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A METHOD FOR RESTRAINING PENGUINS

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It is generally accepted that researchers working on seabirds should attempt to minimize stress to the animals as much as possible. There are good ethical as well as scientific reasons for this. The effects of stress can be manifest in, for example, increased corticosterone levels (Le Maho *et al*. 1992, Kosiorek & Van den Hoff 1994), increased heart rate (Culik *et al*. 1990) or increased body temperature (Boyd & Sladen 1971). Stressed birds often behave in an atypical manner (e.g. Wilson & Culik 1992) and when stress levels become too high birds may even desert their nests.

The capture and manipulation of penguins can be stressful, both for the birds and the researcher. When handled inappropriately, penguins can struggle violently, a process which seems to increase the level of stress that they perceive. The purpose of this note is to present a penguin restraint method which allows a single researcher to hold birds for periods of up to at least 30 minutes during which time the penguins struggle little, if at all. As such, birds can be easily banded and, where necessary, equipped with recording devices (e.g. Watanaki *et al*. 1992) by one person.

After capturing a penguin, the researcher sits on an object the height of a chair. The penguin is then placed on the researcher's lap with the breast lying along the line between the researcher's legs and the head facing away. The bird's head is then pushed between the knees and held by gently squeezing the legs together. Penguins of the genus *Spheniscus*, which have powerful bills, are best treated so that they cannot bite (e.g. by putting their head in a glove or sock or taping their beak almost, but not completely, closed) before this is done. A strip of elastic material *c.* 30 cm long (unstretched), but of adjustable length, terminating at both ends in two opposing strips of Velcro is then passed round the researcher's back. The penguin's legs are then pulled back slightly and the double Velcro strips then wrapped round the tarsi so that the elasticity of the material round the researcher's back continues pulling the legs backward (Fig. 1). When in this position the researcher has both hands free and the whole of the penguin's back, tail and the flippers are exposed. I have used this method on eight species of penguins (Magellanic *Spheniscus magellanicus*, Humboldt *S. humboldti*, African *S. demersus*, Macaroni *Eudyptes chrysolophus*, Rockhopper *E. chrysocome*, Gentoo *Pygoscelis papua*, Adélie *P. adeliae* and Chinstrap *P. antarctica*). Birds rarely struggle and appear to experience little stress. King *Aptenodytes patagonicus* and Emperor *A. forsteri* Penguins are too large to be treated in this way but a restraint system for these birds has been published by Robertson (1991).

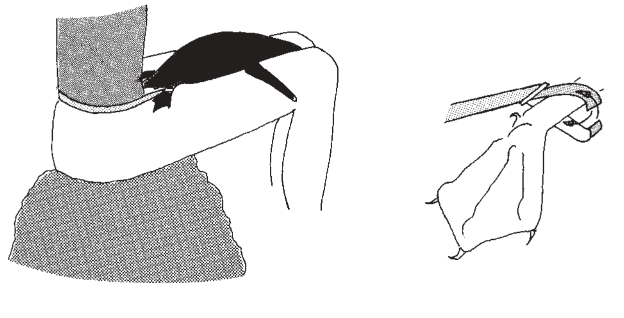

Fig. 1. *Schematic diagram showing the proposed method for restraining penguins.*

In an attempt to quantify stress levels, I measured the amount of time Gentoo Penguins struggled when held in the way described above, as well as changes in flipper surface temperature because stress in penguins is manifest by an increase in body temperature (Boyd & Sladen 1971). I chose Gentoo Penguins because in my experience this species appears particularly prone to stress (cf. Bost 1994). Between 17 and 21 February 1996 three adult Gentoo Penguins were caught at Ardley Island (62º13'S, 58º55'W), Antarctica and restrained by the method detailed above for 30 minutes. In two of these birds I measured the flipper surface temperature by assessing the intensity of infra-red electromagnetic radiation (emissivity index 0.95) using a thermo scanner 1190 (Casio). The sensor was placed directly on the flipper outer surface in the middle, close to the leading edge on the radius/ulna *c.* 1 cm from the point of articulation with the carpometacarpus. In order to minimize disturbance and to ensure that the locality at which the temperature was measured did not change, the sensor was held in place for the full duration of the experiment. Flipper surface temperature was measured at *c.* seven-second intervals.

Over the complete course of the restraint period only one of the three Gentoo Penguins struggled at all, for a total of 12 s in four bouts lasting for 6, 2, 2, and 2 s. Overall, birds were completely immobile for a total of 99.8% of the time they were restrained. Immediately following a struggling bout the flipper temperature dropped for a few seconds before rapidly rising again, generally to a higher level than that preceding struggling (Fig. 2). However, the flipper temperature of the restrained birds decreased over the course of the 30-minute restraint period (Fig. 3).

Early work by Boyd & Sladen (1971) indicated that body temperature in penguins rises when the birds are stressed by humans and this has been recently confirmed by stomach temperature measurements in Adélie, Chinstrap, Gentoo (Reins 1993), Emperor and Macaroni Penguins (Regel 1994). Although my work indicates that immediately following struggling blood flow to the flippers may be reduced, this condition is quickly reversed, possibly in part because the flippers are used to dissipate excess body heat (Despin *et al*. 1978). If flipper temperature is used as a measure of stress, the proposed restraint method appears highly suitable, at least for Gentoo Penguins. I would advocate usage of this technique for any procedure involving handling of penguins which is liable to take longer than a minute unless the restraint method actually proves prohibitive with regard to the technique to be carried out. Note that much of the initial temperature rise in Fig. 3 is

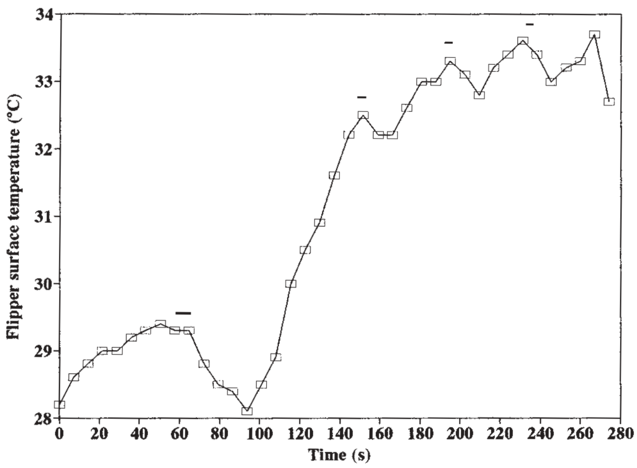

Fig. 2*. Changes in flipper surface temperature over time in a restrained Gentoo Penguin (bird no. 1). The bird struggled for periods of between two and six seconds (indicated by bars) but was otherwise completely immobile during the experiment.*

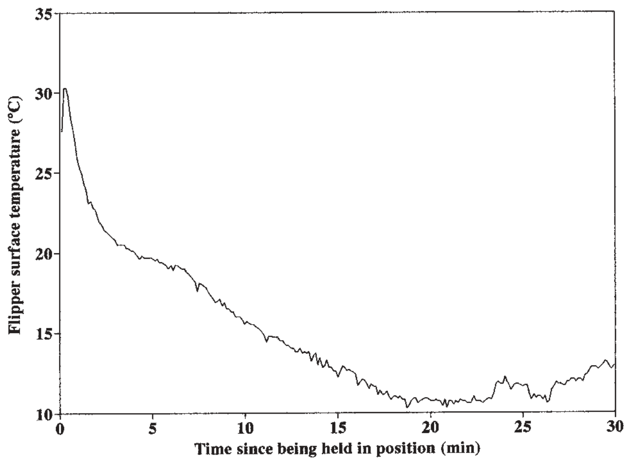

Fig. 3*. Change in flipper surface temperature in a restrained and completely immobile Gentoo Penguin (bird no. 2) over 30 minutes.*

due to heat generated during the time the bird was actually captured rather than being associated with the restraint procedure as such.

There are at least two factors inherent in the presented technique which I believe to be important in ensuring that the bird remains calm. One of the these is that the bird's visual field is very limited, if not completely obscured. Kosiorek & Van den Hoff (1994) noted that corticosterone levels in restrained Gentoo Penguins were lower in hooded birds than in non-hooded individuals while J. Regel and K. Pütz (unpubl. data) noted that hooded King Penguins were considerably calmer than non-hooded birds. In addition, I have noticed that the incidence of struggling is highly dependent on the extent to which the legs are pulled backwards. When penguins are able to pull the restraining elastic enough so that the soles of their feet rest on the researchers legs, the birds are much more likely to struggle than if their legs are pulled back so that their soles can only face upwards. Yamazaki *et al*. (1994) presented a restraint method for Humboldt Penguins in which the birds are held within a PVC tube. These authors also recommend that the penguin's feet be held and pulled out behind by an assistant.

It is perhaps unfortunate that I do not have more comprehensive notes on the struggling behaviour of different species of penguins when restrained by various methods. During the course of my work I have witnessed a number of different restraint methods which have varied from virtually sitting on the birds to using complex straps to immobilize the animals completely. In all other cases, the methods appeared more stressful for the birds than the method presented here. However, to repeat methods which I believe inappropriate for the sake of scientific completeness is difficult to justify, where it is bound to lead to discomfort for the birds concerned. The purpose of this note is to present a restraint method for penguins which I believe is least taxing for the birds. In so doing I hope to be kinder to both penguins and researchers alike.

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