

Who is attracted to work at Arctic station in Hornsund? Analysis of personality profiles of applicants

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Running title: Who is attracted to work at Arctic station?

Abstract: The first Arctic explorers underwent no formal selection procedure, and their personality traits were not diagnosed. Today, select in and select out procedures in systematic screening activities are common, although each country manages a polar station recruits according to its standards. The main goal of this article is to present the results of personality tests of work candidates at the Polish Polar Station Hornsund in Spitsbergen in 2019–2023. The applicants' personality was diagnosed with the NEO Five-Factor Inventory examining the Big Five personality traits. Results indicated that candidates for work in the polar station were significantly lower in neuroticism, slightly lower in openness to experience and higher in conscientiousness than the general Polish population. Moreover, there was a significant discrepancy in neuroticism between winterers and those not selected for wintering. This result was not observed in the female group. Potential reasons for study outcomes will be discussed in the article.

Keywords: Arctic, Polish Polar Station Hornsund, extreme environment, personality, selection procedure.

Introduction

Work is an elemental human activity that satisfies basic needs and self-realization (Wrzesniewski *et al.* 2003). However, the contexts for doing work can sometimes be significantly different. Some people choose to be professionally active in so-called extreme environments (EEs), which pose challenges to human physiology (*e.g.*, extreme cold, high altitude, lack of gravity), psychology (*e.g.*, prolonged social isolation), and human survival in these contexts are made possible primarily by advances in technology (Barnett and Kring 2003). One example of extreme workplaces, classified as Isolated-Confined-Extreme (ICE) environments (Sandal *et al.* 2006), are polar stations. They operate both seasonally and year-round. There are 82 bases located in Antarctica managed by about 30 countries (Davies 2022) and 39 polar stations in the Arctic (<https://eu-interact.org/accessing-the-arctic/infrastructures/>) managed by nearly 20 countries (Sandal *et al.* 2006). In Antarctica alone, they provide jobs for nearly 5,000 people (Davies 2022). Those who stay at stations form a small social group in relative isolation from civilization, although there is usually Internet access, and extreme social isolation, especially during the polar winter. They struggle with unfavorable environmental conditions, low temperatures, lack of the typical solar cycle of their original residence, and terrain difficulties or threats from fauna (Kadir *et al.* 2013; Skorupa 2015).

Polar conditions pose many challenges for those pursuing professional activities in these contexts. Contrary to popular belief, it is not the physical characteristics of the Arctic environment that are the most stressful for polar explorers but factors of a psychological nature (Bishop *et al.* 2000; Decamps and Rosnet 2005). There are many classifications of psychological factors that affect the adaptation to work in polar stations (Bhargava *et al.* 2000; Bishop *et al.* 2000; Decamps and Rosnet 2005; Sandal *et al.* 2006), however, key stressors can be named as limited ability to leave the station, lack of privacy, boredom, stimulus deprivation, reduced social interaction, and sometimes the inability to avoid interpersonal conflict and resulting stressful situations (Palinkas 1991). In many cases, people have limited influence over the occurrence of those stressors. However, their perception and application of ways of coping are crucial for the safety of those working in the polar regions (Skorupa 2019).

Given the context of polar explorers' work and its challenges, the question is whether there is a specific set of psychological traits that predispose people to cope with extreme environments. The need to conduct research on the psychological characteristics of polar expeditioners appeared at the beginning of the last century (Cherry-Garrard 1989/1922). As early as 1914, Shackleton described the desirable qualities of polar explorers. These were

optimism, patience, physical endurance or physical fitness, idealism, courage, friendship and brotherhood; people with a strong sense of humor influenced the entire expedition very well (Guly 2012). Since systematic research in polar psychology, *i.e.*, since the mid-1950s, attention has begun to be paid to many individual characteristics significant for adaptation to work in polar stations (Palinkas and Suedfeld 2008). Personality and temperament, style of coping with stress, stress resistance, psychological hardiness, and mental health status were explored (Palinkas 2003; Sandal *et al.* 2006; Leon *et al.* 2011a; Johnsen and Gjeldnes 2023). Among relatively stable individual characteristics, by far, the most attention has been paid to personality traits.

Personality is a dynamically organized set of traits within an individual that determine adaptation to the environment. These traits influence motivation for action, information processing and behavior in various situations (Allport 1937). Given the very definition of personality, it can be assumed that this trait will be relevant to adaptation to work in a polar station. While there are many theories of personality, one of the most popular and widespread for several decades is the Big Five model of personality, which assumes the existence of five main personality traits: neuroticism, extraversion, openness to experience, agreeableness and conscientiousness (Feher and Vernon 2021). Neuroticism is associated with a tendency to experience negative emotions, *viz.* anger, fear, guilt, and susceptibility to psychological stress; extraversion refers to the quality and quantity of social interactions and the level of activity and energy; openness to experience indicating a search for a variety of life experiences, tolerance for novelty and cognitive curiosity; agreeableness describes a positive attitude toward others, a tendency to act for the benefit of others; conscientiousness shows goal orientation, including persistence and motivation in actions (Neal *et al.* 2012). The final version of the Big Five model, including the traits mentioned above, was constituted by Costa and McCrae's development of the Big Five measurement tools, NEO-PI-R and NEO-FFI (John and Srivastava 1999). Those questionnaires used to be applied also to measure polar station workers' personality traits (Steel *et al.* 1997; Wood *et al.* 1999; Palinkas and Houseal 2000; Sandal *et al.* 2006; Sarris 2006; Kanas *et al.* 2009; Leon *et al.* 2011a; Kjærgaard *et al.* 2013; Skorupa 2015; Corneliussen *et al.* 2017; Van Fossen *et al.* 2021). Of course, researches on the personality of polar stations' personnel are also being carried out based on other personality models and with reference to other tools, such as the Cattell's Sixteen Personality Factor Questionnaire (16PF) in the Australian (Van Fossen *et al.* 2021) and Chinese (Wang *et al.* 2021) polar stations, or the Eysenck Personality Questionnaire (EPQ) distributed among Ukrainian winterers (Bakhmutova 2021). Regardless of the theoretical perspective adopted, the main aim of personality trait

measurements is to predict polar explorers' future emotional stability, sociability and task ability, as a key ability in the ICE conditions (Van Fossen *et al.* 2021).

Assuming that the study of personality traits can provide guidelines for the selection and support of crews working in isolated, extreme environments, it is worth looking at the desired profile of polar explorer personality traits. Considering the Big Five model, for example, Wood *et al.* (1999) indicate that polar explorers are characterized by low neuroticism, high extraversion, high openness to experience, average agreeableness, and average to high conscientiousness. Researchers such as Steel *et al.* (1997) also point to differences between the intensity of personality traits in the polar group compared to the general population. It was shown that polar station workers scored higher than the normative group in all personality factors except neuroticism. However, not all researchers agree on the most adaptive intensity of personality traits of polar explorers. A summary of studies indicating different preferred personality traits according to the Big Five can be found in Table 1. Appearing inconsistencies will be addressed below.

Low neuroticism indicates good coping with stress under extreme conditions (Palinkas and Housea 2000; Sandal *et al.* 2006; Sarris 2006; Leon *et al.* 2011a; Kjærgaard *et al.* 2013; Corneliussen *et al.* 2017). It is also related to reducing social conflicts, a more positive perception of the group and lower intensity of behavioral and mental health problems (Van Fossen *et al.* 2021). While most researchers agree that low levels of neuroticism are beneficial in ICE, it is unclear whether high levels of extroversion are an adaptive trait in polar isolation. Usually, participants of polar expeditions are characterized by a higher level of extroversion than the general population (Steel *et al.* 1997). However, personality scores from men working at Australian Antarctic stations showed that they were less extroverted than the general population (Sarris 2006). Another issue is whether high levels of extraversion are adaptive in the context of ICE. While studying *Henryk Arctowski* Polar Antarctic Station workers, Terelak (1982) showed that the predominance of extroverted traits with concurrent emotional stability is a good predictor of effective adaptation to isolation. In a study by Sarris (2006), polar explorers with higher extraversion scores indicated greater job satisfaction. In contrast, some researchers suggest that while extraversion increases individual task performance, it is not known whether it causes problems for the team as a whole (Wood *et al.* 1999). The group may perceive extroverts as disruptive and requiring constant attention. Also contrary to expectations, Van Fossen *et al.* (2021) did not prove that extraversion is associated with better social functioning and well-being; moreover, the trait was found to be positively associated with health difficulties. Extroverted individuals may suffer greatly during the wintering period, as

they will try to maintain their social image as highly active individuals, contrary to the decreased stimuli and increased need for a rest (Rosnet *et al.* 2000). While their higher social needs may be unmet in ICE surrounding, they could more probably engage in conflicts (Van Fossen *et al.* 2021). As Jaksic *et al.* (2019) has shown, higher extraversion may be associated with more severe feelings of loneliness.

On the scale of openness to experience, polar explorers also score higher than normative groups, *e.g.*, female winterers working at Australian Antarctic stations scored significantly higher on the scale of openness to experience than the general population (Sarris 2006). Researchers indicate that a high level of this trait is adaptive. For example, participants of military special patrol teams operating in a polar environment achieved the highest scores on the scale of openness to experience and, at the same time, were rated as a group very well psychologically adapted to the extreme environment (Kjærgaard *et al.* 2013). Similarly, to extraversion, some researchers indicate that very high levels of openness to experience can cause problems at the group level (Wood *et al.* 1999). Individuals who are very open to experience will constantly look for novelty, which can be tiring for other polar station workers.

Agreeableness and conscientiousness are usually statistically insignificant factors for adaptation to polar conditions. However, some studies, such as those on Danish soldiers stationed for two years in Greenland, indicated as important scores above the population average for conscientiousness and agreeableness. Those traits were considered positive personality traits, and their occurrence was associated with good adaptation to polar conditions (Corneliusson *et al.* 2017). Most researchers point to the adaptability of the higher intensity of these two traits (Table 1). The more agreeable polar station workers were, the less lonely they felt (Jaksic *et al.* 2019) and experienced fewer conflicts and disappointments (Van Fossen *et al.* 2021). However, the case of conscientiousness seems to be more complicated. Van Fossen *et al.* (2021) observed that conscientiousness is connected with positive attitudes towards other expeditioners and lower depressive symptoms. Hence, researchers such as Palinkas (2003) and Leon *et al.* (2011a) point out that the low need for order is an adaptable disposition. It is worth noting the areas in which the individual reveals conscientiousness. Sharing space with other people significantly limits an individual's influence on, for instance, the station's appearance.

When considering the most desirable profile of a polar explorer personality, it is worth noting a few more points. On the one hand, the diversity of personality traits of people in extreme environments is more narrowed than the typical normal distribution in the population (Sandal *et al.* 2006; Palinkas 2003), but on the other hand there are only a few traits, such as low neuroticism, that can serve to predict polar winter adaptation effectively (Palinkas 2003).

Moreover, some studies show a complete lack of differences in adaptation to an expedition between groups matched with and without the criterium of personality traits (Sandal *et al.* 2006) or no relationship between personality profile and assessment of good polar adaptation (Skorupa 2015). Unfortunately, polar research is often characterized by a small sample number. The surveyed groups are often very homogeneous, *i.e.*, mainly consisting of young and educated men. Different nationalities operate polar stations, and there is a lack of international studies, so single-case research results are sensitive to cultural differences.

Given the various ambiguities surrounding the measurement of personality among polar station personnel, including partially contradictory indications as to the most adaptive the Big Five personality traits, the purpose of the present study was to explore in this context work candidates and individuals selected for a year-round contract at the Polish Polar Station Hornsund. We focused on the following research questions: (1) Individuals with what personality characteristics apply to work at the polar station? (2) Does the personality profile of candidates selected for year-round work at the polar station correspond to the most frequently indicated in the literature desirable personality traits? (3) Do individuals selected for year-round work at the polar station differ significantly from those not selected for that position?

Methods

Participants and procedure. — The study was conducted among candidates for work at the *Stanisław Siedlecki* Polish Polar Station Hornsund in Spitsbergen, hereafter abbreviated as the Hornsund station, in the years 2019–2023. The personality questionnaire was distributed to job candidates during the interview process. All applicants consented to its completion and were informed that the data would be used anonymously for scientific purposes. The Institute of Geophysics of the Polish Academy of Sciences, employer of the Hornsund station workers, distributed research tools. The personality measurement was intended to be used as a criterion to support selection in case of doubts about a candidate's fitting into the workplace, but such a situation has not occurred. In light of the significantly limited number of candidates meeting the formal criteria for the position, the recruitment process in each case was based on an interview and an assessment of the self-presentation of candidates. There was no need to resort to a psychological test as a criterion to support the decision-making.

Six polar expeditions were covered by the research procedure, making a total of 190 candidates, including 147 (77.4%) men and 43 (22.6%) women. Most applicants were in early or middle adulthood (mean = 35.749 years, SD = 9.007). There was no maximum age limit for

applicants and obtained age distribution is also typical for, for example, Ukrainian polar station personnel (Miroshnychenko *et al.* 2020).

All candidates were of Polish nationality. Full demographic data can be found in the OSF repository (https://osf.io/xn5qj/?view_only=2901f06f9e4541338b7bdfb729a396af). Of those selected for wintering were 32 (69.6%) men and 14 (30.4%) women. The outcomes of the recruitment process are shown in Fig. 1. The group of candidates unselected for wintering also includes those selected for a short-term stay during the polar summer, as well as those not qualified to participate in the expedition at all. Due to the data collection method during the selection process, it was impossible to separate the group of summer workers in each expedition, hence, the data, with an awareness of the limitations this entails, were treated together. It is also not possible to identify those who have successfully passed the selection procedure but, for objective reasons, did not go on a full-year expedition.

Measures. — The NEO Five-Factor Inventory (NEO-FFI; Costa and McCrae 1989) personality questionnaire was selected to diagnose the personality profiles of candidates to work in the Hornsund station. The questionnaire is based on the Big Five personality theory and has also been frequently applied in other studies on the personality of polar explorers. The Polish adaptation of NEO-FFI (Zawadzki *et al.* 1998) was administered to the examined sample. NEO-FFI is a 60-item inventory measuring five personality dimensions: neuroticism, extraversion, openness, agreeableness, and conscientiousness. Respondents answer on a five-point Likert-type scale (1 = strongly disagree, 5 = strongly agree). Each respondent can score on every scale from 12 to 60 points. The Cronbach's alpha reliability coefficient of the Polish version of the questionnaire was satisfactory and within the range of 0.68 and 0.82. Basic sociometric data of the candidates, like age and gender, were also collected.

Results

To answer the research questions, data was collected from applicants for six expeditions. Tables 2 to 5 show the intensity of the traits tested in all candidates divided by gender and the result of the recruitment process. Data taking into account the intensity of the traits among the participants of the particular studied expeditions were placed in the OSF repository. It can be observed that those who applied for work in the Hornsund station were significantly lower in neuroticism ($p = .001$) and openness to experience ($p = .001$), as well as higher in conscientiousness ($p = .001$) than the general population. Significant differences in levels of

extraversion ($p = .01$) can also be observed, with polar station candidates being less extroverted than the general population. There are no significant differences in the level of agreeableness (Table 2).

When a division is made between winterers and candidates not selected for wintering, the average scores of those two groups on personality scales present similarly to the general population as the results of all candidates taken together. Winterers are significantly less neurotic ($p = .001$), paradoxically less open to experience ($p = .001$), and more conscientious than the general population ($p = .001$). Differences in the intensity of extraversion and agreeableness were not confirmed. Those who apply to work at the polar station but are not selected to participate in the year-long expedition are additionally significantly less extroverted than the general population ($p = .01$) (Table 3).

When the population is divided by gender, the comparison of the performance of winterers and candidates not selected for wintering to the general population looks similar. The results on the personality scales showed that the male winterers and candidates are significantly less neurotic ($p = .001$), less open to experience ($p = .001$), and more conscientious ($p = .001$) than the general population. Those not selected for the year-long expedition are also significantly less extroverted ($p = .05$) than the general population (Table 4). When interpreting the intensity of a given trait in a wintering population, following the assumptions outlined in the manual for NEO-FFI (Zawadzki *et al.* 1998), it can be concluded that the mean level of neuroticism ($M = 15.406$, $SD = 4.737$) across the men's group of winterers was very low. Extraversion ($M = 38.031$, $SD = 5.97$), openness to experience ($M = 36.594$, $SD = 4.384$) and agreeableness ($M = 39.438$, $SD = 5.376$) intensity reached an average level, while conscientiousness results ($M = 45.625$, $SD = 5.104$) indicate a slightly high intensity of trait.

The traits among female winterers were similar to those of men. Both the women selected for wintering and the candidates not selected for the year-long expedition were significantly less neurotic ($p = .001$) and significantly more conscientious ($p = .001$) than the general population. In contrast to the male population, there were no differences in the intensity of openness to experience and extraversion. Differences in agreeableness also remained insignificant (Table 5). When interpreting the intensity of a given trait in a wintering population, following the assumptions outlined in the manual for NEO-FFI (Zawadzki *et al.* 1998), it can be concluded that the mean level of neuroticism ($M = 18.571$, $SD = 3.228$) among female candidates was very low. Extraversion level ($M = 40$, $SD = 4.297$) was slightly above average, the intensity of openness to experience ($M = 38.143$, $SD = 5.172$) was average, agreeableness

($M = 42$, $SD = 3.721$) was below the population's mean level, and conscientiousness ($M = 48.143$, $SD = 5.097$) intensity was moderately high.

We also conducted analyses of the significance of differences in the intensity of personality traits between the populations of those selected and those not chosen for wintering (Table 3), also taking into group male and female candidates (Tables 4 and 5). Due to the unequal number of participants in tested groups, the non-parametric Mann-Whitney's U test was used for each comparison. The analysis showed that winterers differ from the other candidates only in their level of neuroticism (winterers: $M = 16.37$; $SD = 4.543$; other candidates: $M = 19.022$; $SD = 5.622$). The statistic for this test was 2284.5 ($p = 0.005$), and the effect size was slightly moderate ($r_{rb} = 0.275$). This means that in the recruitment process, candidates who had significantly lower levels of neuroticism were selected more often than others. Male winterers appear to be moderately less neurotic than unselected male candidates ($r_{rb} = 0.346$). Among women, on the other hand, this relationship was not significant ($p > 0.05$), however, the female sample is underrepresented. Interestingly enough, openness to experience is slightly lower among female winterers than unselected female candidates ($r_{rb} = 0.23$), but still not significantly ($p > 0.05$). These results should also be cautiously treated due to the small research sample and a disproportion of compared groups. Detailed results of the conducted analysis can be found in the OSF repository.

Discussion

Our study sought to investigate the phenomenon of the personality of polar station workers, especially those wintering over. The results revealed that those who applied for work in the Hornsund station were significantly lower in neuroticism and openness to experience, slightly less lower in extroversion, and significantly higher in conscientiousness than the general Polish population. No differences between polar station work candidates and the general population were observed in agreeableness. These results only partially fall with outcomes previously obtained by researchers. For example, Steel *et al.* (1997) showed that polar station workers scored higher than the normative group in all personality factors except neuroticism. In the case of Polish winterers and those not selected for wintering, only neuroticism and conscientiousness results support this thesis.

The diagnosed intensity of these two traits is also consistent with the profile of desirable personality traits of a polar explorer indicated in the literature, which is basically unarguable low neuroticism (Palinkas and Houseal 2000; Sandal *et al.* 2006; Sarris 2006; Kjærsgaard *et al.* 2013; Corneliussen *et al.* 2017), and rather high conscientiousness (Steel *et al.* 1997; Wood *et*

al. 1999; Kanas *et al.* 2009; Leon *et al.* 2011b; Van Fossen *et al.* 2021). In the context of the second trait, some researchers point out that its very high intensity may not be fully adaptive in a space shared with others (Palinkas 2003; Leon *et al.* 2011b). However, given that Polish winterers point to intensive work and organizational problems as some of the main stressors in a polar station (Skorupa 2019), the thesis of the adaptability of higher conscientiousness may be favored. As indicated by Fisher and Boyle (1997) or Van Fossen *et al.* (2021), conscientiousness predicts polar explorers' motivation for good performance in professional tasks. It is also worth noting the magnitude of the difference between the level of neuroticism in the general population and the population of polar station applicants. Perhaps polar expedition applicants are performing a kind of self-selection, which is also observed among candidates in other job sectors (Pager and Pedulla 2015). It can be assumed that the stereotypical image of the polar station as extreme setting attracts the recruitment process of individuals who rate themselves as more emotionally stable and less prone to negative feelings to participate (Van Fossen *et al.* 2021). Neuroticism is also related to anxiety (Van Fossen *et al.* 2021), and to apply for a job position in the Arctic or Antarctic, one has to be low-anxious. There is another possibility. A job at a polar station may be perceived as unique and only available to a few people; hence when entering the recruitment process, polar candidates will try to present themselves more positively. In a situation of high-stakes conditions, there is a risk of potential malfeasance while filling out measuring personality (Arthur *et al.* 2010), and perhaps it is not difficult to predict what neuroticism responses are not desirable.

The results regarding extraversion are also interesting. Contrary to what was previously indicated (Steel *et al.* 1997), Polish polar station workers do not have a higher intensity of this trait than the general population. Moreover, in the context of the adaptive intensity of extraversion, researchers probably have the most divergent opinions, appreciating both the low intensity of results on this scale (Rosnet *et al.* 2000; Palinkas 2003; Sarris 2006) and its high intensity (Terelak 1982; Steel *et al.* 1997; Palinkas and Houseal 2000; Sandal *et al.* 2006; Sarris 2006; Kanas *et al.* 2009; Leon *et al.* 2011b). An obtained mean extraversion score among male Polish winterers was interpreted as moderate, while among female Polish winterers, it was slightly above average. This result is consistent with scores previously obtained from the Hornsund station workers (Skorupa 2016). Moderate intensity of extraversion could be considered the most optimal, agreeing with the thesis put forward by other researchers about the desired profile of the so-called social introvert (Guly 2012).

Perhaps the most surprising result is the intensity of openness to experience among candidates to work at the Hornsund station, which is lower than the population average. This

difference is evident among women and men applying for a job at that polar station. A higher intensity of openness to experience than in the general population was shown in the work of Wood *et al.* (1999) and Sarris (2006). Moreover, the high intensity of this trait is also indicated in the literature as adaptive (Palinkas and Houseal 2000; Sandal *et al.* 2006; Sarris 2006) and was diagnosed in an earlier study of Polish winterers from the Hornsund station (Skorupa 2016). It would seem that a heightened openness to experience is crucial to applying for a job at a polar station. However, worth noticing is a limited amount of stimulus provided to polar station workers during year-round stay, especially during the polar night. Hence, some researchers point to a low need for stimulation (Sandal *et al.* 2006) and high resistance to boredom (Palinkas 2000; Palinkas 2003; Leon *et al.* 2011a) as desirable traits. It is also likely that this result will capture the cultural uniqueness of Polish applicants or the social changes that have occurred over the years, *i.e.*, greater employee mobility, the possibility of remote work from any part of the world treated as a norm, and not a phenomenon requiring a particular search for new things and general openness. More longitudinal and simultaneous studies conducted in stations administered by different countries are needed in this area.

While checking the differences between the entire population of winterers and those not selected for wintering, a significant difference was observed only in one trait, namely neuroticism. Neuroticism, as other researchers have mentioned, is a key feature for adaptation to extreme environments (Palinkas and Houseal 2000; Sandal *et al.* 2006; Sarris 2006; Leon *et al.* 2011a, 2011b; Kjærgaard *et al.* 2013; Corneliussen *et al.* 2017; Van Fossen *et al.* 2021). Its high level also seems to be accurately detected during the selection process. Considering the distinction between the female and male populations, this difference in the Polish sample was significant only in the male winterers group. This may be due to differences between the genders, where women are naturally more neurotic than men. However, this difference begins to blur when we analyze groups of people working in extreme conditions (Goel *et al.* 2014). Perhaps, to be a candidate for a job at a polar station, regardless of whether one is ultimately selected for wintering or not, as a woman, you still need to demonstrate a lower level of neuroticism.

The lack of differences between winterers and candidates not selected for wintering at the Hornsund station in the remaining personality scales can be attributed to several factors. (1) Some researchers claim that there is no profile of an ideal polar explorer and even that the basic personality measurement may be a poor predictor of behavior in extreme environments (Sandal *et al.* 2006; Skorupa 2016). Certain assumptions are made about the potential adaptation of specific individuals, but the precise criteria for these predictions are difficult to specify (Burns

and Sullivan 2000). Perhaps it is worth looking at issues related to personality in the context of its completeness among all expedition participants (Leon and Scheib 2007; Skorupa 2015) and not only from the individual perspective. (2) The imperfections of the Big Five Model itself. Although numerous studies, including meta-analyses such as Berry *et al.* (2012), indicate the usefulness of determining certain personality traits to predict workplace deviance, other researchers, such as Tisu *et al.* (2020), indicate the role of different personality qualities than the Big Five traits in the optimization of job performance. (3) Diagnostic imperfection of the NEO-FFI test - perhaps in some questions, such as those regarding conscientiousness, respondents answer biasedly, anticipating what the answer desired by the employer will be. (4) Difficulty in definitively identifying the reasons why someone was not qualified to participate in the year-long expedition in the first place. The candidate's personality profile may have been as adaptive as possible, but objective factors meant that he or she preferred short-term work at the polar station or could not participate in the expedition at all. When conducting future research in the context of personality trait screening, more factors should be taken into account in order to provide a more precise answer to this question. (5) In the current study, only personality tests completed during the selection procedure were analyzed. It was not possible to assess the effectiveness of the adaptation of winterers to life and work in the Hornsund station. A more comprehensive study design would make it possible to verify whether personality traits and if so, which ones are associated with effective adaptation to work in polar conditions.

Conclusions

More than a hundred polar stations in the Arctic and the Antarctic employ several thousand people yearly. Polar stations, however, are not average places of work. The conditions there are described as isolated, confined and extreme. To effectively carry out professional tasks in such a context, participants in polar expeditions, especially winterers, should be characterized by psychological predispositions that enable them to make a wide-ranging psychological adaptation.

Polar stations are managed by dozens of countries, each of which also conducts its unique selection process. One trait identified as significant for adaptation is personality, as defined by the Big Five model. The 2019–2023 recruitment procedure for the *Stanislaw Siedlecki* Polish Polar Station Hornsund in Spitsbergen was accompanied by a personality assessment with the NEO-FFI questionnaire. Although the results of personality tests did not

constitute the basis for evaluating a job candidate, thanks to several years of measuring the personality traits, better insight into who applies for work at the polar station and who ultimately becomes selected was gained.

While there are indications of what qualities polar explorers find most desirable, there still no consensus among researchers in that respect. Typically, however, low neuroticism, higher extraversion, higher openness to experience, higher conscientiousness and possibly higher agreeableness are desirable. Those who applied for a job at the Hornsund station and those who were finally selected for wintering do not quite fit into the above pattern. The neuroticism pattern was confirmed, with winterers showing lower levels of neuroticism compared to non-winterers and the general population. The conscientiousness of polar candidates was higher than in the general population; however, no statistically significant differences were detected between winterers and non-winterers. On the other hand, the intensity of extraversion and openness to experience was not diagnosed higher than in the general population, and agreeableness remained average. Women applying to work at the station were less neurotic than females not interested in such work; however, no significant differences were shown between winterers and women not selected for the year-long expedition.

These results indicate the need for further research in assessing personality traits in the selection threshold for polar stations. From a practical perspective, personality tests could become a more significant criterion in the recruitment process, and it is also worth discussing the aspect of person-environment fit during pre-expedition training. It is also worth asking not only who is applying but also why and for what reasons is ultimately selected. Cover letters or entire recruitment processes could be potentially included in future analyses. Moreover, the longitudinal perspective is worth applying to enable researchers to verify the effects of recruitment procedures and explorers' adaptation to ICE conditions of polar expeditioners. Sociocultural factors also seem important; hence, future research should include intercultural comparisons of winterers from different stations and focus more on the gender differences already highlighted in this study.

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References

- Allport G.W. 1937. *Personality: A psychological interpretation*. Holt, Rinehart & Winston, New York.
- Arthur Jr.W., Glaze R.M., Villado A.J. and Taylor J.E. 2010. The magnitude and extent of cheating and response distortion effects on unproctored internet-based tests of cognitive ability and personality. *International Journal of Selection and Assessment* 18: 1–16. doi: 10.1111/j.1468-2389.2010.00476.x
- Bakmutova L. 2021. Main features of expeditioners' personality traits in Antarctic conditions. *Mental Health: Global Challenges* 4: 42–49. doi: 10.32437/mhgcj.v4i1.130
- Barnett J.S. and Kring J.P. 2003. Human Performance in Extreme Environments: A Preliminary Taxonomy of Shared Factors. *Proceedings of the Human Factors and Ergonomics Society Annual Meeting* 47: 961–964. doi: 10.1177/15419312030470080
- Berry C.M., Carpenter N.C. and Barratt C.L. 2012. Do other-reports of counterproductive work behavior provide an incremental contribution over self-reports? A meta-analytic comparison. *Journal of applied psychology* 97: 613. doi: 10.1037/a0026739
- Bhargava R., Mukerji S. and Sachdeva U. 2000. Psychological impact of the Antarctic winter on Indian expeditioners. *Environment and Behavior* 32: 111–127. doi: 10.1177/00139160021972450
- Bishop S.L., Morphey M.E and Kring J.P. 2000. Avoiding risky teams in risky environments. *Proceedings of the Human Factors and Ergonomics Society Annual Meeting* 44: 2–800–2–803. doi: 10.1177/154193120004401299
- Burns R. and Sullivan P. 2000. Perceptions of danger, risk taking, and outcomes in a remote community. *Environment and Behavior* 32: 32–71. doi: 10.1177/00139160021972423
- Cherry-Garrard A. 1989/1922. *The worst journey in the world*. Carroll & Graf, New York.
- Corneliussen J.G., Leon G.R., Kjærgaard A., Fink B.A and Venables N.C. 2017. Individual traits, personal values, and conflict resolution in an isolated, confined, extreme environment. *Aerospace Medicine and Human Performance* 88: 535–543. doi: 10.3357/AMHP.4785.2017
- Costa P.T. Jr. and McCrae R.R. 1989. *NEO-PI/FFI manual supplement*. FL: Psychological Assessment Resources, Odessa.
- Davies B. 2022. *Living and working in Antarctica*. <https://www.antarcticglaciers.org/antarctica-2/people-in-antarctica/living-and-working/>
- Decamps G. and Rosnet E. 2005. A longitudinal assessment of psychological adaptation during a winter-over in Antarctica. *Environment and Behavior* 37: 418–435. doi: 10.1177/0013916504272561
- Feher A. and Vernon P.A. 2021. Looking beyond the Big Five: A selective review of alternatives to the Big Five model of personality. *Personality and Individual Differences* 169: 110002. doi: 10.1016/j.paid.2020.110002
- Fisher C.D. and Boyle G.J. 1997. Personality and employee selection: Credibility regained. *Asia Pacific Journal of Human Resources* 35: 26–40.

- Goel N., Bale T.L., Epperson C.N., Kornstein S.G., Leon G.R., Palinkas L.A. and Dinges D.F. 2014. Effects of sex and gender on adaptation to space: behavioral health. *Journal of Women's Health* 23: 975–986. doi: 10.1089/jwh.2014.4911
- Guly H. 2012. Psychology during the expeditions of the heroic age of Antarctic exploration. *History of Psychiatry* 23: 194–205. doi: 10.1177/0957154X11399203
- Jaksic C., Steel G., Stewart E. and Moore K. 2019. Antarctic stations as workplaces: adjustment of winter-over crew members. *Polar Science* 22: 100484. doi: 10.1016/j.polar.2019.100484
- John O.P. and Srivastava S. 1999. The Big-Five trait taxonomy: *History, measurement, and theoretical perspectives*. <https://www.personality-project.org/>
- Johnsen B.H. and Gjeldnes R. 2023. Back to the basics of polar expeditions: personality hardiness, fear, and nutrition in polar environments. *Safety in Extreme Environments* 5: 47–58. doi: 10.1007/s42797-023-00068-6
- Kadir S.M.S.A., Yunus K.R.B.M., Omar A.H.H. and Hamid D.T.A. 2013. The daily life challenges faced by the researcher in Arctic. *Procedia - Social and Behavioral Sciences* 90: 764–771. doi: 10.1016/j.sbspro.2013.07.150
- Kanas N., Sandal G., Boyd J.E., Gushin V.I., Manzey D., North R., Leon G.R., Suedfeld P., Bishop S., Fiedler E.R., Inoue N., Johannes B., Kealey D.J., Kraft N., Matsuzaki I., Musson D., Palinkas L.A., Salnitskiy V.P., Sipes W. and Wang J. 2009. Psychology and culture during long-duration space missions. *Acta Astronautica* 64: 659–677. doi: 10.1016/j.actaastro.2008.12.005
- Kjærgaard A., Leon G.R. and Fink B.A. 2013. Personal challenges, communication processes, and team effectiveness in military special patrol teams operating in a polar environment. *Environment and Behavior* 47: 644–666. doi: 10.1177/0013916513512834
- Leon G.R. and Scheib A. 2007. Personality influences on a two-man Arctic expedition, impact on spouse, and the return home. *Aviation, Space, and Environmental Medicine* 78: 526–529. PMID: 17539449.
- Leon G.R., Sandal G.M. and Larsen E. 2011a. Human performance in polar environments. *Journal of Environmental Psychology* 31: 353–360. doi: 10.1016/j.jenvp.2011.08.001
- Leon G.R., Sandal G.M., Fink B.A. and Ciofani P. 2011b. Positive experiences and personal growth in a two-man North Pole expedition team. *Environment and Behavior* 43: 710–731. doi: 10.1177/0013916510375039
- Miroshnychenko O., Pasichnyk I. et al. 2020. Study of Ukrainian polar explorers' psychological readiness for extreme environments at the Antarctic station. *International Journal of Human Movement and Sports Sciences* 8: 455–461. doi: 10.13189/saj.2020.080618
- Neal A., Yeo G., Koy A. and Xiao T. 2012. Predicting the form and direction of work role performance from the Big 5 model of personality traits. *Journal of Organizational Behavior* 33: 175–192. doi: 10.1002/job.742

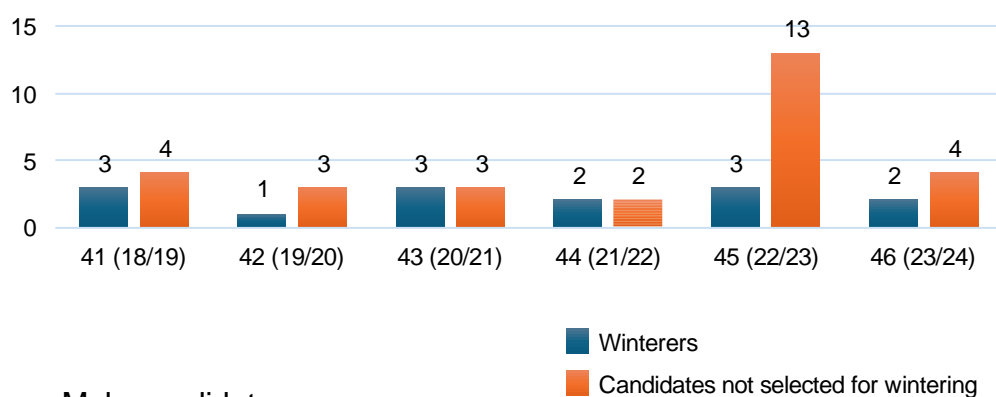
- Pager D. and Pedulla D. S. 2015. Race, self-selection, and the job search process. *American Journal of Sociology* 120: 1005–1054. doi: 10.1086/681072
- Palinkas L.A. 1991. Effects of physical and social environments on the health and well being of Antarctic winter-over personnel. *Environment and Behavior* 23: 782–799. doi: 10.1177/0013916591236008
- Palinkas L.A. 2003. The psychology of isolated and confined environments: Understanding human behavior in Antarctica. *American Psychologist* 58: 353–363. doi: 10.1037/0003-066X.58.5.353
- Palinkas L.A. and Houseal M. 2000. Stages of change in mood and behavior during a winter in Antarctica. *Environment and Behavior* 32: 128–141. doi: 10.1177/00139160021972469
- Palinkas L.A. and Suedfeld P. 2008. Psychological effects of polar expeditions. *The Lancet* 371: 153–163. doi: 10.1016/S0140-6736(07)61056-3
- Rosnet E., Le Scanff C. and Sagal M.S. 2000. How self-image and personality influence performance in an isolated environment. *Environment and Behavior* 32: 18–31. doi: 10.1177/00139160021972414
- Sandal G.M., Leon G.R. and Palinkas L. 2006. Human challenges in polar and space environments. *Reviews in Environmental Science and Bio/Technology* 5: 281–296. doi: 10.1007/s11157-006-9000-8
- Sarris A. 2006. Personality, culture fit, and job outcomes on Australian Antarctic stations. *Environment and Behavior* 38: 356–372. doi: 10.1177/0013916505279044
- Skorupa A. 2015. *Determinants of effective functioning of an individual in a group in polar conditions*. PhD Thesis. University of Silesia, Katowice (in Polish).
- Skorupa A. 2016. The psychological indicators of human adaptation to working in extreme conditions on the example of the Polish Polar Station. In: Alcover C.M., Moriano J.A. and Topa G. (eds.) *Psycologia del trabajo. Conceptos clave y temas emergentes*. Sanz y Torres, Madrid: 499–534.
- Skorupa A. 2019. Safety of people working in the polar regions. *Human Resource Management/Zarządzanie Zasobami Ludzkimi* 2–4/19: 29–42 (in Polish).
- Steel G.D., Suedfeld P., Peri A. and Palinkas L.A. 1997. People in high latitudes: "Big Five" Personality characteristics of the circumpolar sojourner. *Environment and Behavior* 29: 324–347. doi: 10.1177/001391659702900302
- Terelak J. F. 1982. *Man in extreme situations: Antarctic isolation*. Wydawnictwo Ministerstwa Obrony Narodowej, Warszawa (in Polish).
- Tisu L., Lupşa D., Vîrgă D. and Rusu A. 2020. Personality characteristics, job performance and mental health: the mediating role of work engagement. *Personality and Individual Differences* 153: 109644. doi: 10.1016/j.paid.2019.109644

- Van Fossen J.A., Olenick J., Ayton J., Chang C.H. and Kozlowski S.W. 2021. Relationships between personality and social functioning, attitudes towards the team and mission, and well-being in an ICE environment. *Acta Astronautica* 189: 658–670. doi: 10.1016/j.actaastro.2021.09.031
- Wang J., Li H. *et al.* 2021. Analysis of the psychological states of the scientific expeditioners in extreme environment. <https://www.researchsquare.com/article/rs-1023330/v1>
- Wood J., Lugg D.J., Hysong S.J. and Harm D.L. 1999. Psychological changes in hundred-day remote Antarctic field groups. *Environment and Behavior* 31: 299–337. doi: 10.1177/0013916599313001
- Wrzesniewski A., Dutton J.E. and Debebe G. 2003. Interpersonal sensemaking and the meaning of work. *Research in Organizational Behavior* 25: 93–135. doi: 10.1016/S0191-3085(03)25003-6
- Zawadzki B., Strelau J., Szczepaniak P. and Śliwińska M. 1998. *Costa and McCrae's NEO-FFI Personality Inventory. Polish adaptation. Manual.* Pracownia Testów Psychologicznych PTP, Warszawa (in Polish).

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Female candidates



Male candidates

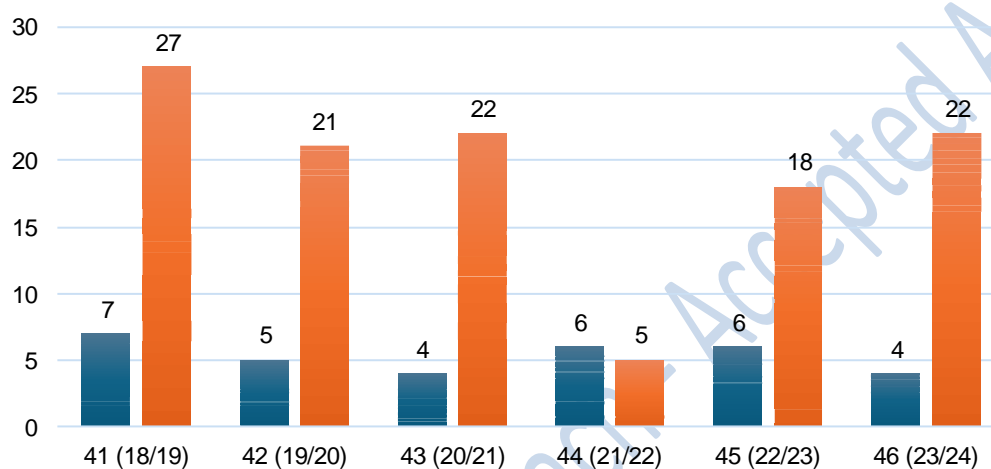


Fig. 1. Results of the recruitment process among female and male Hornsund station work candidates divided into winterers and those not selected for wintering. From the 44th expedition authors received only results of candidates selected for winter and summer expedition; results of unselected applicants were not available.

Table 1.

A compilation of articles indicating the adaptive level of the Big Five personality traits for an effective adaptation polar station work.

Personality traits	Low-intensity	Moderate intensity	High-intensity
Neuroticism	Corneliussen <i>et al.</i> (2017) Kjærgaard <i>et al.</i> (2013) Leon <i>et al.</i> (2011a) Palinkas and Housea (2000) Sandal <i>et al.</i> (2006) Sarris (2006) Van Fossen <i>et al.</i> (2021)	Leon <i>et al.</i> (2011b)	
Extraversion	Jaksic <i>et al.</i> (2019) Palinkas (2003) Rosnet <i>et al.</i> (2000) Sarris (2006) Van Fossen <i>et al.</i> (2021)		Kanas <i>et al.</i> (2009) Leon <i>et al.</i> (2011b) Palinkas and Housea (2000) Sandal <i>et al.</i> (2006) Sarris (2006) Steel <i>et al.</i> (1997)
Openness to experience			Palinkas and Housea (2000) Sandal <i>et al.</i> (2006) Sarris (2006)
Agreeableness	Steel <i>et al.</i> (1997)		Jaksic <i>et al.</i> (2019) Leon <i>et al.</i> (2011b)
Conscientiousness	Steel <i>et al.</i> (1997)		Kanas <i>et al.</i> (2009) Leon <i>et al.</i> (2011b) Steel <i>et al.</i> (1997) Van Fossen <i>et al.</i> (2021) Wood <i>et al.</i> (1999)

Table 2.

Personality characteristics of polar station work candidates from all expeditions versus results from the general Polish population.

Personality trait	General population (A) ^a		Candidates (B)				Significance of differences between (A) and (B)
	Mean	SD	Mean	SD	Mini	Maxi	Independent t-test ^b
Neuroticism	34.79	7.87	18.500	5.503	8	34	-40.804***
Extraversion	39.79	6.86	38.626	5.270	23	54	-3.044**
Openness to experience	39.80	6.31	37.184	4.756	25	48	-7.582***
Agreeableness	40.68	5.76	40.316	4.642	30	52	-1.081
Conscientiousness	41.40	7.26	46.074	5.080	28	56	12.682***

^a for Zawadzki *et al.* (1998), results obtained within the development of the Polish adaptation of the NEO Five-Factor Inventory.

^b $df = 189$.

* $p < .05$, two-tailed.

** $p < .01$, two-tailed.

*** $p < .001$, two-tailed.

Table 3.

Comparison of personality characteristics between the general population, winterers, and candidates not selected for wintering.

Personality trait	General population (A) ^a		Winterers (B)				Unselected candidates (C)				Significance of differences between (A) and (B)	Significance of differences between (A) and (C)	Significance of differences between (B) and (C)			
	Mean	SD	Mean	SD	Min	Max	Mean	SD	Min	Max	One-sample t-test ^b	One-sample t-test ^c	Mann-Whitney's U	p value ^d	r _{rb} ^e	SE of Rank-Biserial Correlation
Neuroticism	34.79	7.87	16.370	4.543	8	25	19.181	5.622	9	34	-27.501***	-33.320***	2284.500	0.005	0.275*	0.098
Extraversion	39.79	6.86	38.630	5.543	25	48	38.625	5.199	23	54	-1.419	-2.689**	3116.500	0.913	0.011	0.098
Openness to experience	39.80	6.31	37.065	4.635	27	47	37.222	4.801	25	48	-4.002***	-6.433***	2876.500	0.377	0.087	0.098
Agreeableness	40.68	5.76	40.217	5.033	31	52	40.347	4.523	30	51	-0.623	-0.882	2917.500	0.452	0.074	0.098
Conscientiousness	41.40	7.26	46.391	5.179	32	56	45.972	5.062	28	56	6.537**	10.839***	3191.000	0.899	-0.013	0.098

^a for Zawadzki *et al.* (1998), results obtained within the development of the Polish adaptation of the NEO Five-Factor Inventory.

^b df = 45.

^c df = 143.

^d significance level below 0,05 was assumed (two-tailed test).

^e r_{rb} – rank-biserial correlation coefficient

* p < .05, two-tailed.

** p < .01, two-tailed.

*** p < .001, two-tailed.

Table 4.

Comparison of personality characteristics between male general population, male winterers, and men not selected for wintering.

Personality trait	Male population (A) ^a		Male winterers (B)				Male unselected candidates (C)				Significance of differences between (A) and (B)	Significance of differences between (A) and (C)	Significance of differences between (B) and (C)			
	Mean	SD	Mean	SD	Min	Max	Mean	SD	Min	Max	One-sample t-test ^b	One-sample t-test ^c	Mann-Whitney's U	p-value ^d	r_{rb} ^e	SE of Rank-Biserial Correlation
Neuroticism	32.94	7.67	15.406	4.737	8	24	18.930	5.438	9	34	-20.937***	-27.626***	1151.500	0.003	0.346**	0.116
Extraversion	39.38	6.84	38.031	5.970	25	48	38.244	4.692	27	51	-1.278	-2.598*	1686.500	0.719	0.042	0.116
Openness to experience	39.48	6.33	36.594	4.384	30	47	36.565	4.494	25	47	-3.725***	-6.956***	1592.500	0.412	0.095	0.116
Agreeableness	39.65	5.86	39.438	5.376	31	52	40.130	4.516	30	51	-0.224	1.141	1486.500	0.181	0.155	0.116
Conscientiousness	40.96	7.12	45.625	5.104	32	56	45.417	5.230	28	55	5.171**	9.140**	1727.500	0.872	0.019	0.116

^a for Zawadzki *et al.* (1998), results obtained within the development of the Polish adaptation of the NEO Five-Factor Inventory.

^b $df = 31$.

^c $df = 114$.

^d significance level below 0,05 was assumed (two-tailed test).

^e r_{rb} – rank-biserial correlation coefficient

* $p < .05$, two-tailed.

** $p < .01$, two-tailed.

*** $p < .001$, two-tailed.

Table 5.

Comparison of personality characteristics between female general population, female winterers, and women not selected for wintering.

Personality trait	Female population (A) ^a		Female winterers (B)				Female unselected candidates (C)				Significance of differences between (A) and (B)	Significance of differences between (A) and (C)	Significance of differences between (B) and (C)			
	Mean	SD	Mean	SD	Min	Max	Mean	SD	Min	Max	One-sample t-test ^b	One-sample t-test ^c	Mann-Whitney's U	p	r_{rb} ^e	SE of Rank-Biserial Correlation
Neuroticism	36.48	7.66	18.571	3.228	12	25	20.172	6.302	9	34	-20.761***	-13.934***	154.500	0.347	0.183	0.190
Extraversion	40.15	6.86	40.000	4.297	30	48	40.138	6.744	23	54	-0.131	-0.010	165.000	0.523	0.127	0.190
Openness to experience	40.09	6.28	38.143	5.172	27	46	39.828	5.204	26	48	-1.409	-0.272	145.500	0.235	0.230	0.190
Agreeableness	41.63	5.50	42.000	3.721	36	48	41.207	4.554	32	51	0.372	-0.500	200.000	0.776	-0.058	0.190
Conscientiousness	41.81	7.37	48.143	5.097	38	55	48.172	3.636	42	56	4.649**	9.424**	193.000	0.924	-0.021	0.190

^a for Zawadzki *et al.* (1998), results obtained within the development of the Polish adaptation of the NEO Five-Factor Inventory.

^b df = 13.

^c df = 28.

^d significance level below 0,05 was assumed (two-tailed test).

^e r_{rb} – rank-biserial correlation coefficient

* p < .05, two-tailed.

** p < .01, two-tailed.

*** p < .001, two-tailed.