

CHILLING STATISTICS

Large wind turbines being built today have a "swept area" nearly the size of a football field. Their arms reach high in the sky, affecting birds that used to fly beyond reach of the older models. The rotors appear to turn slowly, but the blades travel at 150 to 300 Km/h at the tip, surprising the birds.

They are deadly to anything that flies, including birds, bats, and insects. In Cordelia, California, a single turbine erected in a low avian activity area was estimated to have killed 54 birds in one year⁽¹¹⁾. This invalidates the idea that turbines having ample space between them will cause insignificant mortality (an argument presented by the promoters of the Chautauqua project in New York State, for instance).

The Cordelia results also fly in the face of the contention that American windfarms have lower birdkill rates than European ones.

Because of scavengers, searches for dead birds and bats are often unsuccessful. This is because they occur at intervals ranging from twice a week to once every 3 months, which leaves plenty of time for coyotes, foxes, and other animals to take away the remains.

In the Cordelia study, *"dead bird searches were conducted five days a week during nocturnal migration monitoring and once a week thereafter."* Daily searches, and a single turbine to look after: these could be the reasons for the relative efficiency of that particular mortality survey.

Except for certain species, like diurnal raptors, most casualties occur at night. So it is important to conduct the search at dawn, before scavengers find the bodies with their acute sense of smell. But it is clear that if one or two field workers must search an entire windfarm, or even half of it, the portion they will be able to cover at dawn will be tiny.

And ideally, in the case of diurnal raptors, two searches a day should be performed: in the late morning, and before sunset.

In view of this, there is an easy recipe for finding a low mortality rate at any windfarm:

- 1) An insufficient budget, limiting the number of searches to an inadequate frequency.
- 2) An excessive number of turbines to cover, and an inadequate number of searchers.
- 3) Poorly planned and inadequately performed scavenger-removal and searcher-efficiency tests.

In addition, the windfarm keeper could be asked to remove the most visible and embarrassing evidence, like dead eagles, swans, storks etc.

Bird mortality at windfarms is a burning subject. The stakes are high. After initial studies evidenced alarming levels of mortality, money is now being spent on new field surveys. Their purpose is to convince the public that bird populations will not be affected in a "significant" manner. And this may be achieved following the above recipe - with or without added ingredients.

As a result, inadequate studies are now the rule. They are sometimes voluminous and obfuscating, sometimes short and to the point, but mendacious always, minimizing the avian impact. And they serve the purpose that is assigned to them: permit the erection of windfarms where the promoters want them - like Smola island, Norway, sanctuary of the white-tailed sea eagle; Beinn an Tuirc, Scotland, on the home range of a breeding pair of golden eagles; Edinbane, Scotland, on a ridge where young eagles from two different species come to soar daily.

Such widespread use of pseudo-science and misleading conclusions renders precious the few reports that do not attempt to minimize survey results and mortality estimates. They are briefly summarized in this paper.

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PRELIMINARY CONSIDERATIONS ON AVIAN MORTALITY:

Large turbines of the latest technology may have blades that rotate more slowly than those of older types; but they are much longer - 35 to 40 meters

- and sweep much larger areas. They also reach higher in the sky, up to 125 meters high, affecting more species of birds and bats ⁽¹⁾.

Furthermore, in spite of their slower rotation, speed at the tip is very high. Their increased length accounts for that. To give an example: General Electric model 1.5S has a rotor 70.5-meter-wide (diameter), and a generating rotor-speed varying between 11 and 22 rpm ⁽²⁾.

It is simple to calculate the tip-speed from this data:

$$70.5 \text{ meters} \times 3.14 (\pi R^2) = 221.37 \text{ meters circumference} \times 11 \text{ rpm} = 2,435 \text{ meters per minute} \times 60 \text{ minutes} = \mathbf{146 \text{ km/h}}$$

At 22 rpm (revolutions per minute), the tips go twice as fast:

$$70.5 \text{ meters} \times 3.14 (\pi R^2) = 221.37 \text{ meters circumference} \times 22 \text{ rpm} = 4,870 \text{ meters} \times 60 \text{ minutes} = \mathbf{292 \text{ km/h}}$$

Large, fast moving blades that appear to turn slowly are a deadly trap to birds and bats, as shown by evidence provided below.

It is a known fact that intelligent animals like dogs can easily misjudge the time needed to cross the road safely. And the higher the speed of approaching cars, the greater the chances of miscalculation.

As a matter of fact, children, and even grown men, happen to err in their appreciation of speed and distances. Many accidents on our roads attest to the fact. And there is an aggravating factor: unlike cars, blade-tips travel on an orbit. Birds crossing the swept area would not always see them coming.

Why should birds, which some people regard as stupid, know better than people the speed at which the blade-tips are travelling? Hired consultants often claim that all but a few birds do see and avoid the blades. - The statistics below will show that this is hardly the case.

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BIRD MORTALITY ESTIMATES FROM EARLIER REPORTS.

1) Altamont Pass.

Several studies evidenced an on-going massacre at this very large windfarm near San Francisco. Golden eagles are being killed there at the rate of 40 to 60 per annum ⁽³⁾. - A yearly average of 50 eagles, if we apply it from when the farm became operative about 20 years ago, represents 1,000 dead eagles.

The same windfarm also kills about 500 other raptors each year: hawks, owls, falcons, harriers and kites ⁽⁴⁾. Cumulatively, that's 10,000 "protected" raptors over 20 years.

Other victims include doves, larks, ducks, blackbirds, gulls, swallows, herons, ravens, passerines, and bats ⁽⁵⁾.

For all birds inclusive, Dr. Smallwood gives us an estimate of 25,000 to 50,000 specimens killed at Altamont over 20 years ⁽⁴⁾ - bats excluded.

2) Strait of Gibraltar.

In 1995, SEO/Birdlife ⁽⁶⁾ evidenced that 14 species enjoying protected status were being killed at two windfarms in Tarifa. Short-toed eagles, griffon vultures, eagle owls, kestrels, kites, egrets are included in the list.

Yet, "The scarce effect of both windfarms studied on migration of soaring birds in 1994 is attributed to the fact that, although most birds have followed routes very near the windfarms, the location of the turbines are such that they do not interfere with these routes" ⁽⁶⁾

So, in spite of being located off the migration corridor, these two windfarms kill migrating as well as local birds. How many? This remains undetermined for sure, because the report was trying to minimize the results. In an earlier analysis, I tried to expose this lack of objectivity:

"Here, the actual body count was: 65 large or medium-size birds for 34% of the 256 turbines surveyed "generally twice a week", and 54% of the tension lines surveyed once a week. Two short-toed eagles were among them, as well as 30 griffon vultures, 15 kestrels (3 of them on the endangered list), 2 eagle owls, 1 black kite, 1 "unidentified raptor" (it could be an endangered imperial eagle, for all we know) and one egret. Based on this, the summary estimates total mortality to be: 89 large and medium size birds – whereas a weighted extrapolation from 64 bodies on

34% of the windfarm area, and 1 on 54% of the tension lines area, would yield 190 bird carcasses for 100% of the area.

So, in effect, we are asked to believe that the estimated mortality is less than half the estimated body count." ⁽⁷⁾

Other irregularities included the fact that, although small bird mortality was not surveyed, it was easy for the superficial reader to think all birds were included. Another was that scavenger and searcher-efficiency factors were only applied to kestrels ⁽⁷⁾.

But in spite of under-valuing bird mortality at the Strait of Gibraltar, the SEO report did create waves in the ornithological community. After Altamont Pass, it had evidenced that windfarms were particularly dangerous for raptors.

However, the wind industry, and accommodating bird societies, decided to treat the Altamont and Tarifa examples as "exceptions". They still do, in spite of the rest of the evidence below, which is simply ignored.

3) San Geronio, California.

Raptors were the main concern. But a study by Mccrary (1986) evidenced that passerines were also being killed in numbers: "an overall estimate of as many as 6,800 birds killed per year, most of them nocturnal passerine migrants." ⁽⁸⁾

Many waterbirds are on the list as well.

But 6,800 birds out of millions were said to be "biologically insignificant".

No one bothered to ask what the cumulative effect would be, over thousands of future windfarms, over time, and over bird mortality from other causes. Instead, the wind industry and their followers take the minimizing approach: what's 10,000-40,000 birds killed by windfarms in the US compared to millions killed by cats, cars, windows etc.!

- Notes: a) 10,000-40,000 is "their" estimate,
b) it does not consider the ever-expanding number of windfarms,
c) cats and windows do not kill eagles, storks, swans etc.
d) more windfarms mean more power lines, another bird killer,
e) saturation of the airspace with obstacles is likely to increase the overall bird mortality rate,
f) the cumulative effect of all mortality causes is what is worrying,

g) cynically, what is actually being said is: one bird massacre justifies another. In the Chautauqua report, they call it the "real life" approach.

4) Navarra, Spain.

In 2001, a report commissioned by the local government gave evidence that one third of the wind turbines in the region had made 7,150 victims in one year, including 409 griffon vultures, 24 eagles and other raptors, 650 bats and over 6,000 small birds, 40% of them migrants. ⁽⁹⁾

A deceitful summary was added to the 150-page document, disclosing only 0.03 victims/turbine/mo; and the report was shelved. This falsification* of the results did not cause the Spanish ornithological society to come out in the press, let alone take legal action. Not even when an employee with a conscience leaked out the report to GURELUR, a local association, or when it was published on Internet by IBERICA 2000.org.

* $0.03 \times 368 \text{ turbines} = 11 \text{ victims/mo}$

And the true mortality of 7,150 had to be reconstructed from various tables in the report.

$7,150 / 368 \text{ turbines} = 20 \text{ victims/turbine/year}$

Dr. Lekuona, biologist and author of the field study, stresses that his mortality estimates are conservative.

5) Flanders, Belgium.

"At 12 sea-directed wind turbines on the 'East dam' in the port of Zeebrugge the mean number was 39 birds/wind turbine/year." ⁽¹⁰⁾

The overall bird-kill average for the Flanders windfarms studied by biologist Joris Everaert in 2001-2002 comes to 20 birds per turbine/year. The author adds that his figures are conservative.

Yet, when this study was mentioned by a comprehensive Birdlife report, only the bird species were mentioned, not the figures. The protest of a few concerned individuals made them rectify in a subsequent edition.

6) Cordelia, Solano County, California.

S. Byrne monitored a solitary wind turbine for one year, starting in 1992: *"The mortality adjusted for scavenger removal and detectability suggests an actual mortality during the study as high as 54 birds."*

"Findings indicated relatively low rates of waterfowl movements and nocturnal songbird migration over the wind turbine site". And the author adds: *"Migration rates were considerably lower than those recorded in the eastern United States."* ⁽¹¹⁾

This example is remarkable on various counts:

A) Searches were conducted 5 days a week during nocturnal migrations - once a week thereafter.

Too many studies are based on weekly, half-monthly, monthly, and sometimes quarterly searches. This allows for most dead birds and bats to disappear. Besides, scavenger-removal tests are not an exact science. Some biologists use road-kills that have been frozen for months; but well-fed scavengers patrolling the windfarm daily may show a preference for freshly killed victims bearing no human or road scent. - This could distort the results significantly.

Daily searches are crucial when rare species are at stake. For example: let us suppose three Bonelli's eagles are killed at a given windfarm in a given year, and their bodies are removed by foxes (or windfarm employees) between the weekly searches. - The study will show zero Bonelli's eagles among the victims, even if scavenger-removal tests were conducted: a correction factor applied to a zero body-count comes out as nought.

Hence the importance of daily searches.

B) Being a solitary rotor, it should be easy for birds to avoid it - easier than a long string of turbines barring a migration flyway, like the Chautauqua project for instance. But the high mortality evidenced by Byrne shows that even a single machine is not so easy to avoid.

Moving blades, at night, are difficult to see - worse still in overcast conditions. Rain, wind are aggravating factors for visibility and avoidance action. And during the day, raptors are not deterred but attracted by the wind turbines, because of the mice, rabbits, or ground-squirrels that proliferate under them. Freshly-moved topsoil makes for easy burrowing around the concrete bases, and cleared woodlands turn into grasslands - i.e. rodent habitat. This has been amply demonstrated at Altamont ⁽⁵⁾.

The Chautauqua avian risk assessment pretends that wind turbines having ample space between them will cause insignificant mortality. - The Byrne study of a solitary turbine invalidates that prediction.

C) The Byrne survey yielded the highest-known bird-kill rate in the United States. Yet, it was promptly shelved and forgotten - evidencing a will to downplay the negative effects of windfarms on birdlife.

It is also in line with European findings (20 to 60 birds/turbine/year), whereas the US wind industry pretends that American windfarms only kill about 2 birds/turbine/year.

Unchallenged as they are by bird societies, wind promoters are able to go to extremes on the deception scale. Such is the case of the avian risk assessment of the Chautauqua project: here the consultant pretends that a string of 34 turbines on a ridgetop across a well-known migration flyway will kill a "maximum" of 110 birds/y. This compares with 54 birds killed by the single turbine studied by Byrne, which was located in a relatively low avian activity area.

If we applied the Byrne findings to the Chautauqua project:

$34 \times 54 = 1,836$ dead birds/year

But at Cordelia, *"Migration rates were considerably lower than those recorded in the eastern United States."*

This is not the case for Chautauqua: the consultant estimates that 100,000 raptors fly over the wind resource area (WRA) each spring, 16,000 of which at an altitude agl* below 125 meters, which is the height of the turbines. Landfalls occur, so do local flights, and so does soaring and circling within the WRA. *above ground level

Waterbirds, bats and cranes also use the flyway. As for night migrating songbirds, the consultant estimates them at 3 million/year over the WRA, 118,000 of which fly below 125 meters agl and within the WRA.

It is clear that the figure of 1,836 - our birdkill extrapolation from the low bird activity area of Cordelia, is inadequate to estimate mortality at Chautauqua. A number in the five figures would be more likely, not including exceptional massacres due to poor weather conditions.

Yet the consultant predicts 110 dead birds/year. - The gap is that of two orders of magnitude!

7) The Netherlands.

In the ornithology profession, the highest reference when it comes to evaluating windfarm survey results is Dutch biologist J.E. Winkelman. She gave her name to the "Winkelman formula", which permits to extrapolate body-counts into estimated yearly mortality. This is done through applying a number of factors - scavenger removal, searcher efficiency, etc. which are to be established for each windfarm by rigorously conducted tests.

In her 1992 study at Urk and Oosterbierum, she estimated mortality to be somewhere between 33,500 and 195,500 birds per 1,000MW ⁽¹²⁾.

If we were to apply these estimates to the 50 MW Chautauqua project, we would obtain 1,675 to 9,775 dead birds a year. But Chautauqua is well-known for being a migration hotspot, so this extrapolation would be conservative.

What is more, the Dutch biologist emphasizes that her numbers are non-yearly figures: no observations were made during the summer period for both windfarms under study, nor during the winter period at Oosterbierum. More victims undoubtedly fell during those periods, so the "yearly" figures are underestimates, she notes.

She also wrote (translation): "*From the night-research at Oosterbierum it became clear that the real number of victims lies between the average calculated and maximum number of victim.*" - i.e. somewhere between 33,500 and 195,500 dead birds per 1,000 MW. Conservatively, colleagues in the profession use the figure of 46,000 - i.e. 46 birds per turbine/year.

8) Sweden.

From the PIER Study of the California Energy Commission (2002) ⁽⁸⁾:

"In a summary of avian impacts at wind turbines by Benner et al. (1993) bird deaths per turbine per year were as high as 309 in Germany and 895 in Sweden."

These may be maxima, as opposed to averages; they are nevertheless staggering. Even if they occurred in bad weather conditions, or because a light attracted the birds at night, or whatever the reason: they illustrate the fact that these mishaps are likely to occur at windfarms, as they occur with obstacles as obvious and still as are smokestacks:

"On 23 September 1982, 1,265 birds (30 species from an estimated kill of 3,000) were collected below chimneys at the Crystal River Generating Facility, Citrus County, Florida.... On 24 September, an estimated 2,000 birds were involved in chimney collisions". Maehr, D.S., A.G. Spratt, and D.K. Voigts. 1983. Bird casualties at a central Florida power plant. Florida Field Naturalist 11:45-68.

As windfarms do not replace conventional plants, which are needed to back up the random intermittency of wind-produced electricity, the birds killed by windfarms will be added to those killed by smokestacks.

9) Germany.

Bernd Koop estimated there would be 60,000 to 100,000 annual bird collisions per 1,000 megawatt installed capacity in his country⁽¹³⁾. That's 60 to 100 birds/turbine/year.

If we apply his estimate to 15,000 MW of presently installed capacity in Germany, that's 900,000 to 1,500,000 bird collisions per annum. And the closer we are getting to territorial saturation, the lower the chances for the birds to find safe routes through the maze, especially if we add the deadly power lines. Such high mortality rates will be surpassed as more windfarms are built.

Birds in Germany die in great numbers from collision with 70,000 km of high-tension lines that criss-cross the country - 30 million birds per year is an extrapolation found in Hoerschelmann, Haack & Wohlgemuth, based on a study along 4.5 km of power lines - electrocutions excluded⁽¹⁴⁾.

But windfarms need more power lines, so this kind of bird mortality will increase as well.

The cumulative effect of existing tension lines, plus tens of thousands of wind turbines, and yet more power lines to connect the windfarms to the grid, will be severe. And the killing of migrating birds on continental Germany, over the Baltic and the North Sea, and in Scandinavia, will be felt in other parts of Europe as well as Africa.

Reports of monitoring studies on German windfarms have not been made public as yet. It is most regrettable. In any event, the political importance of the birdkill figures to be released is paramount for the survival of the coalition government, which includes the Green party; so the pressure to minimize them will be very strong.

DISCUSSION

Much effort was made to put a lid on the above statistics. The Winkelman yearly figures, for instance, were converted into daily rates per turbine in order to mask their magnitude⁽¹⁵⁾. In the Lekuona study, a summary was added that showed 11 victims *per month*, whereas the body of the report established annual mortality at 7,150 bird and bats, including 409 griffon vultures⁽¹⁶⁾. These, and other examples of deception, have been analysed and published⁽¹⁷⁾. More will be very soon: the Chautauqua and De Lucas studies are among them.

The studies concerning Altamont, and the SEO/Birdlife report on Tarifa (Strait of Gibraltar) did reach some notoriety because of the high visibility of the raptors being victimized. But the wind industry chose to pretend they were exceptions that confirmed the rule, and ignored the rest of the evidence. Bird societies, who support that industry, by and large acted likewise.

And today we are facing a well-financed disinformation campaign. Non-objective, unscientific studies are being released to promote windfarm projects in areas that are vital to birdlife. For people with little time to read them - everybody really - an abstract is added, which states what the sponsor wants them to believe.

For example, in the executive summary to the De Lucas study on a windfarm overlooking the Strait of Gibraltar, we read: "*wind farms have shown a spectacular growth because they have reduced the costs of energy production. This phenomenon has resulted in a proliferation of wind farms around the world (Germany, Holland, Spain, United States, etc.) (Osborn et al. 2000).*"⁽¹⁸⁾

Why would ornithologists dabble in electricity production costing? Do the promoters dictate what the report must say - in this case a lie? Or are the consultants outdoing themselves to try and please their sponsors?

For the record, here is what the RAE has to say about the true cost of windpower:

"According to research carried out by the Royal Academy of Engineering (RAE), the cheapest electricity, costing just 2.3 pence per unit, will be generated from gas turbines and nuclear power stations, compared with 3.7p for onshore wind and 5.5p for offshore. The Academy also emphasised the need to provide backup for wind energy to cover periods when the wind doesn't blow. The study assumed the need for about 65% backup from conventional sources, adding 1.7p to the cost of wind power, bringing its price up to two and a half times that of gas or nuclear power."

Yet, this very report by De Lucas, biased as it is, is the cornerstone of a drive to place windfarms on migration hotspots in the State of New York (Chautauqua and others) ⁽¹⁸⁾.

In the same vein of deceit, we are being asked to believe that wind turbines pose "insignificant" threat to eagle populations, even when placed on their hunting territory - home range or dispersion area. On the basis of this untruth*, which is based on statistical manipulation and disregard for cumulative impacts, windfarm projects have, or will soon be approved, at Edinbane, Ben Aketil, Beinn an Tuirc and Beinn Mholach, Scotland - Smola island, Norway - sierras of Almudaina and Alfaro, Spain - Starfish Hill, South Australia - Slovenia - Panama - and more eagle habitats.

* Explaining "untruth": Scientists have established that about 1,000 eagles have died so far at the Altamont Pass windfarm. At German windpower plants, the bodies of 13 rare white-tailed sea eagles were found by members of the public. In Spain, eagles are being killed by windfarms in the provinces of Navarre, Aragon, and Andalusia - that we know of. At Starfish Hill, South Australia, 2 eagles were killed practically as soon as the turbines became operative ⁽¹⁹⁾. - As monitoring remains the exception, the total eagle-take worldwide is likely to be in the thousands.

Eagles are slow to reproduce. It is clear that, if more windfarms are built on eagle territories throughout the world, their cumulative impact will not be "biologically insignificant".

There is no limit to this line of dishonesty: industry followers now pretend that it is acceptable to place 300 wind turbines in a bird sanctuary of international importance, protected by the RAMSAR convention and the European network of natural reserves NATURA 2000: the Lewis peatlands SPA, in the Western Isles, Scotland. It is home to seven listed species, some of them in numbers constituting a high percentage of the total UK or European populations. It is also an important migration stopover for many other species - including whooper and bewick's swans, barnacle geese, white-fronted geese, etc. - being their first and last landfall on their route to and from Greenland and Iceland.

And they get away with it: witness the approval of a windfarm in South Gippsland* last month - in spite of the parrots, of the eagles, and the opposition of its people. * Victoria, Australia.

CONCLUSION

Deceitful studies, irregular and faulty surveys*, untruthful statements* permit the violation of conservation laws that took 2 centuries to establish.

* the case of Scottish Natural Heritage in removing their objection to the siting of a windfarm in the Lewis peatlands SPA ⁽²¹⁾.

Yet bird societies, who are de-facto watchdogs for the respect of such laws regarding birdlife, remain very quiet. The Royal Society for the Protection of Birds, for instance, refused to mediatize its mild written objection to the Beinn Mholach windfarm project in the Natura 2000/RAMSAR Lewis peatlands SPA. And the project was subsequently approved.

They equally fail to publicize the studies and statistics presented in this paper, and keep pretending stubbornly that Altamont and Tarifa are "exceptions", when evidence is to the contrary.

The Bulgarian Society for the Protection of Birds is the exception that confirms the rule: they did launch a petition to save their migrating birds from a windfarm project. Who would have thought that Bulgarian ornithologists would give a lesson to the rest of the world in conservation ethics?

The question remains: how do other bird societies justify the installation of controversial and deadly windfarms in listed-raptor habitat, on migration flyways, or in bird sanctuaries? Given the chilling statistics presented herein, it is hard to understand. - After all, is there no room elsewhere?

And what about bats?

The effect of windfarms on bats deserves another paper. Suffice to say here that a windfarm on the Backbone Mountain in West Virginia is estimated to have killed 2,000 to 4,000 bats in one year ⁽²⁰⁾.

That's 45 to 90 dead bats per turbine/year.

And the world is heading for one million wind turbines, in a first phase of windpower development.

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(19) - A. Chapman (2003) - Renewable Energy Industry Environmental Impacts: *"I recently received the following information from members of the*

Eaglehawk Conservation Group in South Australia about the Starfish Hill wind farm, a facility developed by Starfish Hill Wind Farm Pty Ltd, a wholly owned subsidiary of Tarong Energy, based in Queensland.

- *On 22 September 2003 the group said a Wedge-tailed Eagle had been killed at the Starfish Hill wind farm. This kill occurred before it was officially opened by Premier Mike Rann on Saturday 4 October 03.*
- *During the first week in October 2003 a second eagle was found dead under one of the turbines by the Tarong Energy Site Manager.*

At least four months after the first turbine commenced operating and even after the last kill there was no official bird kill monitoring procedure in place. These two eagle kills are known only because members of the public have stumbled across them.

(20) - Merlin Tuttle, director of Bat Conservation International in Austin, Texas www.friendsofthealleghefront.org/newsdown14.htm

(21) - M. Duchamp (2004), Objection to the Beinn Mholach (aka Pentland Road windfarm) - Section E: Objection hastily removed by SNH
http://www.iberica2000.org/documents/eolica/Objection_Lewis_SPA.doc