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ESTIMATION OF BIRD STRIKE RATE ON A NEW ISLAND IN THE NORTH SEA

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Abstract

Since 1997 North Sea Directorate has been participating in the research on the consequences of the National Airport Development in the Netherlands. For the long term the Dutch government sees three options: Limited growth of the air traffic on Schiphol, comprehensive reorganisation of the runway system at Schiphol itself and transfer the airport to an North Sea Island. In the design of the two alternatives (North Sea island and redesign Schiphol) many uncertainties still exist. Additional research is crucial for finding realistic solutions.
One of the main subjects for a North Sea island is flight safety and birds on or in the surroundings of the island. The North Sea Directorate is responsible for this subject. To estimate the bird strike rate on a new island in the North Sea information about bird biomass on and in the near vicinity (5,5 km) of a North Sea island is needed. To estimate the bird biomass on a new island in the North Sea is a difficult task. North Sea Directorate decided to organise an international expert workshop in which the participators gave their best professional judgement about the bird numbers on and in the vicinity of a new island in the North Sea. The working method used to estimate the bird numbers on a new island in the North Sea during the workshop will be described in the presentation during the meeting.
At the end of 1999 the Dutch government decided to sustain the option limited growth of air traffic on Schiphol Airport. Although the uncertainties about the option to transfer the airport to an North Sea Island seem to high at this moment it is still a interesting option. Therefore the Dutch Government decided to start a long term research program on this option in which airport safety in relation to birds plays an important role.

Key Words: Bird strike rate, North Sea.

Since 1997 the North Sea Directorate has been participating in the research on the consequences of the National Airport Development in the Netherlands. Air traffic may continue to grow but only under certain conditions. For this growth the Dutch government in 1997 restricted the possible designated areas to four possible sites: Maasvlakte, Flevoland, the North Sea (island) and Schiphol itself. After further investigation in 1998 the government decided that the locations Maasvlakte en Flevoland offer too limited perspective and were for that reason rejected. For the long term the Dutch government sees three options: Limited growth of the air traffic on Schiphol, comprehensive reorganisation of the runway system at Schiphol itself and transfer the airport to a North Sea Island. In the design of the two alternatives (North Sea island and redesign Schiphol) many uncertainties still exist. Additional research is crucial for finding realistic solutions.

The North Sea directorate has been responsible for the research into, flight safety in relationship to birds on or in the vicinity of an island in the North Sea.

The key questions that have to be answered are:
- How high will the risk be of a fatal bird strike in 2015 at a New Schiphol Airport in the North Sea?
- What can we do to lower this risk?

To answer this questions one needs:
- A method for calculating bird strike risk
- Aircraft data
- Bird data
- Bird management possibilities (active and passive)

A method for calculating bird strike risk

The Directorate North Sea has asked the National Aerospace Laboratory (NLR) to develop a method to predict bird strike rates for an airport located on an offshore island. The model they developed describes the bird strike rate per 10.000 aircraft movements under normal circumstances. The following lineair relation between the bird strike rate and the bird density has been defined:

bird strike rate (per 10.000 movements) = 0,063 x bird density

The model can be used for civil transport aircrafts only. The emperical model cannot be used for the phenomena Falls. The model predicts the strike rate assuming that the behaviour of the birds at an airport located on an offshore island will be similar to that of an airport located close to the sea.

Aircraft data

In order to predict the fatal bird strike risk at an airport in the North Sea in 2015, one needs to know the expected numbers of aircraft movements that will use this airport. The Program Department ONL, ***Ontwikkeling Nationale Luchthaven*** (National Airport Development) estimates the number of expected aircraft movements to be 600.000. But it can be more up till 1.000.000.

Bird data/ Bird management possibilities

As an input for the method to predict bird strike risk, one needs to estimate the bird density.
To predict the number of birds on and in the vicinity of an island in the North Sea several research studies have been initiated by the North Sea Directorate:

· **Analyse current bird density**
In 1998 a study has been carried out at the variation of birds in space and time at the North Sea by a team of Dutch ornithologists. The calculations were carried out in numbers per square km and in kg per square km. Eventually two bird density maps on the North Sea were made one for the winter and one for the summer.

· **Radar observations at the pier of IJmuiden**
In 1999 a radar equipment was installed at the pier of IJmuiden. The radar was situated at the southern pier of IJmuiden, 3 km offshore in the North Sea (near to Amsterdam). The radar has the ability to collect data up to 13 km offshore. The purpose of this study was to determine the bird density of flying birds at a right angle to the coast, with the dispersion over twenty four hours and dispersion over the seasons. With reservation (not all data has been sorted out) it is posed that when the bird density above the shore is set to 100%, then the bird density 3 km offshore is 40-60% and at 10-13 km 5-20%.

· **Definition of risk species**
This study focuses on bird species and their behaviour that causes high risks. The list of risk species was established by several selection steps. Firstly, the total species list of all west-Palearctic species was checked for rare or irregular species. Secondly, this list was shortened by excluding species of the based of risk characteristics: numbers and size. In the next step, categories of hazardous behaviour have been defined for birds in general, for breeding birds, non-breeding birds and migrating birds respectively. Species were judged as having little risk, moderate risk or high risk. The result: 12 breeding species and 17 non-breeding species were defined as most hazardous based on their behaviour and expected numbers. Migrating birds

could not be assessed in this study due to lack of data regarding these species.

· **Behaviour of gulls**
In this study the risk posed by gulls for aircrafts operating from an airport at an offshore island, to be constructed off the Dutch coast is evaluated in this report. Gulls may pose a significant risk for aircraft using runways on an offshore island in the North Sea. Herring Gulls, Lesser Black-backed Gulls, Common Gulls and Great Black-backed Gulls are the most likely candidates that will attempt to colonise an offshore island. Risky behaviour is expected from roosting or feeding gulls, from breeding gulls, from migrating, thermal soaring, slope soaring and foraging gulls. Bird avoidance will be very difficult because there are so many attractions for gulls.

· **Falls of migrant birds**
A fall is defined as a sudden arrival of an exceptional number of migrants at a certain location. Falls may occur when migration is interrupted by the rapid onset of adverse weather, such as gales or fog. This study treats the risk of a fall, the circumstances a fall does appear and the bird species that are involved. The databases researched are: beached bird surveys, sea watching from platforms and ships, dead bird surveys on light vessels, trapped birds on coastal CES-sites and visible birds. These databases indicate that falls are restricted to the main annual migration periods. Thrushes, starlings, finches, and warblers are the most commonly recorded species. Falls seem to happen a few times every year. In most cases scale and size seem to be limited, but almost every year there is a reasonable chance a big fall will occur.

· **Shores, new natures and birds**
The National Institute for Coastal and Marine Management (RIKZ) has set out a study to determine the possible development of communities related to sea-defence structures in the North Sea. One of the main goals of this study was to minimise simultaneously the amount of birds which are considered hazardous for air traffic. The ecotopes associated with a soft defence attract most birds, both in species and in numbers. Especially dune areas and tidal flats. Hard bottom sea defences will also attract birds, but further work is needed for a more precise description of the birds to be expected here. The use of a dissipation zone is worth a more detailed study, not everything is clear on how the ecological community will develop.

· **Workshop “Estimation of bird numbers on a new island in the North Sea”**
All the studies so far described the bird density in the current situation at the North Sea. It is impossible to measure the bird density on a new island in the North Sea because this island is still in the planning phase. Experts on birds and their behaviour were asked during a workshop to provide their “best professional judgement” about bird species and their density and the

identification of parameters determining the occurrence of birds on and in the vicinity of a new island in the North Sea.
The results of this workshop were very important for the North Sea Directorate, in determining a first estimation about the bird strike rate on a new airport in the North Sea.

To achieve this we worked in two phases:

***Phase 1*:** Estimation of bird species and its intensity on and in the vicinity (5,5 km) of the reference island. The experts were divided into three groups and were asked to fill in two tables for resident non-breeding birds and resident breeding birds. They had to estimate the number of birds that will occur on the reference island, in which period, how certain they were about this number and what habitats they would use. The experts were also asked to answer a number of questions about migrating birds.

After comparing the tales completed by the groups, it was apparent that there was much agreement on the numbers of birds occurring on the island and the certainty of those numbers. Lesser black-backed and Herring gulls are likely to be the key “problem” breeding species on the island, as al groups considered that they would occur in large numbers (up to 100.000 birds). It is also clear that several resident non-breeding birds will be present at the island in high number. Amongst them are Fulmar (for relatively short periods), Eider and Common Scoter (mostly in winter), Herring Gulls and Starling.

Estimates of the number of migrating birds likely to occur are difficult, as there is insufficient knowledge about flock size, flight altitudes, nighttime flying and precise flight pathways. It is difficult to evaluate whether the distribution of migrating flocks in space and time will change due to the development of the island. The prediction of the frequency of falls on the island depends to an extent on the definition of a “fall”. Large numbers of scavenging seabirds should be expected during weekend storms, when there are no fishing vessels at sea (up to 10.000 birds). For Passerines, falls will occur every autumn with a chance on a mega fall once a year.

***Phase 2*:** Estimate the influence of different design parameters for the airport (e.g. the influence of a bridge to the island) and bird control (e.g. chasing of birds) in relation to bird species and their density. On the basis of propositions the experts had to vote individually about the influences of different design parameters and bird control measures. By using a “voting machine” the results of the propositions were immediately visible on a screen and it was easy to discuss the diverse opinions.

The results show that increasing the distance of the island to the coast would decrease the number of birds on the island. The lattitude is important, but very difficult to predict what would happen without further research. Distance to the coast is far more important than the size of the island. Also a visible connection to the shoreline would make the island more attractive for birds. Layout of the island is very important: dunes, dissipation areas, trees and fresh water will increase the number of birds on the island.

· **Bird control at airports**

Research into the possibilities of lowering the bird strike rate at an airport was carried out in order to obtain an overview of the state of the art' bird control at airports. This included gathering and analyzing international literature and publications on bird control at airports. Bird control methods vary greatly with location, bird species and environmental circumstances. Generally, habitat management and zoning of land use around the airport are successful and most durable, because attractants are eliminated or reduced.

Conclusions of North Sea Directorate

How high will the risk be of a fatal bird strike in 2015 at a New Schiphol Airport in the North Sea?

If we compare the results of the studies on bird numbers the estimation is that through the construction of an island in the North Sea at 20 km offshore the bird intensity will become the same as in the current coastal zone (5-10 km). Quantification of the migration intensity is still not possible.

During the winter the number of birds will be much higher than during the summer. However 50% of the population during the winter consists of sea-ducks, who are more or less considered to be non-risk species. We can assume then bird density of risk species during the winter will be equal to the bird density of risk species in the summer. During autumn and winter the bird densities can become higher because of gulls seeking shelter and falls.

What can we do to lower this risk?

Bird management at an airport in the North Sea will be a difficult task. From the beginning one should design a bird unfriendly island. The most influencing factor will be the distance to the shore. An island closer then 20 km to the shore gives a higher bird density from all the bird species on and in the vicinity of the island. All aspects that make an island more attractive to birds should be avoided. A tunnel is preferred above a dam and a bridge. Other important design aspects are form of the dike, lighting and the construction of the coating of an island.

It is estimated that bird strike rates with gulls can be decreased with maximal 90%, this number is based upon results at John F. Kennedy airport . One assumes that bird strike rates with other species can be decreased by factor 3 (this factor has been derived from the situation at Schiphol Airport). Breeding attempts of cormorants, gulls and sterns must be controlled from the beginning.

The results about bird management are still uncertain and temporary. In the near future more detailed research is needed.

Bird strike rate at an airport in the North Sea compared to other airports

With a maximum of bird avoidance measures during the breeding seasons (March-July) the bird strike rate on an island in the North Sea at 20 km distance offshore can become comparable with Schiphol airport (5 bird strike rates per 10.000 movements). The rest of the year the rate will be higher. During winter and autumn the bird strike rate can become higher due to falls or gulls seeking shelter. The bird strike rate might then be 3-6 times higher.

Conclusions of the Dutch government

In relation to the subject airport safety and birds the Government decided at the end of 1999:
The bird strike rate at an island closer then 13 km offshore will become too high and will endanger the airport safety. An island in that area will attract too many birds.
An island further offshore may be possible, providing that effective bird management is used, but many uncertainties still exist. Uncertainties such as: ‘What bird management is most effective on an island in the North Sea” and “What is the frequency of occurrence, magnitude and predictability of falls?”

At the end of 1999 the Dutch government decided to allow limited growth of air traffic at Schiphol Airport. Although the uncertainties about the option to transfer the airport to a North Sea island seem too high at this moment it remains an option for the future. Therefore, the Dutch Government decided to start a long term research program on an airport island in which airport safety in relationship to birds plays an important role.