

Psychological Collapse in Arctic Environments: A Scoping Review and Future Directions

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Background

- Arctic and Antarctic research stations constitute Isolated, Confined, and Extreme (ICE) environments
- Defining stressors interact to overwhelm adaptive capacity even in carefully selected personnel.
- Understanding how these factors produce psychological deterioration, and what can mitigate them, is of direct relevance
- Psychological deterioration in polar environments has been documented since the Heroic Age (1897–1917)
- Remains clinically relevant for station staff, military personnel, and may also be applicable for long-term space deployments, submarine deployments, and other ICE contexts.

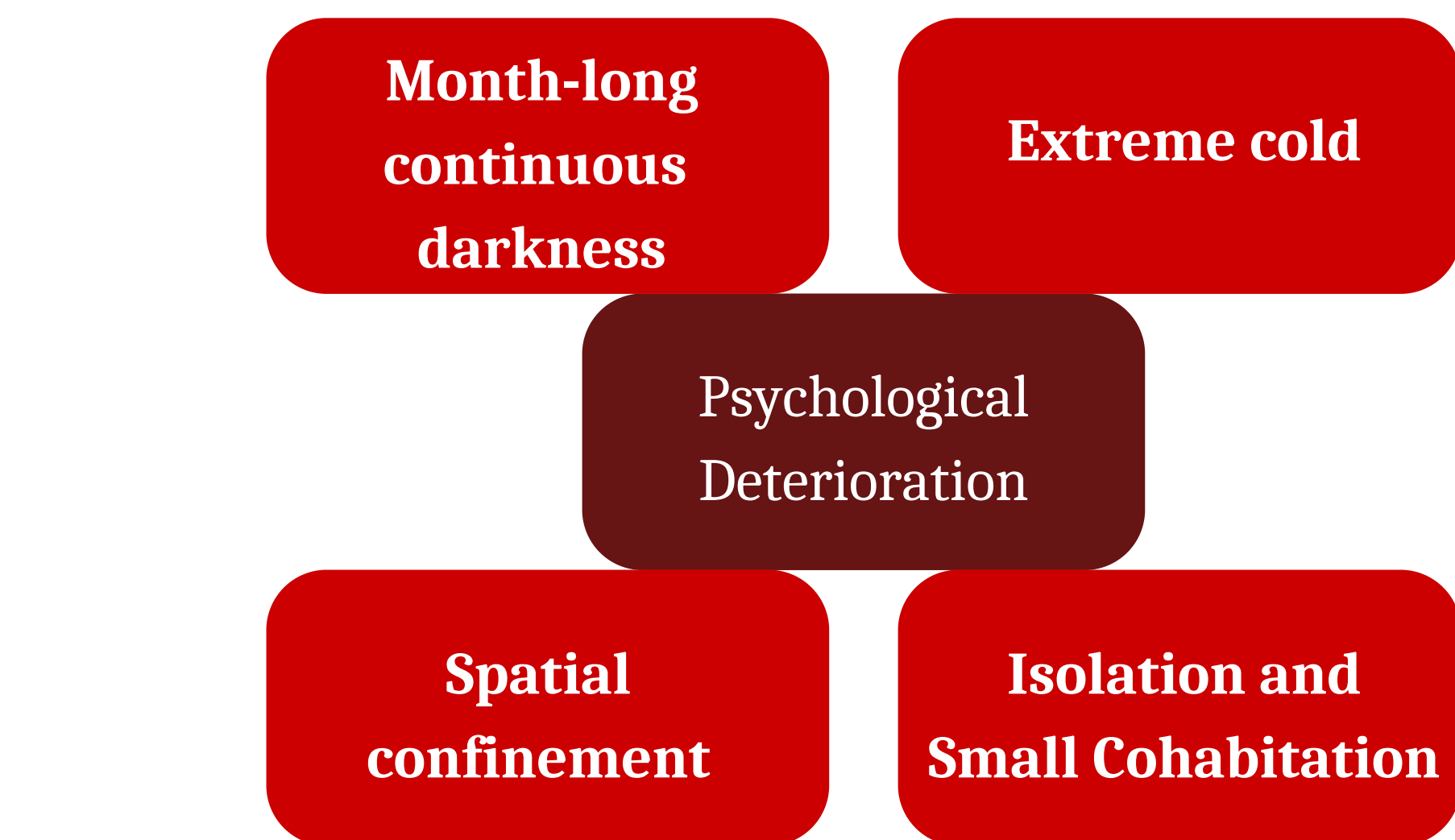


Figure 1: Defining Stressors

Rationale

Limited literature in research area and need to synthesize existing research and identify effective strategies.

This scoping review aims to:

- (1) identify the principal domains of psychological deterioration reported in the literature
- (2) describe the underlying physiological and psychosocial mechanisms
- (3) appraise the evidence for interventions and protective factors
- (4) highlight gaps requiring future research.

Methods

Scoping Review Approach

Based on Arksey & O’Malley (2005) framework.

Inclusion Criteria

Studies reporting psychological or mental health outcomes in polar, sub-Arctic, Antarctic, or ICE (isolated, confined, extreme) environments
Studies involving individuals residing or working in these environments
Studies from recognised polar analog settings (e.g., HI-SEAS, MDRS)
Empirical and observational studies
Reviews, qualitative studies, case reports, and expert commentaries included to capture breadth of literature
Articles published between 1990 and May 2025
English-language studies

Exclusion Criteria

Studies examining general cold-climate populations without explicit ICE conditions
Studies unrelated to psychological or mental health outcomes
Non-human studies
Duplicate publications
Articles without accessible full text

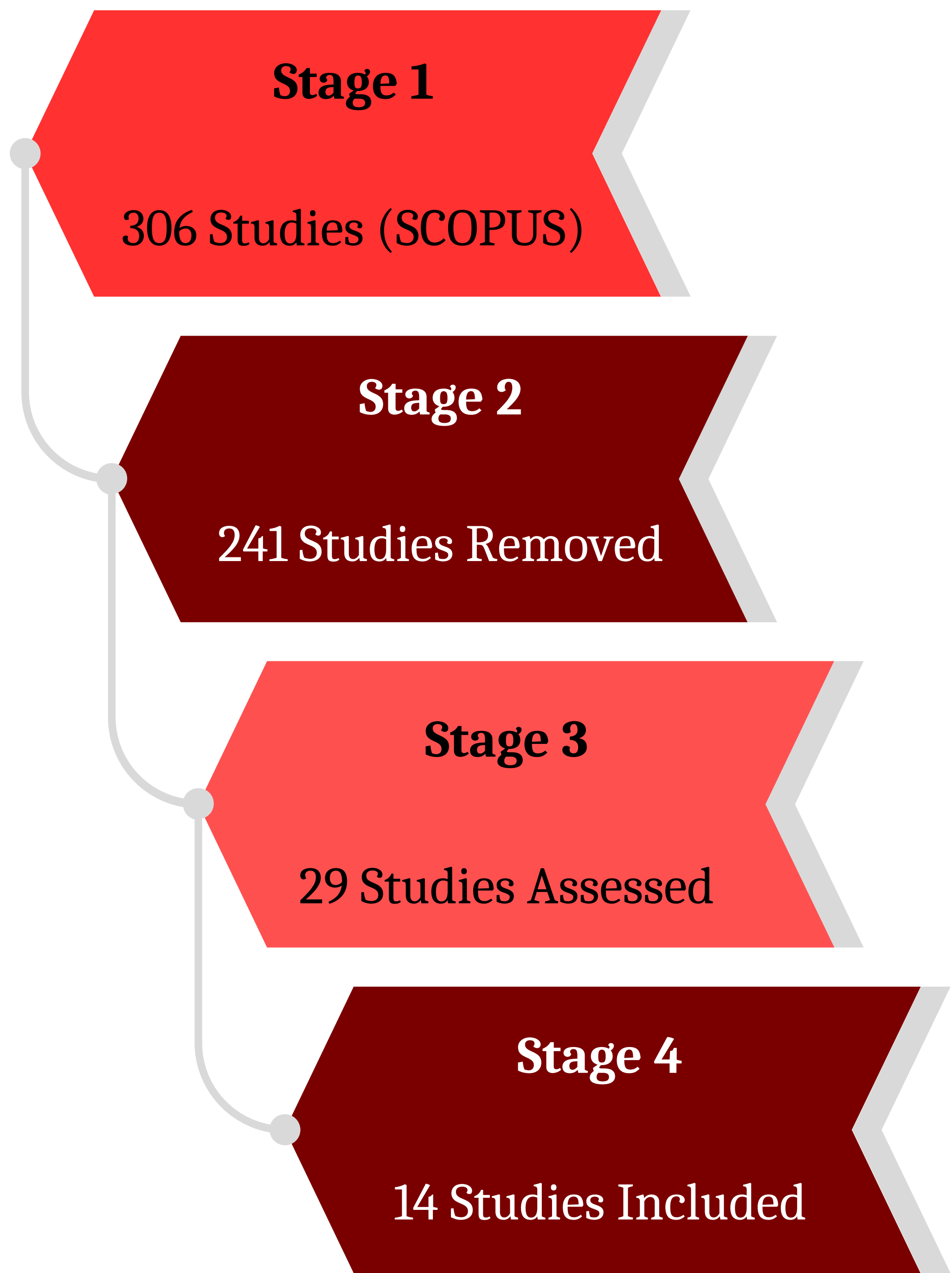


Figure 2: Simplified PRISMA flowchart

Results

INTERVENTION	MECHANISM
Bright light therapy 10,000 lux · 30 min a.m.	SCN re-entrainment
CBT-SAD Behav. activation + cognitive restr.	Dysfunctional cognition
Psychological screening Pre-deployment	Risk exclusion
Melatonin supplementation Evening timing	Phase advance
Telemedicine support Remote mental health	Access to expertise
Pre-deployment training Psychoeducation · team skills	Expectation & coping
Architectural design Light · privacy · nature views	Restorative environment
Physical exercise Structured indoor programme	Behavioural activation
SSRIs / bupropion Pharmacotherapy	Serotonin / dopamine

- **Light therapy**
Morning 10,000-lux exposure advances circadian phase ~1 hr, improves psychomotor speed (digit symbol substitution) and sleep onset. When combined with evening melatonin, phase advances are augmented. Dynamic architectural lighting extends benefits station-wide.
- **Personnel selection**
Emotional stability, low neuroticism, resilience, and coping flexibility predict successful adaptation. Gender-mixed groups show better cohesion. Screening reduces but cannot eliminate risk — in-mission monitoring is essential.
- **Architectural & environmental design**
Li & Zou (2025, n=63): lighting quality, private spaces, communal design, and nature connection are highest-weighted restorative factors. Dedicated quiet/solitary recovery spaces are critical for managing cohabitation stress.
- **Telemedicine**
Non-specialist station providers can deliver psychological first aid and CBT-based interventions with real-time guidance from remote professionals. Asynchronous tools (digital mood tracking, online CBT) extend reach in low-bandwidth settings.
- **CBT-SAD (adapted)**
6 weeks · 2 sessions/week. Behavioural activation + cognitive restructuring targeting winter-specific dysfunctional beliefs. Efficacy equivalent to light therapy for acute SAD; superior for relapse prevention. Feasible via teleconference.

Figure 3: Table of Interventions

Discussion

Limitations & Research Gaps

- Small samples due to logistical constraints
- Heavy reliance on self-report; social desirability bias
- Sparse post-deployment longitudinal follow-up
- Historically male-dominated samples
- Multicomponent intervention trials are lacking
- Exclusion of non-English and gray literature

Conclusion/Recommendations

- Multi-layered approach required: no single intervention is sufficient
- Standardise bright light therapy + dynamic lighting in all polar station protocols
- Embed CBT-SAD and exercise resources (remote-deliverable) in all winter-over deployments
- Integrate telemedicine mental health infrastructure in station planning
- Prioritize private space and restorative design in station architecture

References:

