

## **PSYCHOLOGICAL ASPECTS OF DIVING IN SELECTED THEORETICAL AND RESEARCH PERSPECTIVES**

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### **ABSTRACT**

The aim of the article is to conduct a literature review in relation to the psychological aspects of diving. The acquired knowledge can currently be qualified as belonging to various branches of applied psychology, as well as underwater medicine, sports medicine, psychiatry and psychotherapy. The literature on this subject matter raises two main issues of the psychological perspective: the degree of psychological adaptation of an individual to the underwater environment, and the psychophysical condition of a man involved in a specific type of diving and the resulting skills/competences to perform underwater tasks. The article presents selected reports from around the world related to diving psychology resulting from the applied structure/classification of psychological theories, explaining various mechanisms of psychological functioning underwater. The paper presents studies from the perspective of psychodynamics, psychology of health/stress, psychology of individual differences and personality. The main conclusions indicate that in addition to the main problem of an optimal/lack of adaptation of humans to the underwater environment, there is insufficient psychological knowledge (including Polish reports) in the area of personality differences between various types of divers, their social functioning, mental health and psychoeducation with regard to underwater exposures.

**Keywords:** diving psychology, psychological aspects of diving, psychological adaptation mechanisms in divers.

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## INTRODUCTION

A review of psychological literature on the psychological aspects of diving leads to several conclusions. First of all, this topic is dispersed across various psychological issues within psychology, these being: cognitive [1], personality [2], individual differences [3,4], clinical [5], work [25] and sports psychology [6,7]. Psychological considerations also fall within different topics of medicine, such as underwater medicine [8], sports medicine [9], psychiatry [10] and psychotherapy [11]. In psychological literature diving is mainly concerned with: the degree of psychological adaptation of an individual to the underwater environment, their psychophysical condition in a specific type of diving, along with their skills / competences to perform specific tasks under water [2].

Secondly, it should be noted that while the knowledge of physiological changes and medical problems of a diver seem to be already well-established in the perspective of medical sciences, in the psychological aspect, empirical research is still underway and is aimed, on the one hand, at determining the type of regulatory mechanisms ensuring the optimal functioning of an individual in the underwater environment, and, on the other, at finding the risk factors leading to a diving accident.

The research data leads to the thesis that regardless of the type of diving, the underwater environment is highly unfavourable for the psychophysiological activity of an individual [12,13]. Due to the many obligatory pressures associated with an underwater exposure, the diver needs to possess specified psycho-physical and physiological traits in order to safely operate in this unique environment [14]. Apart from these important dispositions, attention is also paid to further psychological problems resulting from the type of diving that a given person chooses to perform in order to carry out specific activities in the underwater space: a) military diving, (b) commercial diving; (c) scientific and technical diving; (d) semi-professional diving; and (e) recreational (sports) diving [14].

For example, divers of uniformed services must initially meet strict physical standards in order to perform military service, followed by even more stringent standards regarding the status of an officer. In addition, they need to adapt to the status of a military diver working in combat conditions, dangerous situations, such as open-sea rescue operations, neutralisation of explosives, covert operations or evacuation from a damaged submarine. From the psychological point of view, an important limitation seems to be the lack of choice or individual control over the performance of assigned tasks and duties, which are always subject to the decision of the command [15].

Although the selection criteria for commercial diving are as strict as in military diving, not only because of the danger related to underwater works, commercial divers may experience an additional mental burden related to possible litigation in the case of injuries sustained during work. Serious injuries to commercial divers are extremely costly for the employer, which is why "zero defect" is the main requirement when choosing candidates [16,55].

Recreational diving can be defined as an activity

taken up for pleasure [17]. Recreational divers visiting caves or shipwrecks often exceed regular depth limits [17]. Practising diving as a recreational sport improves the mood of people undertaking such a physical activity during the holiday season. The psychological and health benefits of recreational diving tend to surpass those resulting from practising other sports when it comes to stress reduction and improving one's well-being [18, 19].

Knowledge gained from research on sports diving indicates the next fact that the optimal human functioning during such an activity understood as a person's physical capability of undertaking a long-term effort of medium intensity involves the necessity to maintain balance between mental activity, concentration and relaxation [20]. Failure to achieve the above criteria not only has psychological consequences, but also a high risk to human health [21,22,23]. From the psychological point of view, the role of emotional endurance in extreme conditions is also indicated. An absence of such dispositions may result in inefficient operation in the water, an occurrence of various conditions and diving accidents [24].

As has already been mentioned, physiological changes along with corresponding psychological ones occur in the diver's body while under water, and the size of these changes depends on neuropsychological factors and the diver's psychosomatic dispositions [12]. This correlation is moreover associated with an individual diving experience. A lack of previous diving practice contributes to the lowering of the threshold of emotional resilience in water [26].

Furthermore, the diver's mental resilience depends on the individual's psychological properties: personality traits, individual style of action, resources and efficiency of cognitive-perceptual-motor processes, and the level of motivation [17,27]. The maintained strain is intensified with the dissonance between the requirements and tasks that the diver needs to face in the underwater environment, and his level of psychophysical efficiency.

One of the most important psychological dispositions in 'technical' diving is the high level of manual and operational skills, which together with psychological resilience becomes indispensable while performing complicated tasks under water. Activities undertaken in conditions having such a burdening effect on human senses, require the diver to make automatic choices, quick decisions, or choose the best or only possible ways to accomplish the task [15]. The behavioural patterns and procedures learned during training must be applied during an underwater exposure in such a way as to effectively achieve the set goals. In the situation of a psychophysical overload under water, the diver's efficiency is most often degraded which leads to mistakes in the implementation of consecutive partial task sequences [28,55].

Currently, in order to improve the psycho-motor condition (and thus obtain optimal adaptation to the conditions of operation in the underwater environment), simulated procedures are used to enable the creation of very diverse, extreme conditions that may occur in the underwater environment. Simulators performing several important functions, among which are the ones that improve the motivational and emotional functions (increase the diver's resilience in extreme situations) and

optimise the level of stress the diver can cope with seem to be important from the psychological perspective [12,29].

In the undertaken psychological discussion on diving, a separate issue within the scope of clinical psychology and psychiatry is connected with the experience of anxiety. This issue is considered in a threefold sense. The main cause of decompression sickness and pulmonary barotrauma in divers is a rapid ascent which is mainly due to the experience of a panic attack [30]. Moreover, it is likely that an objective measure of the anxiety-trait would be effective in predicting panic attacks while underwater [31]. Finally, research results indicate that underwater trauma has both acute and persistent behavioural consequences, including anxiety disorders, which are discussed in literature in relation to their significance for stress formation and PTSD [32,33].

Summing up, the psychological problems in divers described thus far in literature raise issues related to their acquisition of certain traits of a special adaptation to new conditions. It is already known today that repeated exposure of humans to the unusual conditions of the underwater environment, extends the limits of adaptation to this environment but also gives rise to certain problems. The knowledge gained thanks to such exposures contributed to the development of a psychological domain, which for the purposes of the article will be referred to as "diving psychology".

## RESEARCH REVIEW IN SELECTED ASPECTS OF DIVING PSYCHOLOGY

The current use of the term "diving psychology" may bear the characteristics of a certain theoretical or practical abuse, as in the Polish psychological literature of this subject matter, and in the area of academic education of psychologists, there is a lack of interest in this topic. The area of diving psychology is, colloquially speaking, a niche for the few researchers interested in the issues falling within the scope of marine psychology, who endeavour to explain the interactions between psychology and various areas of the marine world [55].

However, it can be optimistically stated that world literature provides an increasing number of reports connected with the mental functioning of divers and, to a certain extent, the new psychological discipline – diving psychology – has become more established.

This is largely related to an increase in the number of people practising sports and recreational diving. Until the 1980s, this activity was undertaken by only a few athletes; whereas now the situation is changing and thanks to the development of equipment and science, it is practised by approximately one million people all over the world. Diving is a form of activity often recommended in mass tourism, which is why we may speak about a growing social practice [34].

On the other hand, many years of observations related to the safety of military and recreational divers have made it possible to see the importance of health / psychological selection of diver candidates and active divers, both military and recreational. [35,36]. The search for personality factors which have a direct impact on the safety of divers, and the problems reported by divers following the completion of a dive, have all helped to explain the causes of incidents occurring under water.

As it is known today, these factors have proved to be important for the safety of divers.

Summing up, the increase in interest in recreational/sports diving and the intensification of research regarding human safety in underwater activities has opened an empirical space for the search of psychological factors that optimise human functioning under water.

The onset of interest in the psychological aspect of human functioning in the underwater environment is attributed to Behnke and his article *Psychological and psychiatric reactions in diving and submarine warfare* published in 1945 by the American Journal of Psychiatry [37]. The author points out the fact that military divers were burdened with stressors and stress itself during World War Two; the said stressors include: extended periods of time without the possibility of having adequate rest and relaxation, operation of complicated technical equipment, extreme temperatures, lack of sleep, noise and vibration.

A review of psychological research and theoretical considerations on diving resulted in the following part of the article from the applied structure/classification of psychological theories, which served as the basis for particular authors for finding an explanation of various mechanisms of psychological functioning during an underwater exposure.

Using the concept of psychology of depth with a man's instincts and conflicts rooted in the unconscious, Sessa, Pallotti and Fati [38] found in their research that the reasons leading an individual towards taking up diving originate in the unconscious layers of the psyche. In the situation when the diver crosses the line between the air and water, according to the researchers, there is a chasm between one's deep unconscious drives and conscious motivations. In 1968 Tatarelli [39] stated that "a distant, introverted person" is not suitable as a diver because the "suppressed moral traits" can be harmful and dangerous in an underwater operation. In the formed discussion groups of divers and their trainers Odone et al. [40] tried to discover the psychodynamic basis of underwater psychology. According to the authors, it was necessary to understand the psychodynamic mechanisms existing in the underwater activity of divers and apply them in didactic methods.

The authors analysed the techniques used in teaching diving, especially those concerning its safety. Researchers believed that most accidents are not accidental but result from the unconscious willingness to take risks. Therefore, they made an attempt to understand the psychodynamics of this problem. The results of their research indicate that it is important to treat the teaching methods in diving not only as a means of passing on useful skills and knowledge, but also as a psychotherapeutic technique that helps the diver control any sort of self-destructive aggressive inclinations.

In 1985, using psychodynamic theory for their considerations, Spigolon and Dell'oro [41] found that autogenic training could be useful for divers in improving their mental condition. According to researchers, learning of this technique helped in fact to break the negative circle, starting from the diver's troublesome situation under water up to the occurrence of a panic attack.

The results of their research also show that in autogenous training, certain body positions depend on whether the diver is in a state of apnea or oxygenation.

Certain positions may also prevent muscle relaxation, which is necessary for maintaining the optimal psychophysiological balance under water. It is also worth mentioning the works of Jennifer Hunt [42]. She used psychoanalysis to describe the mechanism associated with the risk and diving accidents. The author examined unconscious conflicts that seemed to increase during deep diving, leading divers almost to a fatal accident. Her research was based on interviews with people practising recreational and technical diving.

According to the researcher, the involvement of men in a particular profession, sport or form of recreation is often rooted in early childhood. The interest of sport divers in water, boats or scuba diving usually starts with a certain delay in individual development, and deep diving constitutes a special arena where some men seem to overcome the conflicts rooted in their early experiences related to absent or abusive fathers. There are also indications that divers and elite athletes involved in high-risk sports follow certain parenting patterns and may pursue similar fantasies. The more risky and violent the sport is, the more likely it is that the issue of bisexuality, masculinity, aggression and sadomasochism influences such an individual choice of a sports discipline.

One of the most important psychological areas providing theoretical inspirations to study the adaptation of divers to the underwater environment are the findings of health psychology, including psychological stress of people performing dives in dangerous situations [20].

Researchers' findings are unambiguous, and indicative of stress caused by an extreme environment as in the case of diving to greater depths, subjecting the diver to high pressure causing changes both in the body and in the psyche [15,16,45,46,47]. For example, it has been determined that spatial memory is significantly impaired with compressions performed between 410 and 480 m, showing a large individual variability. Research also revealed a reduced visual spatial ability during diving at 300-540 m [44].

In the theoretical psychological perspective regarding the constancy of personality traits, there are research reports on the personality traits and attitudes of divers in the underwater environment. In their research, Griffiths, Steel, Vaccaro and Karpman [48] examined the diver's anxiety and the correlation between relaxation and diving techniques. However, the main issue consisted in providing descriptions of the psychological profiles of divers in order to determine the personality risk factors of underwater accidents. [49].

In their book titled *Stress and performance in diving* Bachrach and Egstrom explained the role of individual differences in the adaptation of military personnel to a stressful environment, taking into account the existing models of intelligence, personality and performance. Among others, in the sample of professionals (N = 575) a direct and positive relationship between emotional adjustment, conscientiousness and general mental abilities in relation to underwater adaptation, as well as the negative correlation with emotional reactivity were determined.

The conclusions from the research suggest that the optimal personality profile of the diver should be characterised by an ability to function effectively in the conditions of stress and crisis, as well as cope with stress using a cognitive-behavioural strategy. It should be characterised by a high emotional control, with a high level of error control and avoiding high risk levels.

From the point of view of an overall performance model, professional divers should, on the one hand, perform dives with the use of equipment, pneumatic and hydraulic tools, inspect and repair damage to the hulls of ships. These performance dimensions represent skills that result from such psychological competences as: critical thinking, judgment in decision making, problem and time distribution analysis, oral and written understanding, deductive and inductive reasoning, selective attention, spatial orientation, static and dynamic force, dexterity and multiple coordination.

The optimal personality profile of a diver should include such features as: management of anxiety and stress, responsibility, autonomy of action and physical capacity [50]. The research carried out by Nevo and Breitstein [20] shows that divers are more motivated towards risk and adventure, demonstrate a higher level of masculinity and aggressiveness, as well as are less susceptible to anxiety, and are physically healthier. In a 2010 study, Coetzee [51] determined which personality traits are common among recreational divers. In a study of sixty divers the obtained frequency tables showed high results in terms of self-sufficiency, courage and impulsivity whereas low scores in relation to conformity, warmth and sensitivity. The results of this study proved that the personality traits of divers differ from what is indicated in the literature as a typical personality profile of an extreme athlete.

An exploratory factor analysis showed four types of personality of recreational divers: an adventurer, a rationalist, a dreamer and a passive-aggressive diver identified with a macho type. The results of these studies suggest that the number of high-risk behaviours revealed by a diver depends on his personality type.

Van Wijk [4] abandoned the international trend of comparing the personality traits of divers and seafarers and conducted his own research to determine the extent to which the personalities of military and recreational divers differ. By controlling 16 personality factors, examining 28 South African divers, 28 South African seamen, and 28 civilian divers, the researcher determined that navy seafarers qualified as divers achieved higher ego strength scores than seafarers who were not military or civilian divers.

They proved to be more psychologically "tough" and adventurous. Moreover, Navy divers were less assertive, obtained higher scores on the superego scale, were more practical and characterised by a greater well-being. Another important psychological research problem within the perspective of clinical psychology are issues concerned with panic fear described in literature as the most frequent cause of death among divers. Morgan [52] examined over 500 experienced recreational divers and discovered that more than half of them experienced panic attacks and that at least one of these attacks took place during dive performance.

The author constructed an anxiety test allowing to identify people with the highest probability of a panic attack before the commencement of a dive. Although there are many factors responsible for injuries and fatal diving accidents, there is a general consensus among researchers that many of them are caused by panic. There is also evidence that people with an elevated level of the anxiety-trait more often demonstrate stronger anxiety reactions when they are exposed to stressors.

Thus, there is a subgroup in the population of divers with an increased level of the risk of

accident/death. However, the efforts towards showing that selected interventions such as hypnosis, imaging, meditation and relaxation can reduce stress responses in anxiety divers did not produce consistent results, therefore there is still a need for a systematic research into the effectiveness of particular intervention strategies. Such an attempt was made by Gary Ladd, [11] who in his clinical and research activities explained the diving-induced panic, underwater accidents, as well as developed specific therapies for people who lost their partners during a dive.

Van Wijk [3] attempted to investigate and describe the mental health profile of South African navy specialists working in extreme environments and formulated the problem of estimation of an occurrence of psychopathological symptoms among them. Minnesota Multiphasic Personality Inventory (MMPI) -2 was used in the research to determine the main patterns of psychopathology and personality disorders. A sample of 161 divers and 152 submarine seamen were compared with a sample of 139 navy seamen.

Divers and submarine seamen showed the desired mental health profiles, although profession-specific markers of atypical behavioural patterns were found such as: slightly elevated hypomania scores among divers and responsibility scores of submarine seamen. Moreover, it was established that there is a strong expression of intensification of male gender roles among divers, submarine seamen and naval seamen. The author suggests that in cases when an abnormal dynamics of behaviour occurs, it can be interpreted as adaptive and not psychopathological, as the subjects acted in the specific context of an operational environment.

In summary, from the broad perspective of psychological research and knowledge, the current state of reports and considerations on the psychological aspects of diving is still insufficient. Their main focus is involved with the problem of optimal/or a lack of adaptation of humans to the underwater environment. Despite the important contribution recently made by researchers, there is still a lack of knowledge regarding the psychodynamic mechanisms of this activity; the personality differences between recreational and technical divers have not been studied enough; too little is known about the correlation between extreme sports and diving. The current state of knowledge did not allow for the development of a psychological tool cooperating with medical protocols in the selection of people practising diving both as a sports activity and professionally; the social and psychoeducational aspects that are necessary to take up diving are considered only sporadically and to a very limited extent.

To conclude, we should mention that at present works are being conducted on the development of a theoretical model regarding psycho-social risk factors and the quality of life of military divers, which will be subject to empirical verification. The model is built on two concepts of stress (stress at work - a concept developed by Robert Karaska and Tore Theorella [53], and Lazarus's transactional model of stress [54] - personality factors (sense of stress, sense of effectiveness, coping strategies, neuroticism, extraversion, diligence, openness to experience, and agreeableness, causative and community orientation, propensity to risk, emotion control) and the level of general health and life satisfaction.

The general thesis behind the model of psychosocial risk factors and the quality of life of military

divers that will be tested in the future, is that physical and psychosocial risk factors (the discrepancy between conditions and requirements for an individual, and their subjective cognitive assessment of working conditions) activate the mechanism of formation of stress and coping strategies. It seems that some of the personality traits of military divers may constitute specific protective factors (resilience) in coping with stress, however, a long-term exposure to subjectively negatively evaluated psychosocial and physical stressors may lead to a disharmony in their general health condition. Furthermore, it seems that both the direct coping strategies, the concurrent protective factors and, consequently, the good overall health of military divers determine the high level of their life satisfaction.

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