

Abstract

Wind energy effect on bird is studied in the most part of the country where environmental regulations are restricting wind energy development. If many publications are studying loss of habitat during reproduction, wintering or collisions number, another impact is often opposed to wind project development: the barrier effect.

This supposed impact is due to wind turbine avoidance by migrating bird, the energetically cost of this turn around and its impact on migrating bird survival. Because of the onshore and offshore wind turbine increase and effect cumulation, this question becomes more and more crucial.

To estimate the biological impact of this cumulative effect on migrating bird populations, because of a lack of specific publications, we reviewed transversal publications studying energetical, ethological and ecological bird migration.

Studying different biological models:

- energetically cost of the migration Garden Warbler (Barlein, 1991 and Biebach 1998),
- energetically cost of the migration Geese (Buthler et al 2003),
- length or duration of the migration, for Northern Weather studied by Barlein et al (2012),

Regarding a school case we propose relative and absolute quantification of the barrier effect and its implication for migrating bird population survival.

Specifically we propose objective implications evaluation on:

- the additional time need to migrate,
- the additional time need during migration stop to compensate the energetically cost of any detour,
- the bird migration autonomy.

Looking those results, we propose mitigation measures and strategies according migrating bird populations conservation issues and industrial/banking constraints, to ensure a bird friendly development..

Objectives

Objectives are to scale the energetically cost of the Barrier effect on migratory bird survival to propose in case of necessity any mitigation measures.

Methods

As field study are to difficult and to costly to be managed about this topic we studied a school case : a bird migrating across windfarms and that has to avoid it with a 3 km detour.

To evaluate the energetically detour cost we used the bibliography available on different subject for bird flight to biochemical to understand and calculate this cost.



Results

❖ Garden Warbler *Sylvia borin* Barlein, 1991 ; Biebach, 1998 ; Biebach & Bauchinger, 2003 ; Newton, 2008,

Energetical cost for a 3 km detour (EC)

3,3 g body depletion for 1 000km => 0,00033 g/km => **0,0099 g /3 km**

Additional time for refuelling during migration stop

- Migration stop (**MS**), average 10 days
- Dayly feeding time (**DF**), 8 h = 480 min (*highest hypothesis*)
- Energetically reserve to refuel (**ER**), 7,3g (*highest hypothesis*)

Additional daily fidding time for detour compensation = DF x MS x EC / ER

480 x 10 x 0,0099 / 7,3 = 6 min 30 s => **for 0,0099**

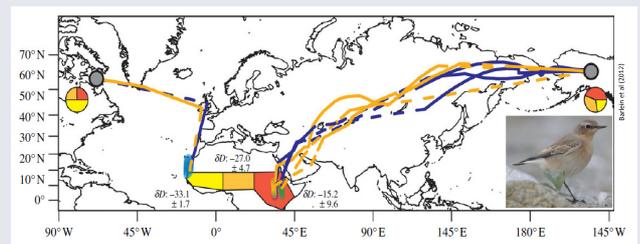
g = 39 s/day

❖ Barnacle goose *Branta leucopsis* Buthler et al, 2003

Energetical ly cost for a 1000 km migration flight = 480 g for a 60h flight duration

❖ Northern Wheatear *Oenanthe oenanthe* Newton, 2008, Barlein et al, 2012 ...

- An European species witch colonized the arctical region after last glaciation,
- Wintering area located in Africa for the all population from Norway to Alaska,
- Migration route across major natural barrier, 6 000 to 14 000 km for the same species,
- Migration speed is half less in spring than in autumn.
- The Alaskan population survival sufficient to conserve an Alaskan genetically domination



Conclusions

- The detour energetically cost is looking to be not significant for birds regarding the migration lenght
- Migrating bird have store them optimum energetically reserve
- Migration duration should not be significantly increased because of :
 - the time needed to compensate the energetically cost of detour, around 39 s/day for 3 km detour
 - the time needed to turn around the barrier created by windmills lines
- Bird adapt easly migration distance in spite of migration routes which are relatively constant because of its endogenous control (some rare exceptions like Blackcap *Sylvia atricapilla*)
- Across arable field bird are able to refuel quite every where

But the question of barriers accumulation is crucial for flight across desert or oceans. It look's to be really less important than global change that is predicted to enlarge Sahara.

The final question is finally to know if our countryside and natural area able to provide enough food along bird migrations routes to refuel.

In case of mitigation measure needed, increasing biodiversity in our countryside and offering quiet and rich natural area for stop are looking to be the strongest issue for migratory bird conservation.

References

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