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# MONITORING AVIFAUNA FOR RISK ANALYSIS AT ATHENS INTERNATIONAL AIRPORT S.A.

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## Abstract

Athens International Airport (A.I.A.) is under construction at the area of Mesogaia (East Attiki, Hellas) and is expected to start operating in March 1st, 2001.

A Baseline Survey has already been conducted for the Bio-monitoring Programme of the airport. Special care has been taken during this survey not only to record data for conservation purposes, but also to record valuable data useful for the Bird Control Programme during operation. Therefore special interest has been paid for recording avifauna species and their activities in the vicinity of the airport. All data observed have been recorded in a specially designed database, the A.I.A. **BIO-M**onitoring **I**nformation **S**ystem ( A.I.A. BIOMIS).

Quantitative and qualitative data for birds like diversity in species and populations, daily or seasonal movements (migration included), staging, nesting, or feeding activities, nutrition habits as well as habitat type analysis for the avifauna biotopes and conservation attributes have been studied. Risk analysis for aviation safety purposes is being performed mainly using ArcView GIS. A.I.A. BIOMIS is directly connected with the GIS software and data input is directly converted in map information providing real time information for Bird Control.

Some data from the above-mentioned Baseline Survey, visualized through ArcView GIS, as well as the online abilities of the designed system are being presented.
**Keywords:** Athens International Airport, Europe, Hellas, Environment, Maps, Warning system, Density, Migration, Resident, Roosting, Food sources, Habitat modification, Bird control, Risk assessment, Conservation**.**

## Introduction

Athens International Airport "Eleftherios Venizelos" is under construction close to the municipality of Spata at the Mesogaia plain, East Attiki (Map 1). During the first stage of operation its parallel runway system is expected to allow minimum peak traffic of 65 movements per hour, or about 600 per day, through simultaneous take-offs and landings, thus serving up to 16 million passengers per year.

The commencement of the construction works was in July 1st, 1996 and they will end by September 31$^{st}$, 2000 allowing a five-month trail period before the Airport opening in March 1$^{st}$, 2001.

The Mesogaia plain is located east of the city of Athens, from Mt. Imittos eastwards to S Evoikos Bay, and its northern border being Mt. Pendeli and southern border being the hilly mountains of Lavreotiki Panion Oros and Merenda.

The character of the area is mainly rural. The main types of cultivation are olives groves and vineyards most of them existing for decades, if not centuries in the area (Diagram 1).

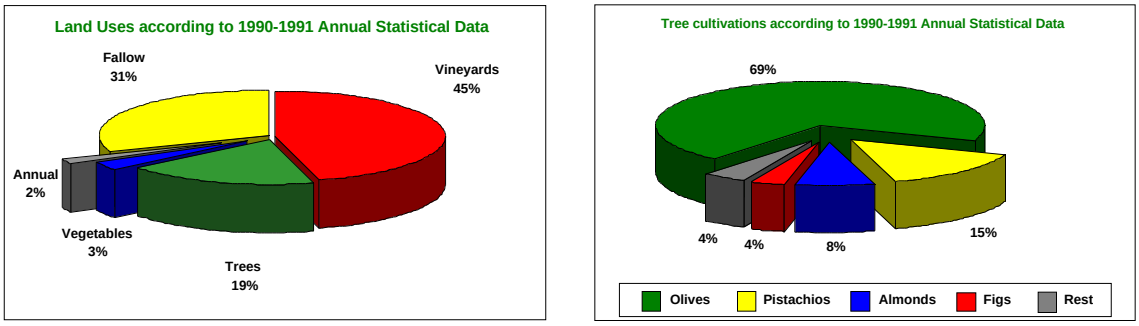



**Diagram 1**

Natural habitats, mainly as forest stands of various vegetation types are rather restricted at the slopes of the surrounding hill and mountains. Along the coastline, mainly at the estuaries of a couple of seasonal water flows, there are a few wetlands the most important being Vravrona wetland, a NATURA 2000 Network SPA (Dafis et al. 1996).

## A.I.A. Bio-monitoring Programme - PHASE I Baseline Survey

In the frames of the Environmental Management System, in order to define and establish biological indicators, A.I.A. has designed and implemented a Bio-monitoring Programme. In order to obtain valuable baseline data the first period of the above-mentioned Programme was mainly dedicated in the implementation of a Baseline Survey. This survey has been considered essential also for Aviation Safety reasons as A.I.A. adopts the most resent philosophy on Bird Control, recommending to work out a comprehensive ecological study of the vicinity of the airport before adopting measures to prevent bird strikes (Hild 1983).

For the better exploitation of the information recorded during the above-mentioned survey a Bio-monitoring Information Systems (A.I.A. BIOMIS) has been established, specially designed to include a great diversity of data. These data include not only phenological, ethological, sociological, life cycle or contamination features of the different organisms but are extended also on population, society and even habitat levels.

Information recorded and eventually stored in A.I.A. BIOMIS is mainly the following:

- Recording Data: Data related to the persons responsible for the observations and time period of them
- Species Data: The name of the species (usually the name in current use), and respective conservation references
- Site Data: Data related to the site of the observation, like the grid cell (in national grid), global coordinates, altitude, geological and ecological data, site details.
- Descriptive Data: Data related to the activities of a certain species in a certain site (nesting, breeding, staging, and wintering) or to the general behavior of the species (resident, migrating, migration or movement route details etc.).

Data recorded by now are showing a significant biodiversity in the extended Mesogaia area, consisting of 600 plant taxa, 215 vertebrate species (fish excluded), 16 standard natural habitat types according to CDs 92/43/EEC and 97/62/EC, and a number of non-standard agroecosystems.
The study of these data is very important not only for conservation reasons but also provides as a good view of the ecosystems function, adding a significant value to the bird control study of the Airport.

## Avifauna Sub-project

A.I.A. Bio-monitoring Programme has been divided in various sub-projects, one being dedicated exclusively to avifauna and was performed by the

Zoological Museum, University of Athens. During this sub-project, started in April 1997 and ended in December 1999, 191 bird species has been observed and their status and monthly occurrence has been recorded in 38 sites in Airport's adjacent area (Diagrams 2 & 3, Map 2). [1]

55 species are breeding in the study region, 31 of that being resident. Largest category is migrants, constituting almost half the region's avifauna. Wintering species are almost at the same level with resident.

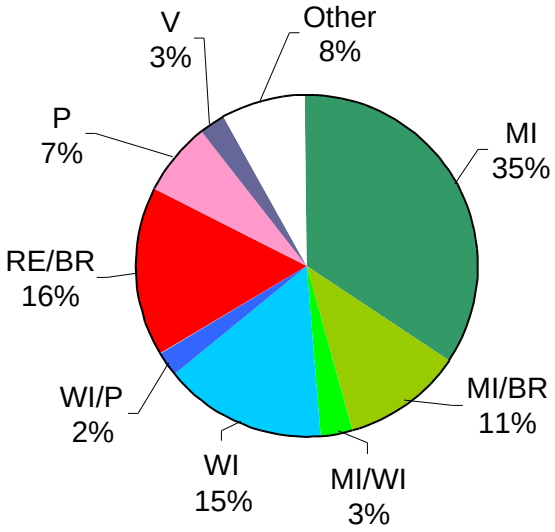
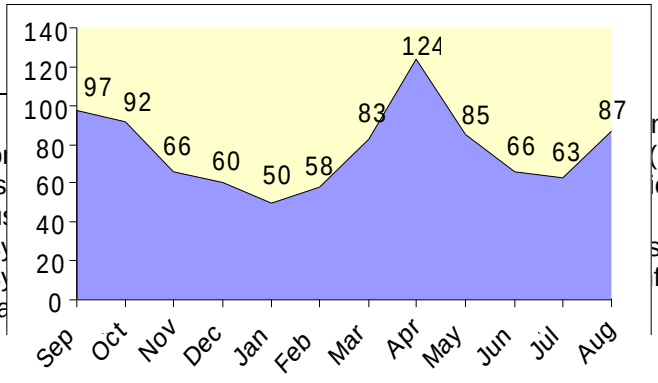



***Diagram 2. The relative contribution of the major phenological categories in the region's avifauna.***
***BR= breeding or summer visitor, WI= wintering, MI= migrant, RE= resident, P= vagrant, V= occasional visitor, NBV= non breeding visitor***

The monthly fluctuation of species richness (Diagram 3) shows that April is the richest month, when many migrating birds are staging at the small wetlands. Another peak is shown in late summer and in autumn, again due to the influx of migrating birds, however there are fewer species, but passing through the region for a longer time period. Winter is the poorest season, followed by mid-summer.




1 ...n, the observations have been based o... (metric system). Therefore, every site is ...ed by it. A different symbol has been u... species of birds are visualized by a s... served. Therefore, the number of the s... formation, but only indicate the site ra...

Additionally, an evaluation of species density in the four most typical habitat types has been attempted (Diagram 4). The olive grove is distinctly the habitat type with the richest density during the whole year. The vineyards come second, followed by maquis and finally the pine forest, except for the summer months, when it probably offers refuge from the heat and sun. In all other habitats the densities generally peak during the winter months, with maquis showing a more regular fluctuating pattern.

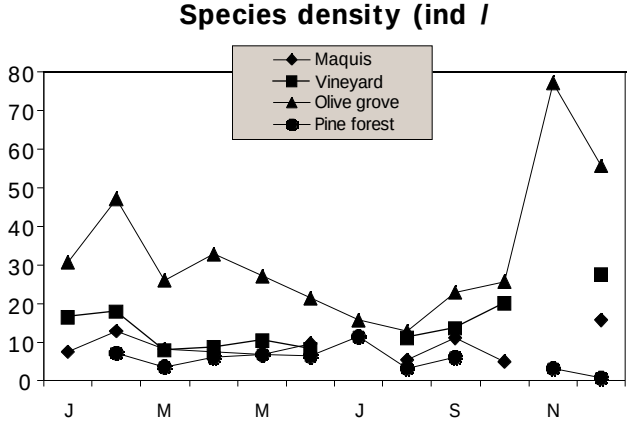



***Diagram 4. The patterns of density throughout the year***

At the same time the movements of species related to aviation safety have been recorded (Map 2) sometimes related to numbers of individuals flying over a site. As an example in Diagram 5 the fluctuation of flock numbers of two gull species is illustrated. This diagram shows an increased number of individuals passing over the town of Rafina towards Mesogaia and back again, till mid spring. Then the numbers decline and stay generally in low

levels until mid-autumn, when they rise again to high levels. The increased numbers going inland during the autumn, winter and early springtime are mainly related to agricultural activities during these seasons (vineyard ploughing in late winter and early spring and olive grove ploughing in late autumn).

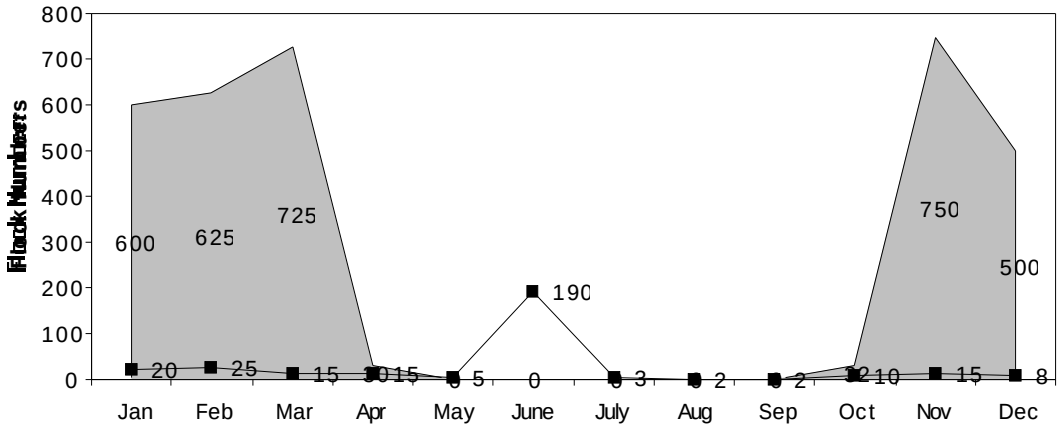



Diagram 5: Maximum recorded flock numbers for Black-headed (blue area) and Yellow-legged Gull (pink line) at Rafina.

## Risk Analysis using A.I.A. BIOMIS and ArcView GIS

Further to the above-mentioned abstracted qualitative and quantitative data about 1700 records concerning bird species have been registered in A.I.A. BIOMIS.

The most important groups of birds that are potentially connected to aviation safety are listed in Table 1 together with the frequency of occurrence in the area and their bird strike ranking evaluation.

***Table 1***

| SPECIES OR GROUPS OF SPECIES | FREQUENCY OF OCCURRENCE IN | RANKING EVALUATION |
|---|---|---|

| OF BIRD CONTROL INTEREST | PROXIMITY TO AIRPORT | REGARDING AVIATION SAFETY* |
|---|---|---|
| Yellow-legged, black-headed and small Gulls | High | 5 |
| Water Birds (Waders, Herons, Ibis etc) | Low | 3 |
| Migrating Raptors | Low | 3 |
| Starlings | High | 5 |
| ***Corvidae*** (Crows, Ravens & Magpies) | Low | 3 |
| Migrant passerines and small non-passerines | Medium | 4 |
| ***Columbridae*** (Doves etc.) | Medium | 4 |

* 1:Without significance, 2: Low danger, 3: Intermediate, 4: High, 5: Very high

Using ArcView GIS to map the distribution of the species related to aviation safety and taking into account the quantitative data and data concerning bird movements a first approach to risk analysis for bird collisions can be attempted. As an example we can refer to the following preliminary assessment:

Gulls show a high collision possibility during winter, early spring and late autumn, especially early in the morning or in the evening, when they pass through the approaching trapezoids on both ends of the Airport. This possibility is decreasing during summertime (Map 3).

Starlings show also a high collision possibility in late autumn and early winter, when they migrate southwards and appear in the area passing through the approaching trapezoids also on both ends of the Airport (Map 4).

***Corvidae*** and ***Columbridae***, mainly dwelling in the area and moving in single to small numbers, show a medium collision possibility, specially those moving very close to the Airport (Map 5).

Raptors, moving seasonally from the hills SE of the Airport to Mt. Pendeli, and backwards, thus passing over the NE approaching trapezoids show also a medium collision risk (Map 6).

Migrating water birds observed mainly in the coastal wetlands in very small number show a rather low collision risk (Map 6).

## Follow-up

During this last year of Airport's construction, and up to the opening date, the avifauna monitoring sub-project is being focused mainly in the species related

to aviation safety. Based on the experience gained during the previous periods, monitoring protocols has been designed in order to record not only species, densities and activities but also, weather and ground conditions. All these data will be registered in BIOMIS, and a 3D View tool will be added to the existing GIS software in order to obtain an integrated risk assessment tool in real time.

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