences in birding specialization were larger (Fig. 4). Furthermore, none of the effect sizes were related to economic development ($p = .75$ for behavior; $p = .14$ for skill/knowledge; $p = .47$ for commitment).

Discussion

The results indicated that men and women differ in birding specialization, with a medium effect size in skill/knowledge, followed by low effect sizes in behavior and commitment.

Table 1 Countries and age of the studied population, and sample sizes for men and women

Country	N Male	N Female	Age mean male	SD age male	Age mean female	SD age female
Argentina	48	26	47.96	13.91	43.74	13.96
Australia	76	56	59.83	16.06	63.71	12.67
Belgium	42	9	53.61	16.08	50.33	15.40
Brazil	145	75	47.33	14.63	45.91	14.24
Canada	70	44	57.16	18.32	52.45	17.29
China	67	45	26.24	11.18	23.71	9.73
Finland	214	51	55.89	15.19	54.57	13.14
France	87	25	50.94	15.50	50.56	17.20
Germany	192	59	43.03	16.19	42.05	14.08
Hungary	59	21	37.39	12.80	33.00	11.58
India	37	21	43.27	13.96	42.48	12.30
Italy	297	61	51.36	13.97	49.00	13.40
México	98	44	40.37	14.84	37.21	11.08
Netherlands	55	7	49.85	12.29	42.71	13.60
Norway	41	16	48.98	13.94	48.63	11.52
Poland	143	67	47.68	12.77	36.28	12.64
Portugal	78	19	42.72	13.41	54.42	13.99
Russian Federation	23	25	50.57	11.94	42.04	11.64
South Africa	24	39	52.71	15.24	58.41	16.83
Spain	92	28	48.52	11.48	43.96	12.70
Sweden	143	27	54.83	13.00	58.81	13.90
Switzerland	68	6	38.93	17.41	56.50	11.81
Taiwan	77	61	37.12	12.38	39.67	13.73
UK	260	96	58.37	12.20	53.69	14.53
USA	301	341	57.33	16.31	60.60	13.94

The data confirm the general picture of higher birding specialization in men obtained from previous single country studies. This study is unique since it presents a worldwide comparison of men and women in their birding specialization including three dimensions from a psychometrically validated questionnaire (Lee & Scott, 2004) and a range of countries, including ones with a rather low (or even absent) number of studies on birding and birding specialization.

Concerning skill/knowledge, this dimension showed the highest effect size: men reported higher skills than women averaged across the 25 countries, which is in line with earlier single country studies (for example, Lee et al., 2015; McFarlane & Boxall, 1996; Moore et al., 2008). Moore et al. (2008) suggested that women seem less compelled to focus on skill development and achievement because they don't participate in competitive birding and list keeping in the same manner like men (Scott et al., 1999). However, this is only based on the behavioral dimension (see below) and does not fully explain the differences in skill/knowledge. In fact, birding is a highly scientific hobby with a relation to natural sciences education (or STEM education), where in fact, the gender gap is closing between boys and girls, and women often outperform men in academic achievement at school and university (Ro et al., 2021). This suggests that women should perform equally in birding knowledge and skills, but species identification is only marginally taught

at school (and sometimes even at university), and currently, there are no gender differences in bird species knowledge at the school level (see, e.g., Härtel et al., 2024, as one example). Concerning vertebrate species, girls scored higher than boys (Gerl et al., 2021). More general, childhood education is seen as a means for gender equity, but despite increased girls' enrollment in primary schools (Chisamya et al., 2012; Durani & Halai, 2020), schooling alone has not transformed gender relations or empowered women as promised. Structural factors—such as labor and marriage markets, family strategies, and gendered dynamics—limit education's transformative potential (Chisamya et al., 2012).

Concerning the dimension of behavior, our results are consistent with other studies where males reported taking more birdwatching trips and owning more birdwatching-related equipment (Lee et al., 2015; McFarlane & Boxall, 1996; Moore et al., 2008). Equally, the effect sizes in our study were lower concerning behavior in comparison to skill/knowledge (see also Lee et al., 2015). The behavioral dimension includes, e.g., the number of birding trips and field outings. The gender difference may be explained by the “ethics to care” socialization of women. Women encounter far more constraints to leisure than men (Shaw & Henderson, 2005), because they have more duties in care, which may result in putting others' needs ahead of their own (Henderson & Allen, 1991). These constraints may result

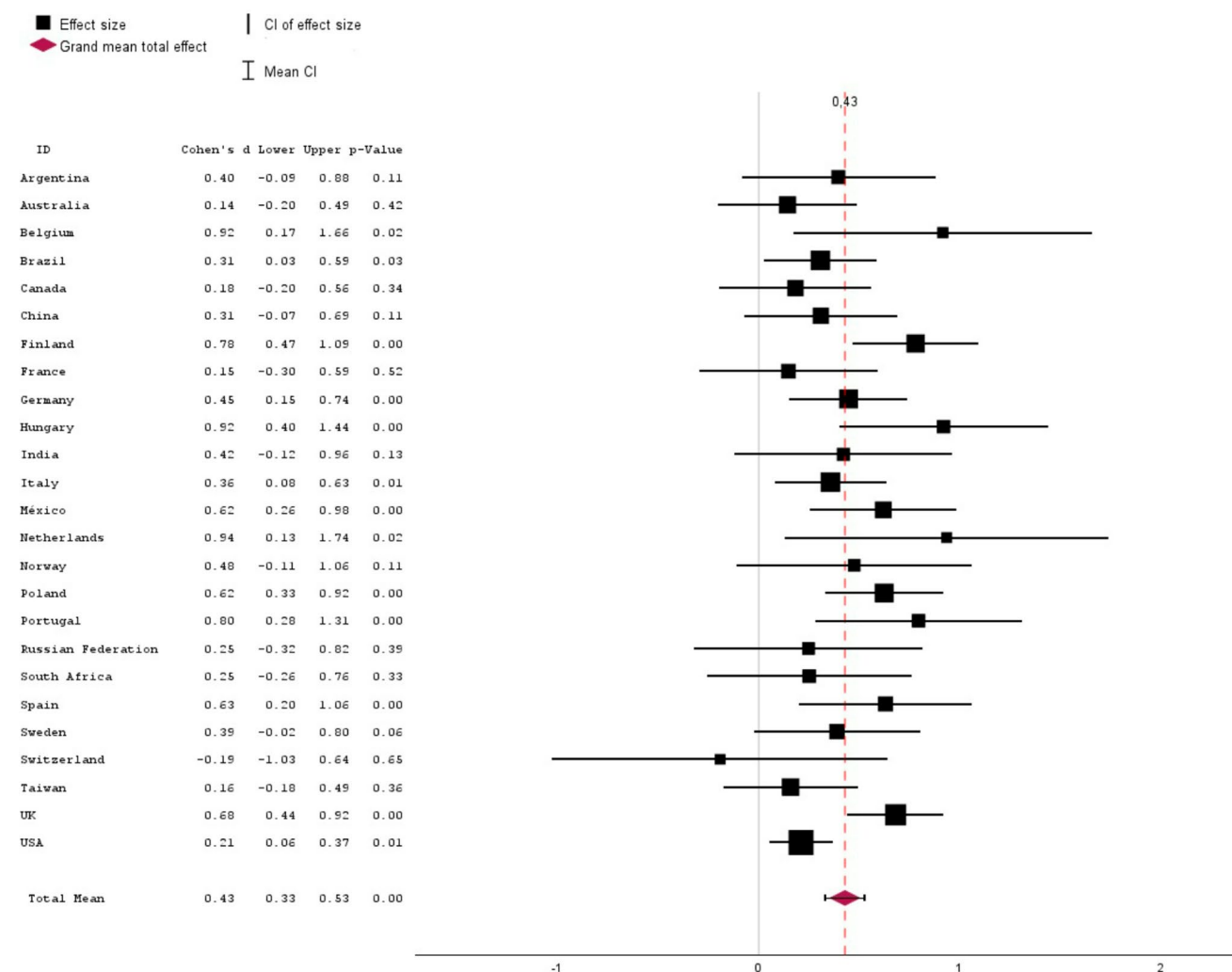


Fig. 1 Results of the meta-analysis of gender differences in the dimension of behavior of birding specialization. The total mean and effect size is given as well as the effect sizes per country

in a lower score in the behavioral dimension, suggesting that women have less time because of their care activities. Another explanation may lie in biological predispositions. Lee et al. (2015) suggested that listing is the main reason why men were more likely to take trips, buy equipment and perfect identification skills because this is related to achievement and to competition. Competition may be more likely in the interests of men (Apollo et al., 2023). This, in line with previous studies on biological predispositions, like testosterone, might explain the higher focus on competition in men (Knight et al., 2022; Mazur & Booth, 1998). Further on, safety in outdoor spaces may constrain women's participation in birding and, prior research highlights the importance of establishing leisure spaces that are perceived as safe and welcoming for women (Zhu et al., 2024).

Although the effect sizes of commitment were significant, they were rather low in the current study, suggesting that there are only minimal differences in psychological

commitment, or in the meaning that birds have for both genders. However, Lee et al. (2015) have suggested that there is no difference in commitment or involvement in birding between men and women. As we found differences in commitment, this may lie in the higher sample size of our study which allowed us to detect smaller differences with lower effect sizes.

The more gender equity existed, the higher were the effect sizes, i.e., differences between men and women in birding skills. At first, this sounds counterintuitive, but a recent meta-analysis indicated the same pattern: that gender differences are more pronounced with improvements in living conditions, such as economy, gender equality, and education (Herlitz et al., 2024). To date there seems to be no convincing explanation for such findings, and it has been referred to as a “gender-equality paradox” (e.g., Stoet & Geary, 2018). The resource hypothesis (Falk & Hermle, 2018) has been used to explain this paradox, and it assumes that free

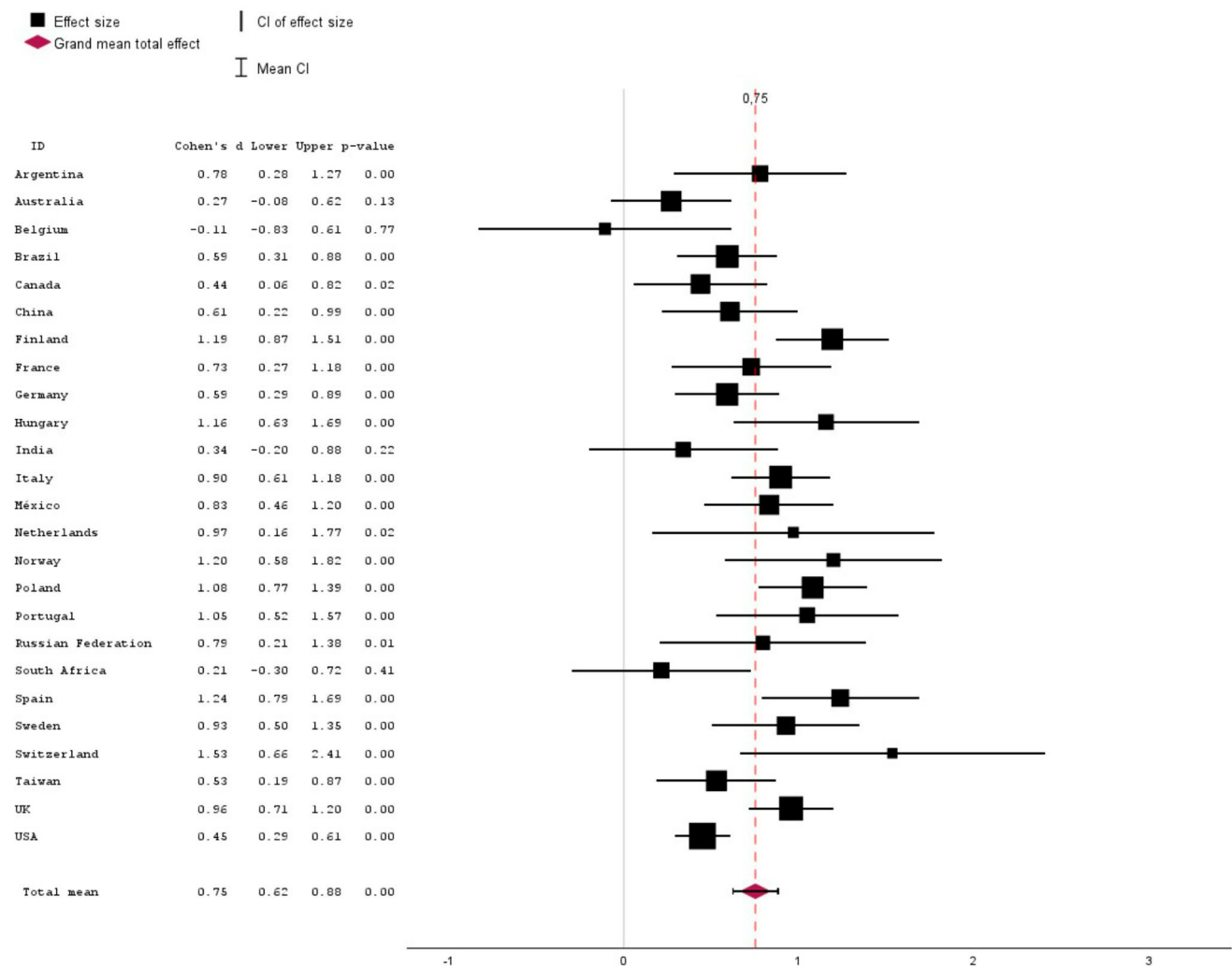


Fig. 2 Results of the meta-analysis of gender differences in the dimension of skill/knowledge of birding specialization. The total mean and effect size is given as well as the effect sizes per country

expression of preferences requires that basic material needs are satisfied, and gender-specific goals can develop (Herlitz et al., 2024).

Another interesting idea put forward by Lee et al. (2015) was that gender differences may reflect value and behavioral dispositions of an “older” generation of birdwatchers. In line with this, they suppose changes should occur in terms of generational differences. This would be an important venue for further research, e.g., in analyzing Big Day competitions in Germany, Randler and Großmann (2022) showed that participants in such competitions were significantly younger and female.

Study limitations

Skill and knowledge assessments in this context are based on self-reports. It is well-established that women tend to underestimate their abilities and competence, whereas men

often overestimate theirs—an effect commonly referred to as the confidence gap (Kay & Shipman, 2014) or the overconfidence bias (Johnson & Fowler, 2011). However, this phenomenon has not been examined in the context of birding specialization. Specifically, no studies have compared self-assessments of knowledge between women and men with objective performance measures, such as quiz-based identification tests. One relevant study conducted with the general public (Randler & Heil, 2021) found a strong correlation ($r=.7$) between self-assessed knowledge and actual test performance, suggesting that individuals can assess their knowledge with reasonable accuracy. Nonetheless, this relationship has not yet been investigated among birders. One benefit of the study is that it used an established measurement for assessing skill, e.g., by asking for the number of bird species being able to identify not in an open format, but in a Likert-scale approach (Lee & Scott, 2004). Probably this might be better because using open-format questions

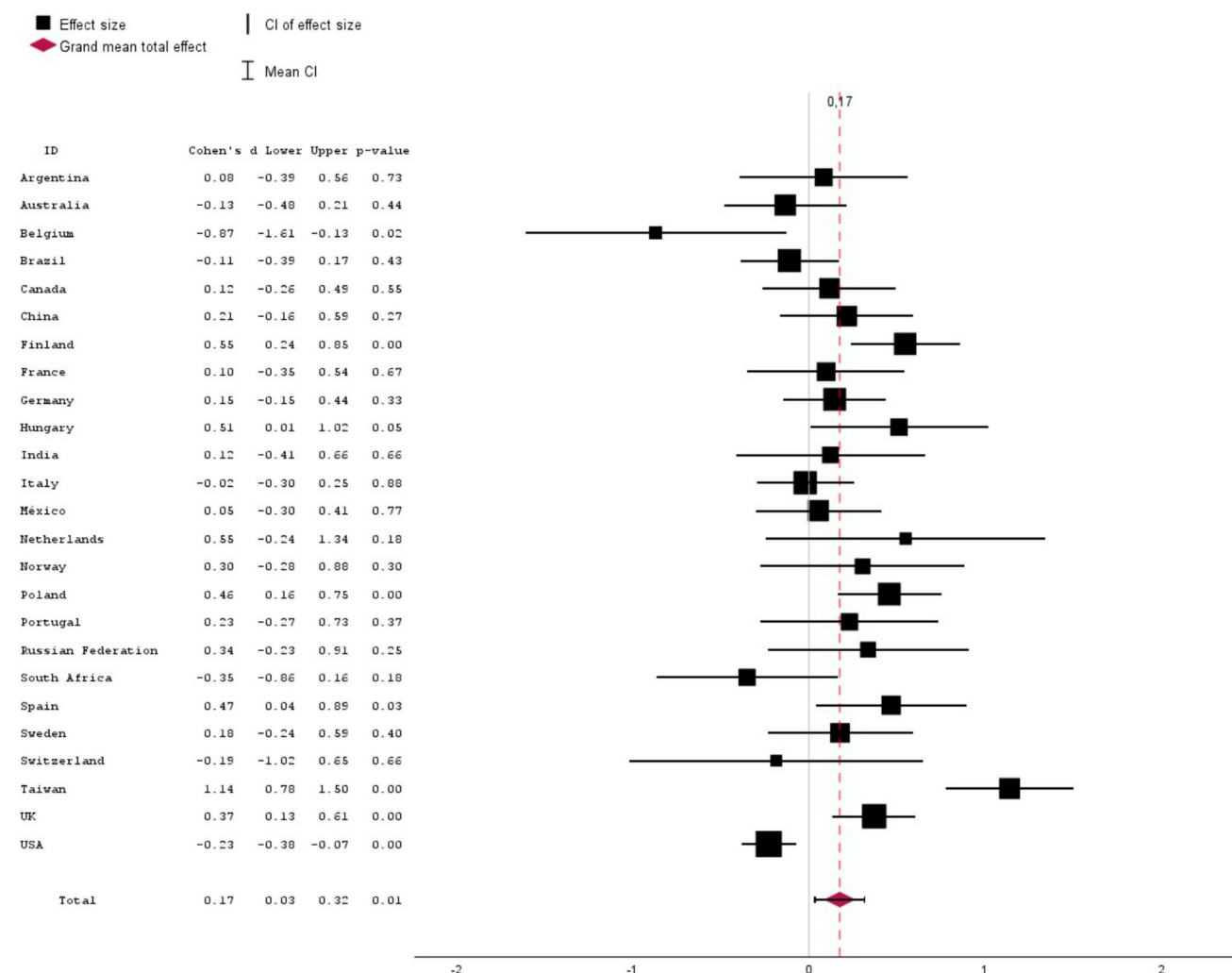


Fig. 3 Results of the meta-analysis of gender differences in the dimension of commitment of birding specialization. The total mean and effect size is given as well as the effect sizes per country

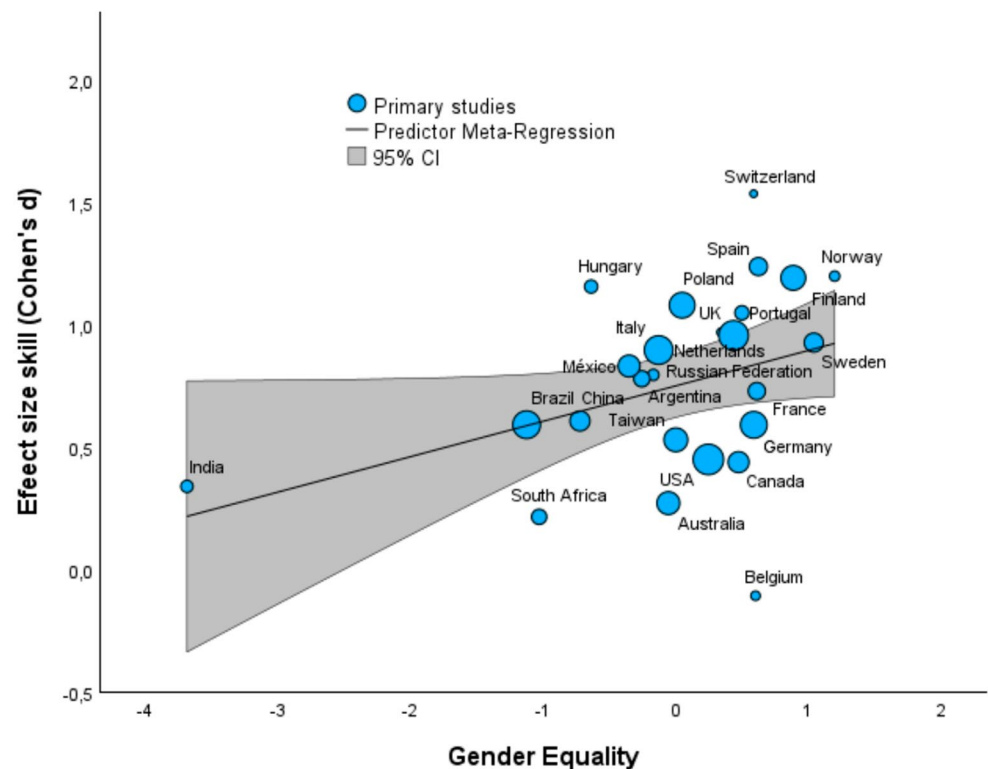
may increase overconfidence. Another line of evidence comes from bird ringing, one of the few or only activities that needs a license based on a testing procedure (Cooper & Smith, 2010). In bird ringing, the female ratio is about 10%, adding some evidence that the self-assessment of men might be realistic. Studying birders' knowledge more objectively is difficult because of the large heterogeneity in knowledge. Such research would necessitate the use of adaptive testing methods, in which each participant receives a customized set of bird species to identify. This approach helps avoid presenting overly simple tasks to advanced birders—which may be seen as unengaging or even disrespectful—and prevents overwhelming novices with excessively difficult items, which could lead to frustration. Although the overestimation in boys and men is well-known (Dahlboom et al., 2011), we suggest that birders are relatively precisely able to assess their own knowledge level. Therefore, this explanation seems unlikely.

The data have been collected during the pandemic, but we have asked about birding behavior prior to the pandemic. Further, the study has sampled countries also from the global south, but the data are still biased towards the northern hemisphere. Another additional aspect would be analyzing gender differences in birding with regard to culture and available leisure, both on an individual level and with nationwide indicators, also collecting data on the individual level concerning leisure activity would improve the findings.

Outline for further theoretical framework

We suggest improving the theoretical conceptualization of gender differences in birding. As there were only slight differences in commitment, we hypothesize that future studies should address gender differences in a more sophisticated manner. First, we suggest that birding initiation should

Fig. 4 Relationship between Gender Equality (factor scores; higher scores = higher equality) and effect sizes measured as Cohen's *d*. Effect sizes above 0.0 are related to a higher skill/knowledge in men



be taken into account, especially the age at initiation age, because higher birding specialization was correlated with a birding initiation during childhood (McFarlane, 1994). Women start birding later in life than men (Moore et al., 2008; Randler & Marx, 2022). This might have significant impact on skill/knowledge, because birding is a real scientific leisure activity with a high level of cognitive demand, such as pattern recognition, comparably to medical diagnostics (Grimalt et al., 2023). Thus, both theoretical and statistical models should use age at initiation as a covariate. Cognitive learning at childhood is considered easier compared to adulthood (Marzola et al., 2023).

Second, time spent birding needs to be incorporated into the models as well. This can be based on two covariates. The time in years between birding initiation and current age can be seen as a measure of birding experience that should be addressed as a moderator, mediator or covariate rather than as a measure of behaviour. Birding is a highly demanding cognitive skill, related to pattern recognition, and therefore, a trainable competence. It is comparable to sports or music where the rule of 10,000 hours suggests that this high amount of time is necessary to become an expert. Ericsson et al. (1993) proposed that achieving expertise in fields like music or sports requires approximately 10,000 hours of “deliberate practice” over about a decade (although this is currently under discussion; see Macnamara et al., 2016). Thus, a longer lifetime birding, as well as more time per week in the field significantly contributes to career progression. We suppose

that women compared to men have a disproportionate share of child-rearing and household responsibilities inhibiting their ability to pursue outdoor recreation activities like bird-watching in the same amount (Moore et al., 2008). Thus, men may have more opportunities to upscale their knowledge.

From a more statistical viewpoint, such measures of behavior that are related to the number of field trips and outings may be considered a predictor of skill/knowledge rather than a separate dimension of birding specialization, which might be in contradiction to all previous work including ours, but nevertheless, the work should be undertaken.

Supplementary Information The online version contains supplementary material available at <https://doi.org/10.1007/s12144-025-08912-7>.

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Authors contribution Christoph Randler: Writing – original draft, Project administration, Methodology, Investigation, Formal analysis, Data curation. Jukka Jokimäki: Writing – original draft, Methodology, Investigation, Data curation, Conceptualization. Maria de Salvo: Writing – review & editing, Methodology, Investigation, Conceptualization. Renan de Almeida Barbosa: Writing – review & editing, Methodology, Investigation, Conceptualization. Marja-Liisa Kaisanlahti-Jokimäki: Writing – review & editing, Methodology, Investigation. Jo-Szu Tsai: Writing – review & editing, Methodology, Investigation, Conceptualization. Raúl Ortiz-Pulido: Writing – review & editing, Methodology, Investigation, Conceptualization. Piotr Tryjanowski: Writing – review & editing, Methodology, Investigation, Conceptualization.

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Data availability The data underlying this meta-analysis are made available on the Open Science Framework (OSF) under <https://osf.io/cbwxxh/>.

Declarations

Ethical approval The study was granted permission by the ethics committee of the Poznan Life Science University [27.4.2020, waiver, following the Act on the Protection of Animals used for Scientific or Educational Purpose in Poland].

Conflict of interest The authors declare that they have no conflict of interest.

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