STRESS FACTORS AND COPING STRATEGIES AMONG PARTICIPANTS IN THE 31st BULGARIAN ANTARCTIC EXPEDITION AND THE CREW OF THE BULGARIAN RESEARCH VESSEL "ST. ST. CYRIL AND METHODIUS"

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ABSTRACT
In the specialized literature, there is a growing interest in behavior, psychological changes, and stress-coping strategies when working in extreme environments. The harsh living conditions pose serious challenges and stressful situations for participants in Antarctic expeditions and ship crews.
The aim of the present study is to investigate the main stress factors and preferred stress-coping strategies among participants in the XXXI Bulgarian Antarctic Expedition on Livingston Island and the crew of the Bulgarian research vessel, and to reveal the specificities in their manifestation.
The study involved 53 participants aged 33 to 71, of whom 32 were participants in the Antarctic expedition on Livingston Island and 21 were crew members of the research vessel. The sample is exhaustive.
To achieve the research objective, the following were used: 1) A methodology for investigating sources of stress in participants in Antarctic expeditions; 2) The Coping Orientations to Problems Experienced (COPE) scale (Carver et al., 1989), adapted for Bulgarian conditions (Georgiev et al., 2003).
The factor "Interpersonal relationships and abrupt change of usual environment" showed the highest values as a potential source of stress, followed by the factor "Specificity of activity." The factor "Climatic conditions and work regime" had the lowest values. Cognitively engaged strategies were dominant. Emotionally engaged coping strategies had very similar values, while cognitive and emotional disengagement showed the lowest. Significant differences were found in the results of participants in the Antarctic expedition and the ship's crew, both in terms of leading stress factors and coping strategies. Significant correlations were revealed between stress-coping strategies, the number of expedition participations, and age. The obtained results provide valuable guidance for the psychological preparation of expedition participants and coping with extreme environmental conditions.

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Cite this article as:
Boyanov, D., Iancheva, T. (2025). Stress factors and coping strategies among participants in the 31st Bulgarian Antarctic Expedition and the crew of the Bulgarian research vessel "St. St. Cyril and Methodius". *Proceeding book of the 4th International Scientific Congress "Applied Sports Sciences", 2025, Sofia.* pp. 526 - 533.
https://doi.org/10.37393/ICASS2025/82

Keywords: *stress, coping strategies, Antarctica*

INTRODUCTION

Problems related to psychological changes in behavior, actions, and states in extreme environments and as a result of isolation have long attracted the attention of researchers. Some of the studies focus on the functioning of members of polar expeditions and the coping strategies used to deal with stress caused by environmental conditions and isolation (Gunderson, 1974; Gunderson & Pálinkás, 1991; Mihra, 2006; Pálinkás, Suedfeld & Steel, 1995; Suedfeld, 2001; Khandelwal et al., 2015, 2017; Zimmer et al., 2013; Domuschieva-Rogleva & Iancheva, 2017). Others examine the process of adaptation and activity in Antarctica, and their specifics related to the extreme nature of Antarctic climatic and geographic conditions (Gjelten et al., 2016; Padrtová &Trávníčková, 2017; Descamps et al., 2016; Simonova et al., 2023). Lilier et al. (2024) explore the mental well-being of people exposed to risk due to climate impacts, the psychological consequences of climate vulnerability, coping strategies, and the outcomes of adaptive behavior. The authors point out that certain barriers may lead individuals to pursue more easily accessible coping strategies, some of which may be interpreted as maladaptive. Kokun and Bakhmutova (2020) studied the dynamics of mental states, psychological well-being, and satisfaction with relationships with colleagues and the work performed during the stay at the Antarctic station (Kokun & Bakhmutova, 2020). Hasnulin (2013) and Atkov et al. (2019) emphasize in their research the significance of psychophysiological states and psycho-emotional tension associated with the impact of environmental factors on participants in Antarctic expeditions. Some studies focus on the search for preventive approaches - psychological recruitment of expedition participants (Kokun & Bakhmutova, 2021), psychological training and support to reduce symptoms and aid adaptation to Antarctica (Zimmer et al., 2013; Kokun & Bakhmutova, 2021; Lilier et al., 2024).

The issues related to adaptation and the psychological consequences of isolation among ship crews are comparatively less explored. Maritime activity is associated with an increased risk, particularly in a specific environment characterized by limitations within the confines of the ship, including a lack of personal space, restricted social contacts, irregular watch schedules, and 24-hour work cycles. Peev and Bakalov (1998) identify three groups of environmental factors: 1) Natural environment – transitioning through different climate zones, sea turbulence, air humidity, passage through high-risk zones; 2) Ship habitability – vibrations, noise, fumes, limited living conditions and 3) Social environment – restrictions within the ship, lack of opportunity for solitude, movement, and forming new social contacts. The 24-hour work cycle and "watch schedule" typical of seafaring can lead to negative outcomes such as personal exhaustion, "sensory deprivation," "information starvation," etc. (Peev & Stavrev, 2016). Numerous authors investigate anxiety (Carotenuto et al., 2012; Dimitrova & Tarpomanova, 2016), psychological well-being (Xia et al., 2016; Mellbye & Carter, 2017; Sampson & Elis, 2019; Velikova et al., 2024), and depressive symptoms among seafarers (Carotenuto et al., 2012). Velikova et al. (2024) raise the issue of the necessity for psychological support of naval personnel.

The harsh living and working conditions in extreme environments present participants with serious challenges and stressful situations. Stress is defined as "the nonspecific response of the body to any demand for change" (Selye, 1936), a psychophysiological response to internal or external stressors that arises when people perceive their personal resources as inadequate for successfully carrying out a particular task (Lazarus & Folkman, 1984). The response can vary in nature; in some cases, the demands for change lead to positive adaptive changes in the organism, increasing its resilience to external influences. In other cases, when the demands exceed the personal and social resources the individual can bear, defensive states are triggered, which can result in lasting disruption of the body's normal vital processes (Lazarus & Folkman, 1984).

The tendency toward risk-taking behavior and its consequences prompt researchers to explore their relationship with various coping strategies. Coping strategies are defined by numerous scholars as a complex, dynamic, and multidimensional process (Crocker & Graham, 1995; Crocker & Isaak, 1997; Eklund et al., 1993; Gould et al., 1997). Coping aims to regulate emotions and change behavior to better manage a particular situation. Coping with a situation requires a change in behavior and/or cognition to better control the situation. Lazarus and Folkman (1984) define it as "a process of constantly changing cognitive and behavioral efforts to manage specific external and/or internal demands or conflicts that are appraised as taxing or exceeding the resources of the person" (Lazarus & Folkman, 1984, p.141). The application of certain coping strategies requires high and adaptive levels of coping in order to maintain psychological well-being and effectiveness (Gram et al., 2013; Meneghel, 2014). The sources of stress directly related to a given profession may be physical environmental factors or various psychological states that occur regardless of the type of occupation (Von-Onciul, 1996). Participation in an Antarctic expedition and the specific activities of ship crews presuppose, on the one hand, a tendency to take risks and a certain degree of adventurousness, and on the other hand, require strict discipline, endurance, and compliance with rules and regulations. The present study aims to examine the primary stress factors and preferred coping strategies for stress among participants in the 31st Bulgarian Antarctic Expedition on Livingston Island and the crew of the Bulgarian research vessel, and to identify the specific manifestations of these factors.

METHODOLOGY

The study involved 53 participants aged between 33 and 71 years, including 32 members of the Antarctic expedition on Livingston Island and 21 crew members of the research vessel. The sample was exhaustive. The average age of the participants was 45.1 years. All participants in the Antarctic expedition had undergone a preliminary preparatory camp, medical examination, and selection process by the Bulgarian Antarctic Institute (BAI) for inclusion in the expedition. Some of them had previous experience in Antarctica, with an average of 2.7 expedition participations. The study was conducted during the journey and expedition on Livingston Island. All participants were informed about the research objectives and provided their written consent to participate.

Research method

To achieve the aim of the study, the following methods were used:

Coping Orientations to Problems Experienced scale – COPE – 1 (Carver et al., 1989), adapted for Bulgarian conditions (Georgiev et al., 2003). The scale includes 52 items organized into 14 subscales. After additional factor analysis, they were grouped into three generalized secondary factors: cognitive engagement, emotional engagement, and cognitive and emotional disengagement.

A methodology for identifying specific sources of stress among participants in Antarctic expeditions and ship crews. A specially developed methodology was used to assess sources of stress. It consists of 30 items related to potential sources of occupational stress in expedition participants and ship crews. The participants evaluated each item using a 5-point Likert-type scale. After applying factor analysis, the sources of stress were grouped into three factors - Specifics of the activity, Climatic conditions and work schedule, Interpersonal relations and abrupt changes in the usual environment.

For processing the data obtained from the conducted research, the statistical software package SPSS 25 was used. Descriptive, comparative (U-criterion of Mann-Whitney, H-criterion of Kruskal-Wallis), and correlational analyses were applied.

RESULTS AND ANALYSIS

As previously mentioned, a specially developed methodology was used to examine the sources of stress, created specifically for the purposes of this study. A preliminary study with 168 expedition participants allowed us to identify three summarized factors: Specifics of the activity ($\alpha = .754$), Climatic conditions and work schedule ($\alpha = .841$), and Interpersonal relations and abrupt change of the usual environment ($\alpha = .779$). The results of the descriptive analysis reveal that the highest values were recorded for the factor "Interpersonal relations and abrupt change of the usual environment" ($M = 2.23$; $SD = .82$). This includes relationships between team members, absence of family and friends, teamwork, and the sudden shift in daily routines and the usual environment for living and working. This is followed by the factor "Specifics of the activity" ($M = 1.98$; $SD = .49$), which involves the need for quick reaction in emergency situations, long periods (12–16 hours) of fieldwork, lack of time for rest, terrain-related challenges, limited access to communication tools, news and information, shift duration, risk of accidents, sleep disturbances, and others. The lowest values were observed for the factor "Climatic conditions and work schedule" ($M = 1.94$; $SD = .65$). It includes stressors such as the specific work schedule, travel to work sites, and adherence to timelines, weather conditions, time zone changes, lack of personal time, and difficulties during travel. The considerable experience of many expedition participants in working under the extreme conditions of Antarctica, as well as the professionalism of the research vessel's crew, likely reduces the stress-inducing effect of these factors.

Among the individual stressors, the highest values were reported for "Interpersonal relations" ($M = 2.94$; $SD = 1.36$), followed by "Lack of family, friends, and loved ones" ($M = 2.84$; $SD = 1.36$), and "Lack of time for rest" ($M = 2.68$; $SD = 1.27$). The lowest values were found for "Difficulties during travel to Antarctica" ($M = 1.77$; $SD = 1.02$) and "Personal characteristics" ($M = 1.77$; $SD = .82$). These were followed by "Limited access to news and information" ($M = 1.82$; $SD = .87$) and "Compliance with safety regulations and instructions" ($M = 1.82$; $SD = 1.36$).

The results of the comparative analysis reveal significant differences between the two groups of participants (Antarctic expedition members and ship crew members) regarding seven of the examined stress factors (Table 1): lack of personal time, quick reaction in force majeure circumstances, insomnia, interpersonal relations, limited access to communication tools, personal preferences for food and beverages, and duration of rest periods.

Table 1. *Results of the comparative analysis of data between Antarctic expedition participants and ship crew members*

	Lack of personal time	Quick reaction in FMC	Insomnia	Interpersonal relations	Limited access to communication tools	Personal preferences for food and beverages	Duration of rest periods
Mann-Whitney U	155.500	199.500	148.000	122.000	182.500	200.000	187.000
Wilcoxon W	386.500	430.500	379.000	353.000	413.500	431.000	418.000
Z	-3.025	-2.230	-3.187	-3.736	-2.567	-2.214	-2.471
Asymp. Sig. (2-tailed)	.002	.026	.001	.000	.010	.027	.013

The results of the comparative analysis indicate that, for all of the specified stress factors, the members of the Antarctic expedition show significantly higher values (Figure 1).

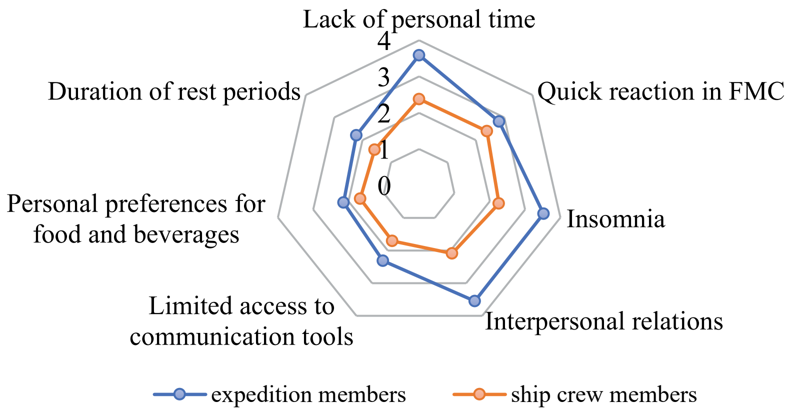

Figure 1. *Mean values of stress factors among Antarctic expedition participants and ship crew members*

One possible explanation for these results is that the expedition members come from diverse professional backgrounds, many of them being researchers, for whom these stress factors are not part of their everyday work environment. For the ship crew members, the identified stress factors are closely tied to the performance of their professional duties and are largely associated with the routine nature of their work. The results of our study regarding the preferred coping strategies for stress (Table 2) show that cognitively engaged strategies are dominant (M = 2.70; SD = .46). These include active coping, planning, positive reinterpretation and growth, and taking purposeful actions to overcome stress.

Table 2. *Results from the descriptive analysis of preferred coping strategies (N = 53)*

Variable	*Mean*	*SD*	Min	Max
Cognitive engagement	2.70	0.46	1.65	3.85
Emotional engagement	2.66	0.73	1.08	4.11
Cognitive–emotional disengagement	1.56	0.97	0.63	3.66

The results obtained confirm the findings from our previous studies (Domuschieva-Rogleva & Iancheva, 2017; Iancheva, Boyanov, & Panayotov, 2023). Emotionally engaged coping strategies show very similar values (M = 2.66; SD = .73), *including seeking emotional and instrumental support, the need for emotional responsiveness, and* focusing on and expressing emotions. The lowest values were recorded for the cognitive and emotional disengagement strategy (M = 1.55; SD = .97), which implies psychological and behavioral disengagement, denial, turning to religion, and the use of alcohol and drugs.

The results of the comparative data analysis reveal statistically significant differences between the two groups - Antarctic expedition participants and ship crew members - across all three coping strategies (Table 3).

Table 3. *Results from the comparative analysis of coping strategies*

	Cognitive engagement	Emotional engagement	Cognitive–Emotional Disengagement
Mann–Whitney U	182.50	97.00	130.00
Wilcoxon W	617.50	328.00	565.00
Z	−2.40	−4.08	−3.43
Asymp. Sig. (2-tailed) (p)	.016	< .001	.001

Participants in the Antarctic expedition more frequently prefer emotionally engaged coping strategies, while the ship crew members show significantly higher values in terms of cognitively engaged and cognitive and emotional disengagement coping strategies (Table 4).

Table 4. *Results from the descriptive analysis of preferred coping strategies*

Coping Strategy	Group	*N*	*Mean*	*SD*	Min	Max
Cognitive engagement	1	32	2.57	0.40	1.84	3.85
	2	21	2.88	0.49	1.65	3.55
	Total	**53**	**2.70**	**0.46**	**1.65**	**3.85**
Emotional engagement	1	32	3.01	0.71	1.44	4.11
	2	21	2.18	0.43	1.08	2.75
	Total	**53**	**2.66**	**0.73**	**1.08**	**4.11**
Cognitive–emotional disengagement	1	32	1.46	1.25	0.63	7.66
	2	21	1.69	0.33	1.00	2.33
	Total	**53**	**1.56**	**0.97**	**0.63**	**7.66**

The results of the correlation analysis reveal significant correlations between emotionally engaged coping strategies and the following stress factors: insomnia ($r = .575$; $p = .000$), interpersonal relations ($r = .447$; $p = .001$), lack of time for rest ($r = .403$; $p = .004$), and lack of personal time ($r = .355$; $p = .01$). Significant correlations were also found between the cognitive and emotional disengagement strategy and the following stressors: difficulties in performing professional duties ($r = .448$; $p = .001$), disturbed sleep due to lack of night ($r = .619$; $p = .002$), difficulties during travel to Antarctica ($r = .599$; $p = .004$), and terrain-related dangers ($r = .470$; $p = .015$).

DISCUSSION

Living and working conditions in extreme environments present participants in Antarctic expeditions and ship crews with serious challenges and stressful situations. Prolonged isolation and the extreme conditions of the environment can lead to significant psychological consequences, including cognitive and behavioral changes, and a range of psychophysiological symptoms in response to stressors. Identifying the factors that trigger these changes and understanding their effects on the behavior and actions of participants are essential for supporting psychological and social adaptation, as well as for the prevention and management of stress caused by the unusual and extreme environmental conditions. The environmental and activity-related challenges may cause stress in participants of polar expeditions and ship crews due to the need to overcome significant difficulties associated with extreme living and working conditions (Norris et al., 2010; Iancheva et al., 2023). A number of studies suggest that coping strategies can lead to long-term salutogenic responses in the lives of expedition members (Norris et al., 2010; Palinkas & Suedfeld, 2008). Palinkas and Suedfeld (2008) point out that depression is one of the most common symptoms during Antarctic expeditions, followed by anxiety and irritability.

Similar consequences are reported in studies on ship crews. Peev and Stavrev (2016) note that the so-called “watch schedule” and the 24-hour work cycle inherent to seafaring may lead to personal exhaustion, “sensory deprivation,” “information starvation,” and more (Peev & Stavrev, 2016). Many authors examine anxiety (Carotenuto et al., 2012; Dimitrova & Tarpomanova, 2016), psychological well-being (Xia, et al., 2016; Mellbye & Carter, 2017; Sampson & Elis, 2019; Velikova et al., 2024), depressive symptoms among seafarers (Carotenuto et al., 2012), and raise the issue of the need for psychological support for military sailors (Velikova et al., 2024).

CONCLUSION

Based on the results of our study, we can summarize that the most significant stressogenic factors for participants in the 31st Bulgarian Antarctic Expedition and the crew of the research vessel are those related to interpersonal relations. These are followed by factors related to the specifics of the activity. The lowest values were recorded for stress factors related to the work schedule, i.e., those directly linked to the participants' primary duties. The demonstrated professionalism and substantial experience of many of the study participants in working under extreme conditions likely reduce the stress-inducing potential of these factors. At the same time, the results reveal significant differences between the two groups in relation to seven of the examined stress factors: lack of personal time, demands for quick reaction in emergency situations, insomnia, interpersonal relations, limited access to communication tools, personal preferences for food and beverages, and duration of rest periods. Among the ship crew members, whose daily tasks are closely associated with such constraints and who often perform them as part of their routine, these stressors show significantly lower values.

The most preferred coping strategies for managing stress identified are cognitively engaged strategies, including active coping, planning and restructuring, positive reinterpretation and growth, and taking purposeful action to manage and overcome the situation and the stress. These are followed by emotionally engaged strategies such as seeking emotional support, the need for emotional responsiveness, and focusing on emotions. The lowest values were recorded for the cognitive and emotional disengagement strategy, which is associated with a passive approach to the stressor, psychological and behavioral disengagement, denial, turning to religion, and the use of alcohol and drugs. Significant differences were also found between the two groups regarding coping strategies. Participants in the Antarctic expedition more frequently prefer emotionally engaged coping strategies, while the ship crew members show significantly higher values for both cognitively engaged and cognitive and emotional disengagement strategies. These results differ notably from those obtained in our previous studies (Domuschieva-Rogleva & Iancheva, 2017; Domuschieva-Rogleva et al., 2017).

LIMITATIONS

The present study is subject to certain limitations. On the one hand, the relatively small number of participants can be noted; however, the sample is exhaustive. The logistical challenges associated with travel and the stay at the base, as well as the limited number of participants, are inherent characteristics of Antarctic expeditions, and data collection in this field progresses slowly. As for the crew of the research vessel, the data is also limited. At the same time, the information gathered from such studies, including the identification of key stress factors and preferred coping strategies in the extreme environments of Antarctic expeditions and maritime activities, can significantly support adaptation and the development of effective preventive measures aimed at reducing psychological stress.

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21–22 November 2025

Sofia, Bulgaria

IV International Scientific Congress “Applied Sports Sciences”

21–22 November 2025
Sofia, Bulgaria

PROCEEDING BOOK

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SCIENTIFIC COMMITTEE

Design: Slavka Asenova, Svetla Kostova
Publisher: Scientific Publishing House NSA Press
ISBN (Online): 978-954-718-803-7