

Use of light-level geolocators to identify the wintering site(s) of the Pomeranian AW population

How do geolocators work?

1. Geolocators measure light over certain threshold values and/or light intensity
2. Loggers are fixed on the back of the birds with a leg loop backpack harness
3. Recently applied logger models had a minimum weight of 1.0 g
4. Birds have to be recaptured to read out the logger data
5. Position of birds during migration and wintering is calculated on the basis on sunrise time and day length
6. Best accuracy of up to recently applied mini-geolocators (1.0 g) is +/- 150 km

Why using geolocators for AW?

1. Wintering site could be the bottleneck because:
 - Most recent declines in Pomerania are probably not related to negative changes at the breeding sites
 - Very rapid transformation of habitats in West Africa (Sahel)
2. Pomeranian population is at a critical level
3. Djoudj is probably not the only wintering site of European AW
4. Genetical studies deliver no reliable results about assignment of the Djoudj birds
5. Isotope studies – the same

=> Probably urgent action required – we must not lose time!!

Project performance

1. Co-operation project of
 - University of Applied Science for Techniques and Informatics Bern (development of a new logger type)
 - University of Genf (chair of astronomy)
 - Suisse Ornithological Institute Sempach SVS (coating of loggers, harness, programming of loggers)
 - AWCT (catching of AW, application of loggers, recaptures)
2. 15 Pomeranian AW (proposal) to be fitted with geolocators in late spring 2010
3. Further geolocators to be exposed in the vegetation of Pomeranian breeding sites, known stopover sites (France, Spain) and Senegal (Djoudj) to calibrate data from bird loggers
4. Recapture of logger birds in spring 2011
5. Checking of identified wintering sites in winter 2011.

How do the novel geolocators work?

1. New type, only 0.5 g weight (= 4.6-5 % of AW body mass)
2. Measure light intensity every 2 (or 5) minutes => calculation of sunrise slope possible
3. Expected precision is less than +/-70 km, probably +/-35 km only
4. New developed harness has been successfully tested with Hoopoe, Blackbird and Nightingale

Experience with application of geolocators and transmitters

1. Satellite transmitters have been used to study migration routes of larger birds since the late 1960s; single birds have been tracked over up to 10 years
2. Mini-geolocators have been applied with a number of smaller species, e.g. Wood Thrush, Purple Martin, Hoopoe, Great Reed Warbler, Blackbird, Greenland Wheatear, Nightingale
3. Logger weight was mostly ≤ 3 % of body weight
4. Radio transmitters of 0.5 g weight (= 4-5 % body mass) have been used to study home range and habitat use of AW at breeding site, on migration and in the wintering site; effects have not been observed, but data on survival do not exist.
5. Suggested harness type is tested with Hoopoe, Blackbird and Nightingale
6. Return rate in passerine birds is estimated between 30 and 50 %

7. Survival was not reduced, with exception of Purple Martin (Science 326: 896)

Further studies on effects of transmitters on migrating passerine birds:

Wikelski et al. (2003) and Thorup et a. (2007): transmitter birds followed with cars and aeroplanes;

Wikelski et a. (2003): comparison of energy consumption of transmitter birds and birds without transmitter in a wind channel

=> no effects

Naef-Daenzer et al. (2001): A test for effects of radio-tagging on survival and movements of small birds:

*„in neither weight class did the survival rate of birds equipped with a 0.5 g transmitter differ from the control-group of untagged individuals. ... we conclude that the additional load of 2.4-3.3% of the birds' body mass in great tits and **4.2-5.8%** [!] in coal tits did not significantly affect the birds' body condition, maneuverability or range use.“*

Case of Purple Martin (Stutchbury et al. 2009)

1. 11 males and 9 females (43-54 g) equipped
2. Only 2 females and no male returned (= 10 %)
3. From a colour-ringed control group, 54 % returned
4. Logger weight (1.5 g) was probably not the problem (2.8 -3.5 % of body weight only) => problem was rather the harness than the load
5. Purple Martins forage in flight and spend a high proportion of life time in flight
6. Wood Thrushes investigated in the same study (same weight of birds and loggers) showed no reduced survival (50 % versus 56 % in the control group)

Risks for AW

> Reduced survival of logger-birds:

- Logger weight (0.5 g) would be close to 5 % body mass (10-12 g at breeding and wintering sites => 4.2 - 5 %)
- 3 % of body mass is recommended (at least for larger birds, see below)

> Reduced fitness and breeding performance

But:

No indication for reduced survival or fitness so far from the studies on related passerine species like Wood Thrush, Great Reed Warbler and Blackbird (studies on Greenland Wheatear and Nightingale running since 2009)

No indication of negative effects on radio-tagged birds with 0.5 g transmitters

Smaller birds can carry bigger loads („power surplus“): a 5 % logger at a 10 g bird leads to a power surplus reduction of only 1 % (25 g bird: 2 %; 200 g bird: 5 %!) => see Caccamise & Hedin 1985: An aerodynamic basis for selecting transmitter loads in birds. Wilson Bulletin 97: 306-318.

Measures to minimise the risks

1. Fit only males with loggers (=> broods are raised solely by the females)
2. Apply the loggers late in the season (late June/July), when second broods are placed
3. Minimise number of rings (1 coloured Alu ring only)
4. Fit only a minimum number of birds (proposal: 15; if return rate is 30-50 %, 5-8 birds should come back)
5. Wait for return rates of Nightingale (300 birds fitted with 1.0 g loggers in Switzerland, using the same harness) in April/May 2010: if less than 30 % return, we can cease the AW project.

Worst case scenario (population in 2009: 54 males, 46 (?) females):

15 males fitted with loggers; 5-8 birds should return.

No birds return = 5-8 males loss;

This equals the male surplus of c. 8 males

Birds are polygyn/promiscuid; loss of males in 1 year is likely to be compensable

How to proceed:

April 2010 is the earliest point of time when the new technique is available

SVS selected the Pomeranian Warbler as best qualified species among a larger species set for the first implementation

Funding is available

=> I would strongly recommend to try the geocator approach before it is too late and/or the population has further declined!

Consultations (Sept./Oct. 2009):

Franz Bairlein, Karl Schulze-Hagen, Bernd Leisler and Martin Wikelski:

All consulted experts strongly recommended to try the geocator approach for the Pomeranian AW in the next year.

