

# The Cause of Stereotypic Behaviour in a Male Polar Bear (*Ursus Maritimus*)

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## Abstract

This study was focused on finding the cause of stereotypic behaviour in a male polar bear (*Ursus maritimus*). The zoo wants to reduce the stereotypes present in their male polar bear. However, this can only be accomplished if the cause of the behaviour is identified and targeted [1]. In this study external factors from 3 different categories (i.e. husbandry, geography and environment) are investigated to find out which possible stressors affect the polar bear's behaviour. Video recordings of the polar bear's behaviour and the different external factors were processed with The Observer XT 7.0 software program and later analysed. Many different factors influence the male's behaviour, both positively and negatively. The polar bear's response to these external factors lead to believe his stereotypes have a coping origin, where the animal uses the rewarding endorphins, that are released due to his stereotypes, to cope with continuous stressful situations in his environment [2]. Further experimental research is recommended to investigate to what degree the different factors found in this study can be altered to create a more suitable environment for this polar bear.

**Key words:** Stereotypic behaviour, *Ursus maritimus*, polar bear, captivity.

## Introduction

Polar bears have a long history of high popularity in zoo settings. However, many studies indicate that this wide-ranging species expresses a wide variety of abnormal repetitive behaviours in captivity [3], such as stereotypic walking, head swinging and repetitive swimming bouts [4, 5]. This is also the case in the 13 year old male polar bear in this study, which spends large portions of his day expressing stereotypic behaviour. Stereotypic behaviour is often a sign of a decreased welfare in an animal [2], because their choice to express natural behaviour has become limited [6]. The expression of natural species-specific behaviours is important for a zoo to maintain appropriate levels of animal welfare [7], create a satisfying visitor experience and also enable proper public education [8]. To enable positive visitor experiences and public education about polar bears and their natural species-specific behaviour and to increase the polar bear's welfare, the stereotypes present in this polar bear's behavioural repertoire need to be reduced. His long-term stereotypes must be treated, however, this can only be accomplished if the cause of the behaviour is identified and targeted [1]. This study is focused on identifying the cause of the stereotypic behaviour in this polar bear male by testing the effects of external factors on his behaviour.

## Methods

In this study, different husbandry-, geography- and environment-related factors were investigated to see if one or more of these trigger the stereotypes of the polar bear. External factors that were scored in relation to husbandry were feeding regimes, keeper presence and its purpose, and enrichment effects. Geography-related factors covered geographical preferences within the exhibit and related substrate use, while environment-related factors focused on visitor numbers and employees, the behaviour of other polar bears (an adult female and her two cubs) at the zoo, construction work noises and the effects of time of day. The events that were scored from the female and cubs were defecating, vocalizing, the presence of food in their exhibit, being within sight of the male polar bear in the outside exhibits and being inside the night dens. These events were chosen because of their visual-, sound- and/or scent aspects, which could affect the male polar bear's behaviour. Through continuous recording and focal sampling the male polar bear's behaviour was observed to determine the extent of his stereotypic behaviour in relation to these external factors. A total of 116 observation sessions of approximately 30 minutes were conducted on set times throughout the day between 09.15 and 17.15 daily over a 24-day period. This

resulted in 54 hours and 18 minutes of behavioural data. Four behaviour categories (i.e. 'active', 'inactive', 'stereotypic' and 'in night den') were used to describe the polar bear's behavioural state. Also three short point behaviours were scored. These point behaviours can either be a stereotypy by itself (i.e. 'head swing'), is believed to be related to stress (i.e. 'yawn') or short distractions (i.e. 'variation') from the male's stereotypic pacing. The 'variation' point behaviour means that the polar bear was distracted for a few seconds but not abandoned his stereotypic pacing to investigate any further. All relevant polar bear behaviours were video recorded and all observed abnormalities and external factors were scored on an observation sheet at the time at which the event occurred. The Observer XT 7.0 computer program (Noldus Information Technology, Wageningen, The Netherlands) was used to score the frequency, duration and location of all state behaviours expressed by the polar bear, as well as the number of occurring point behaviours. Information about external factors possibly related to the male polar bear's behaviour was also scored. The Observer XT's visualization function behaviour scores were used to register which and to what extent behaviours and behavioural shifts occurred while external factors were present. After data were collected from the different external factors, a total of 354 data points were processed from 55 randomly chosen observation sessions to gather baseline data about behavioural shifts. These baseline data points present behavioural shifts between the 'active', 'stereotypic' and 'in night den' behaviours at moments where no external factors were occurring. Over 300 baseline data points were needed for statistical tests to detect differences between baseline situations and moments where external factors were occurring. The 55 chosen observation sessions were gathered from the total 116 observation sessions. These baseline data points were then compared to the data collected about the different external factors from this study.

## Results

Data analysis shows that stereotypic behaviour covers a large part of the polar bear's daily activity. Stereotypic behaviour was observed for 45.54% ( $\pm 3.89$ ) of the total data collection period. After stereotypic behaviour, the male was observed most in his night den (35.79% ( $\pm 3.87$ )). It must be noted that the 'in night den' behaviour is an unknown behaviour because the observers could not see the polar bear in his night den. 'Active' behaviour occurred for 16.29% ( $\pm 2.34$ ) of the time, while 'inactive' behaviour was only observed for 1.75% ( $\pm 1.0$ ) of the total observation time. The male only displays stereotypic behaviour on concrete exhibit floors, with a preference for two specific areas in his enclosure. New enrichment was provided on 7 occasions which resulted in 17 observed enrichment interaction moments covering only 3.12% of the total observation period. 3 interactions were with food-based enrichment (e.g. frozen fish), 3 with toy-based enrichment (e.g. tyres) and 11 other interactions were substrate-related (e.g. sand, shells or wood chips). No significant effects were found between the male polar bear's behaviour and enrichment objects. However, 80% of the inactive behaviour was observed after keepers provided new substrate. A total of 292 head swings, 69 yawns and 144 variations were also observed. The male polar bear displayed significantly more stereotypic behaviour in mornings compared to afternoons ( $F(3.104)=5.358$ ;  $P=0.002$ ), while he spent more time in his night den in late afternoons ( $F(3.112)=4.591$ ;  $P=0.005$ ). The polar bear displayed significantly less stereotypic behaviour during observation sessions where he was fed ( $F(2.88)=10.920$ ;  $P=0.001$ ), while stereotypic behaviour was 30% higher on days where he was not fed at all. Keeper presence decreased stereotypic behaviour and increased shifting back and forth between active behaviour and retreating into the night den ( $X^2=237.190$ ;  $df=8$ ;  $P\leq 0.001$ ). The presence of another bear in the night den area also resulted in increased back and forth shifting between active behaviour and retreating into the night den ( $X^2=86.385$ ;  $df=8$ ;  $P\leq 0.001$ ). An increased employee count near the exhibit elicited an increase in the point behaviour 'variation', while traffic passing his exhibit, or noises over 70dB showed to cause an increase in stereotypic point behaviours 'head swing' and 'variation'.

## Conclusions

This study showed that many external factors affect the polar bear's behaviour in both a positive and negative way. It was therefore impossible to point out one specific stressor that is causing his stereotypies. Motivational frustration described by Olsson et al. [2] as a cause of the bear's stereotypic behaviour seemed to be a well-supported option at the start of this study. However, motivational frustration is usually focused on a specific behaviour that cannot be completely executed [9]. Due to the large number of factors affecting his behaviour

positively and negatively, this motivational frustration now seems like a less suitable cause. Coping on the other hand now seems more plausible, because in such a coping mechanism an abnormal repetitive behaviour is expressed for the release of endorphins that an animal then uses to cope with continuous stressful situations [2]. Keeper presence for example resulted in shifting continuously between the night dens and his outside enclosure, making his behaviour seem more 'restless'. This might suggest the male polar bear's anticipation of food. To either support or discard the finding in this study, further experimental research is recommended to test possible relations between behaviour and the stimulation of positive factors such as increased feeding and regular provision of soft substrate. Also, the reduction/elimination of negative factors such as traffic and loud noises over 70dB might result in decreased stereotypies. It is also recommended to assess the polar bear's current living conditions and maybe consider different housing and husbandry strategies in the near future. Recommendations on current husbandry conditions include increased feeding and more variation and regulation of new enrichment objects. For housing conditions, a larger exhibit would be preferred, or at least provide more soft substrates along with implementing more permanent enclosure attributes such as a viewing platform or more sloped edges leading to the water moats.

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