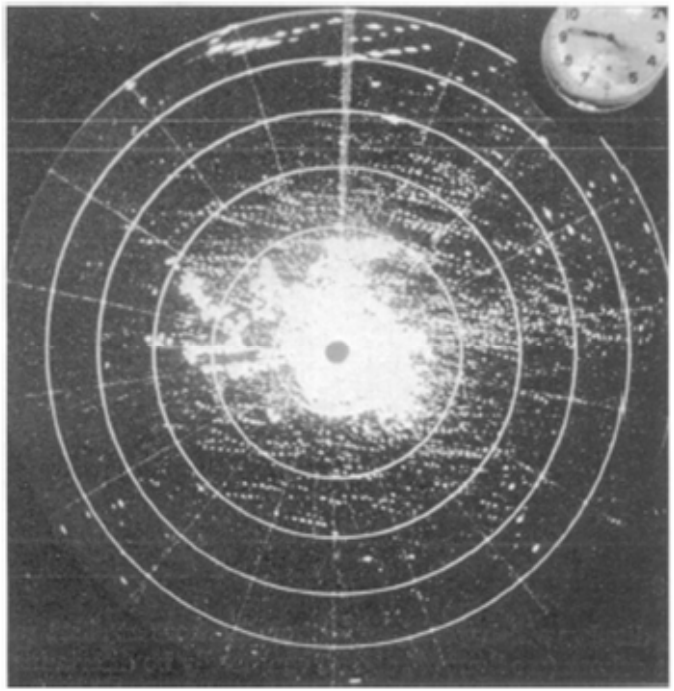
From blips on the screen . . .



. . . to movements of bird and bat populations

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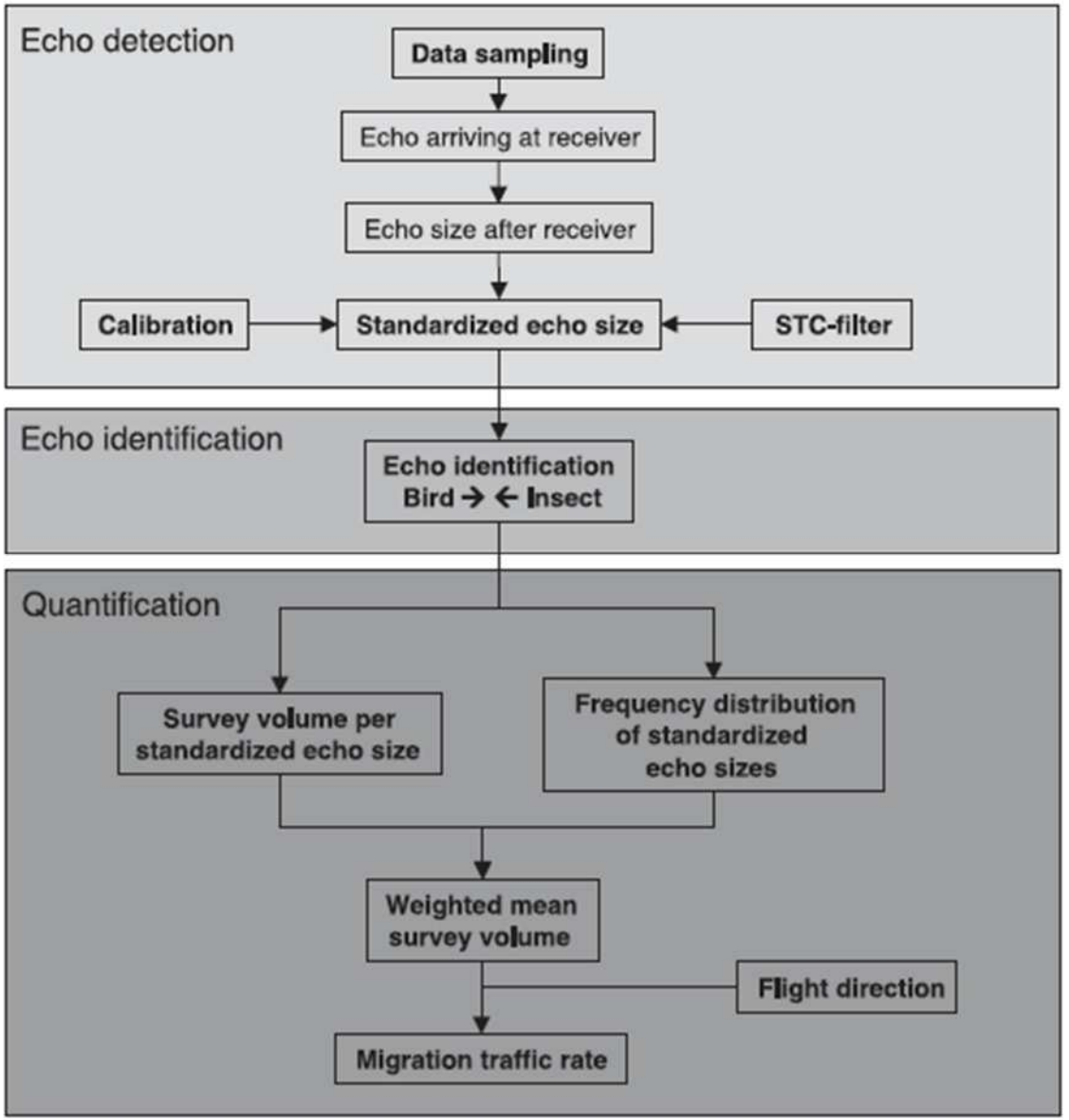
How to count targets?

What is a target?

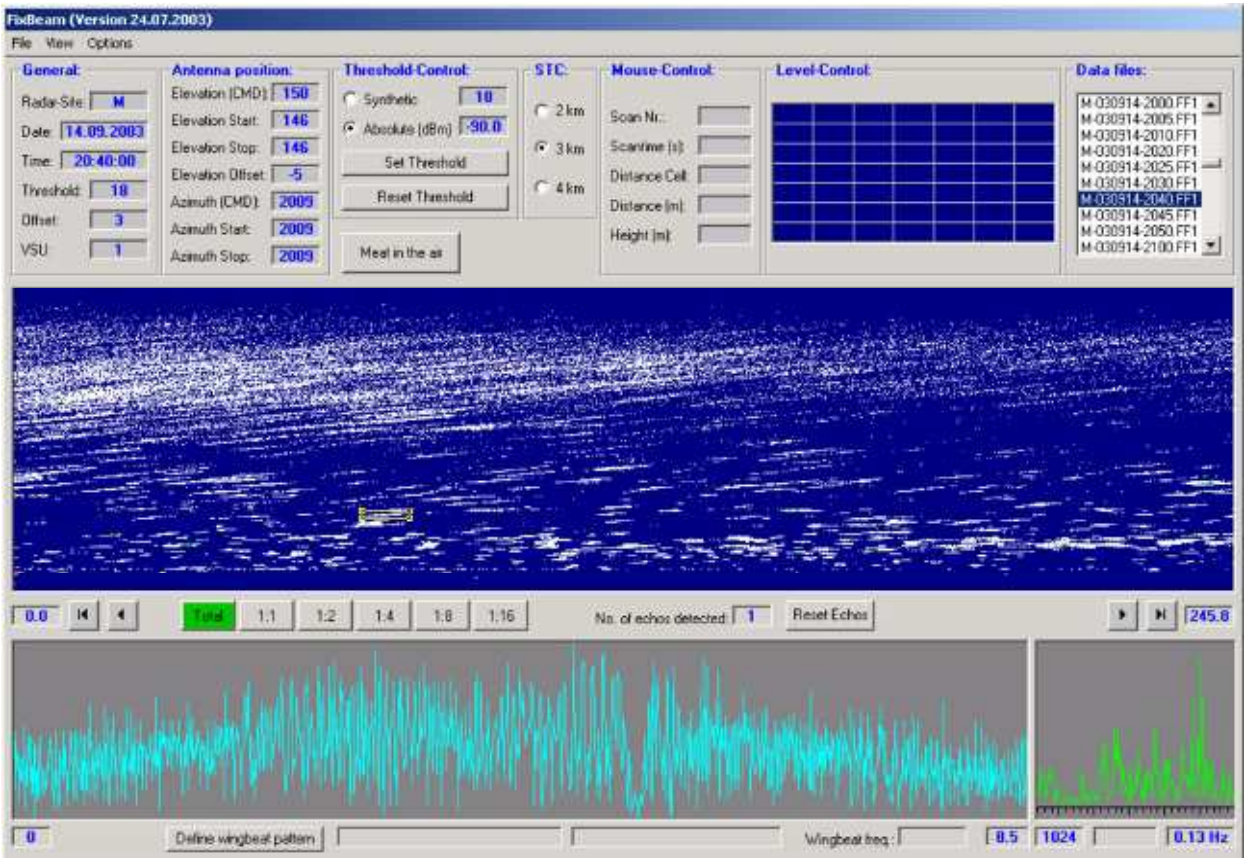
What kind of target is it?

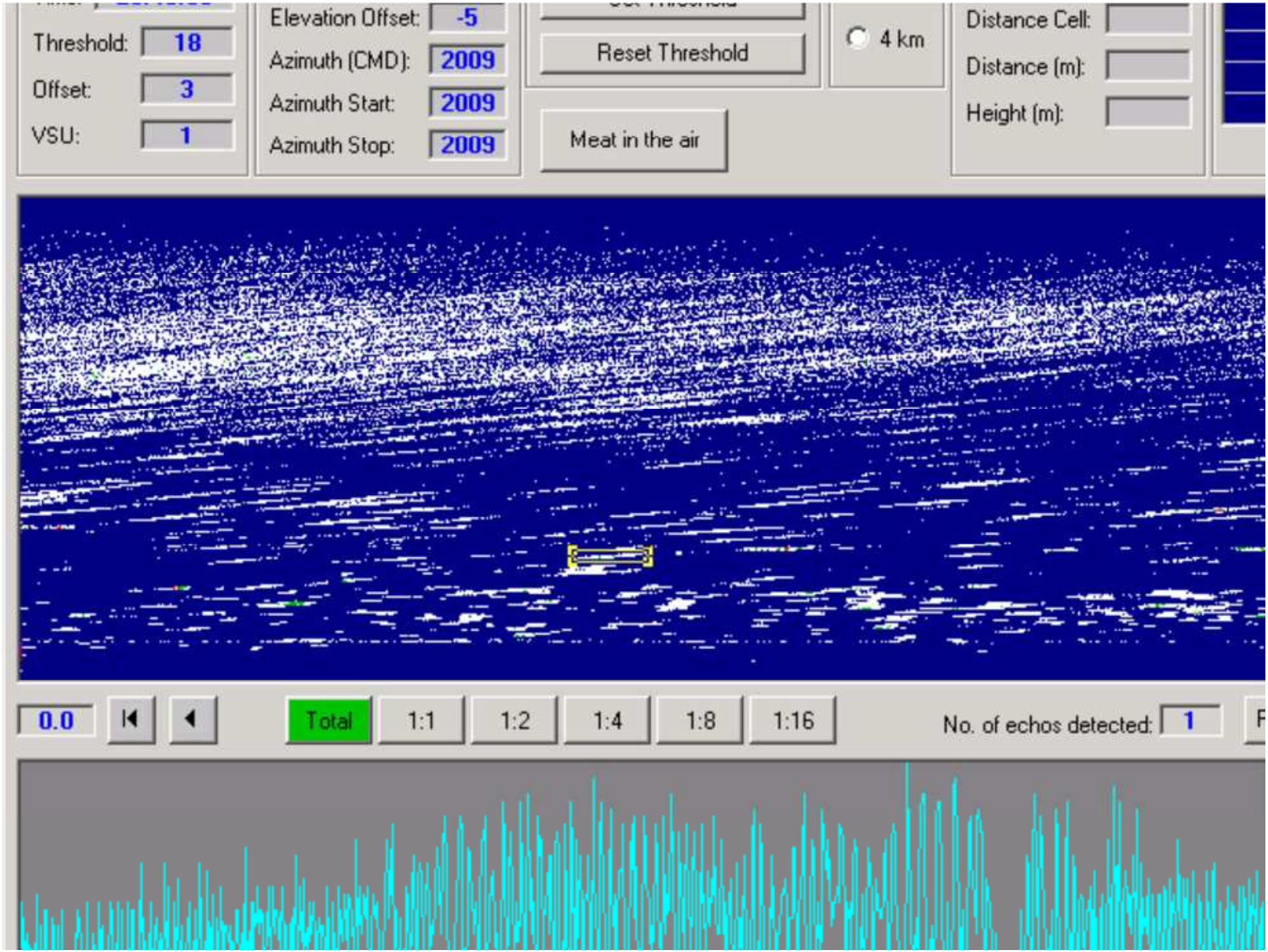
What is my sampling volume? (for this target)

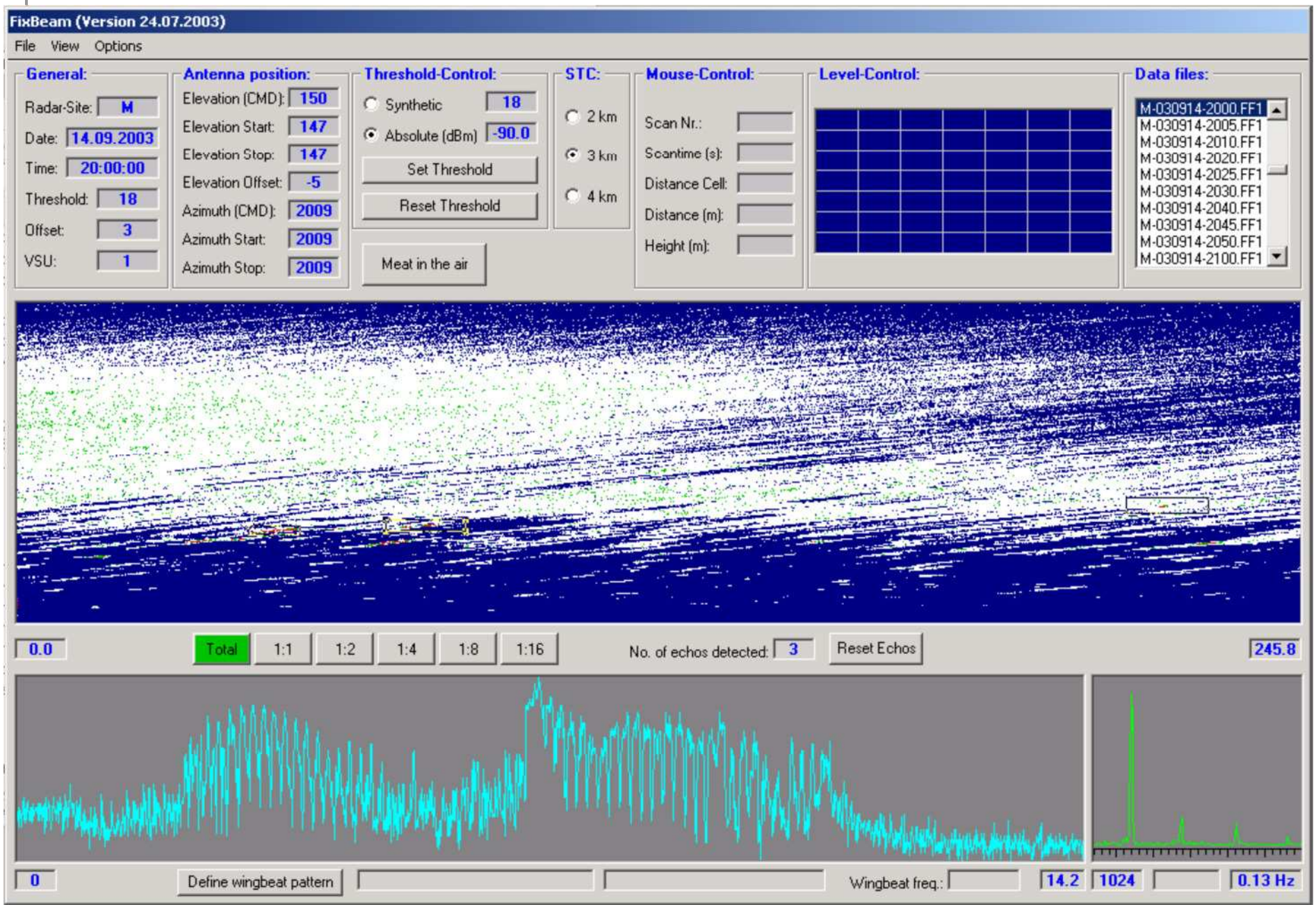


1. How to count targets?

1.1 Echo detection




Threshold: 18
Offset: 3
VSU: 1
Elevation Offset: -5
Azimuth (CMD): 2009
Azimuth Start: 2009
Azimuth Stop: 2009
Reset Threshold
Meat in the air
4 km
Distance Cell:
Distance (m):
Height (m):
0.0
Total
1:1
1:2
1:4
1:8
1:16
No. of echos detected: 1


FixBeam (Version 24.07.2003)
File View Options
General:
Radar-Site: M
Date: 14.09.2003
Time: 20:00:00
Threshold: 18
Offset: 3
VSU: 1
Antenna position:
Elevation (CMD): 150
Elevation Start: 147
Elevation Stop: 147
Elevation Offset: -5
Azimuth (CMD): 2009
Azimuth Start: 2009
Azimuth Stop: 2009
Threshold-Control:
Synthetic 18
Absolute (dBm) -90.0
Set Threshold
Reset Threshold
Meat in the air
STC:
2 km
3 km
4 km
Mouse-Control:
Scan Nr.:
Scantime (s):
Distance Cell:
Distance (m):
Height (m):
Level-Control:
Data files:
M-030914-2000.FF1
M-030914-2005.FF1
M-030914-2010.FF1
M-030914-2020.FF1
M-030914-2025.FF1
M-030914-2030.FF1
M-030914-2040.FF1
M-030914-2045.FF1
M-030914-2050.FF1
M-030914-2100.FF1
0.0
Total
1:1
1:2
1:4
1:8
1:16
No. of echos detected: 3
Reset Echos
245.8
0
Define wingbeat pattern
Wingbeat freq.:
14.2
1024
0.13 Hz

1. How to quantify movements?

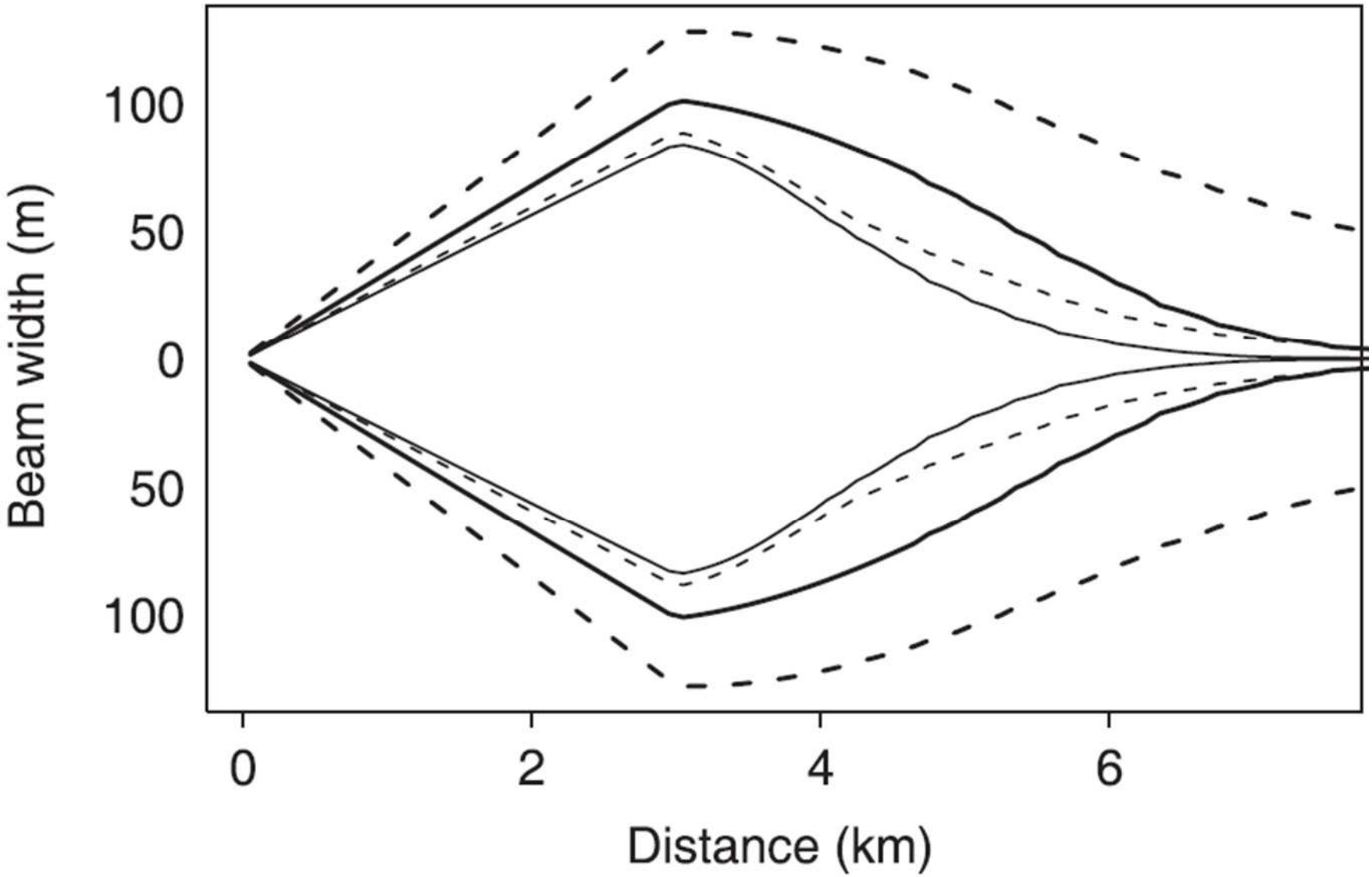
weather radar ➔ reflectivity per **volume**

dedicated bird radars ➔ targets per **volume**

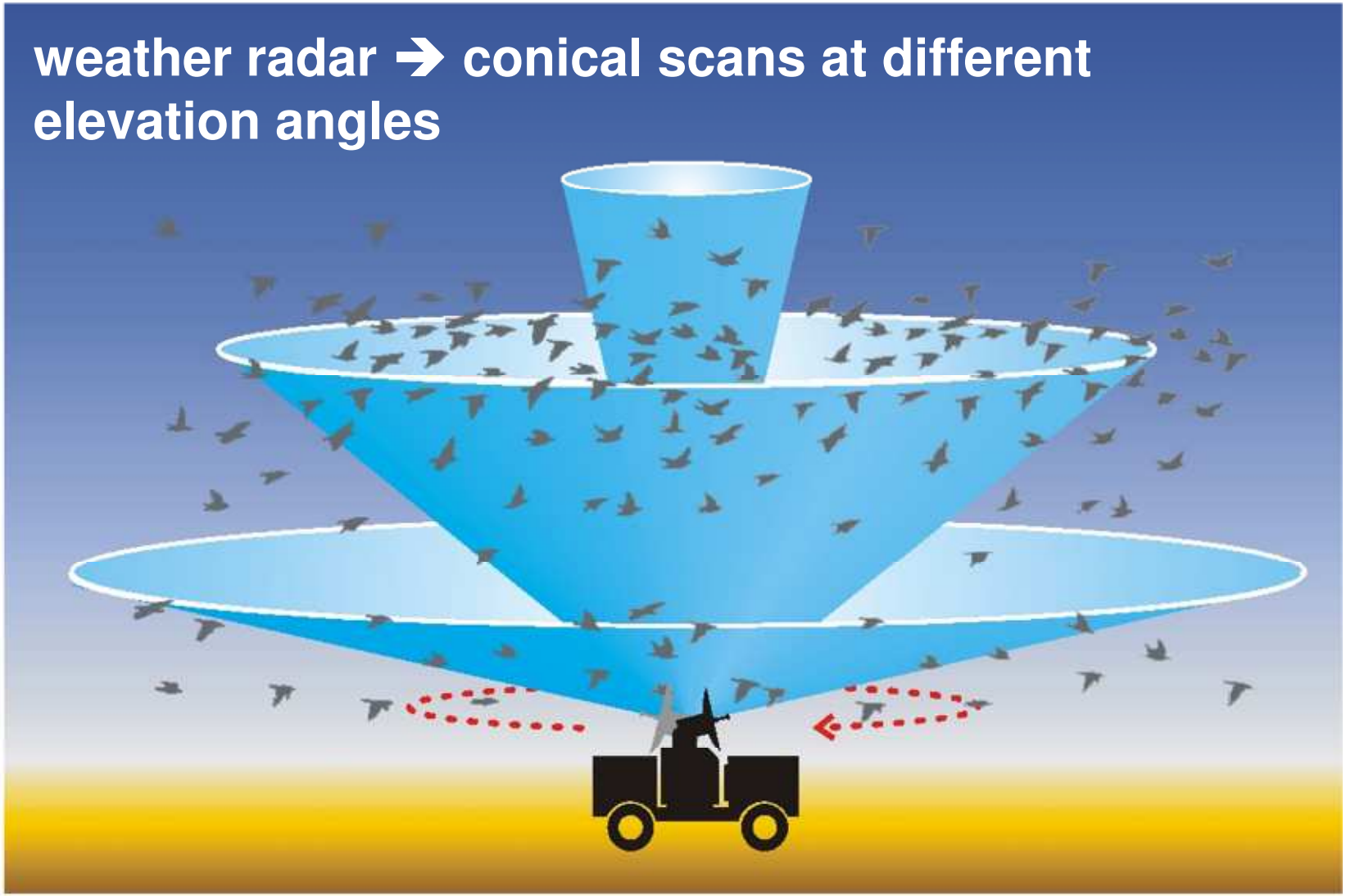
Scanned volume depends on:

- the antenna
- power output
- sensitivity
- target size (➔ RCS, aspect)

Example: operational beam width for different target sizes



Height distributions



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Birdradar

➔ static beam at different elevations

➔ conical scans at different elevation angles

Conical scanning:

- relative temporal pattern
- relative height distribution (vertical mode)

Potential shortcommings:

- partial ground clutter vs. direction of movement
- detection probability of different sized targets
- counting «false» targets
- ??

Static scanning:

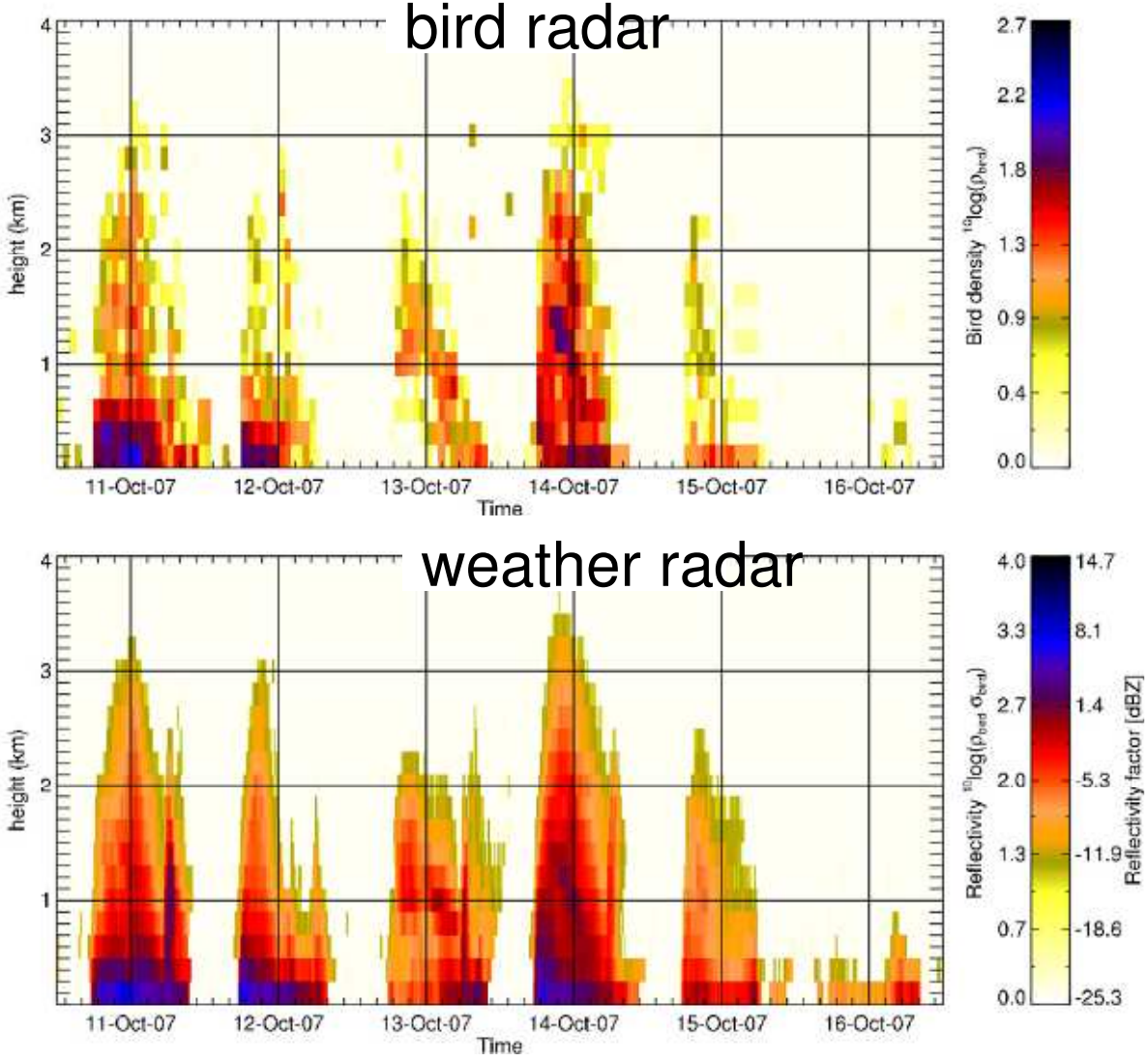
- «absolute» temporal pattern
- «absolute» height distribution

Potential shortcommings:

- direction of movement
- detection probability of different sized targets
- ??

Comparison of weather and bird radar

Temporal and height pattern



Dokter et al (2010). ***J R Soc Interface***

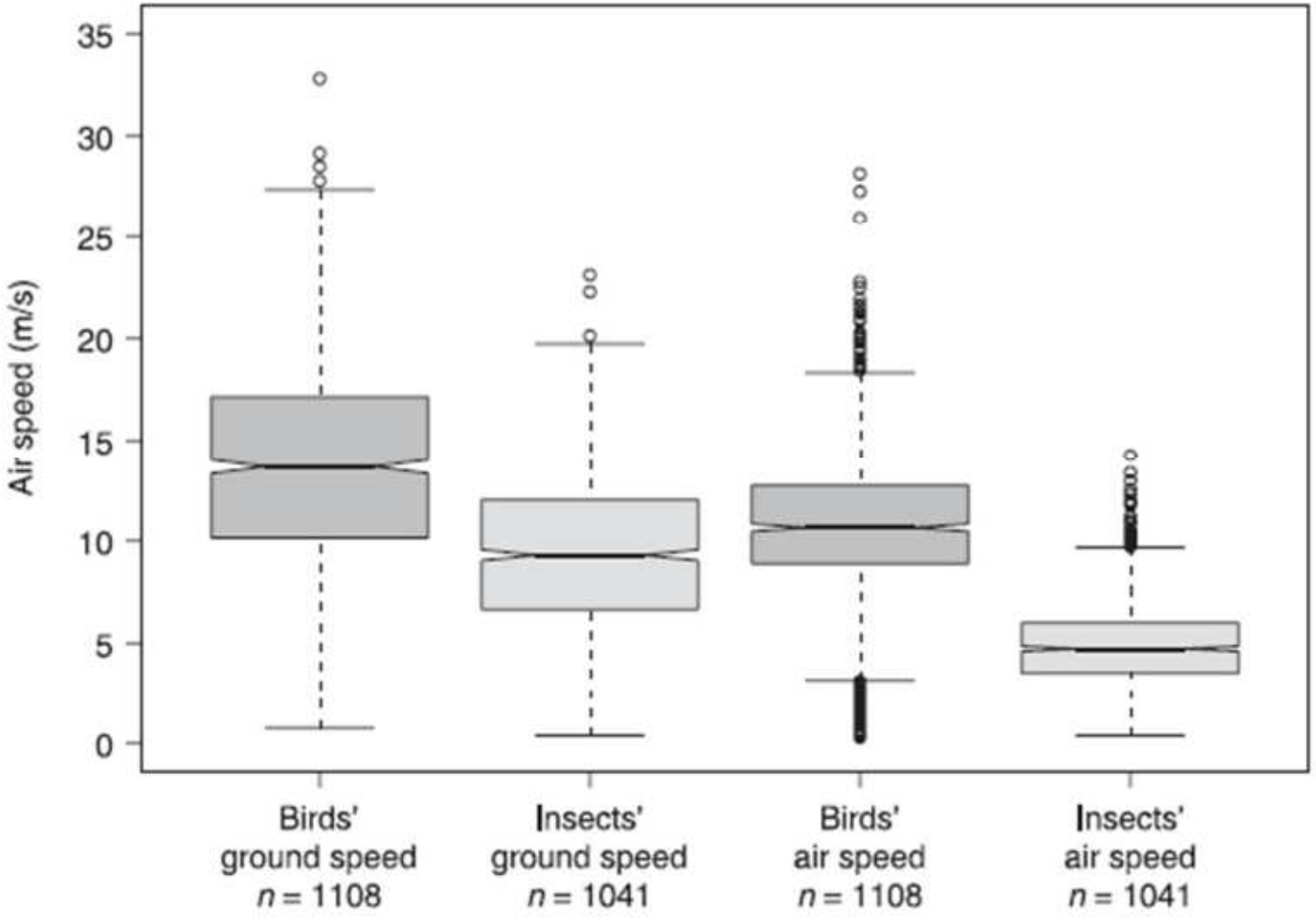
How to solve the problem of target identification

Target identification

Classification of single targets can be based on . . .

- Ground speed
- Air speed
- Echo size (reflecivity,)
- Variation in echo signature (e.g. polarisation, wingbeat pattern, etc.)
- Doppler?

Target identification



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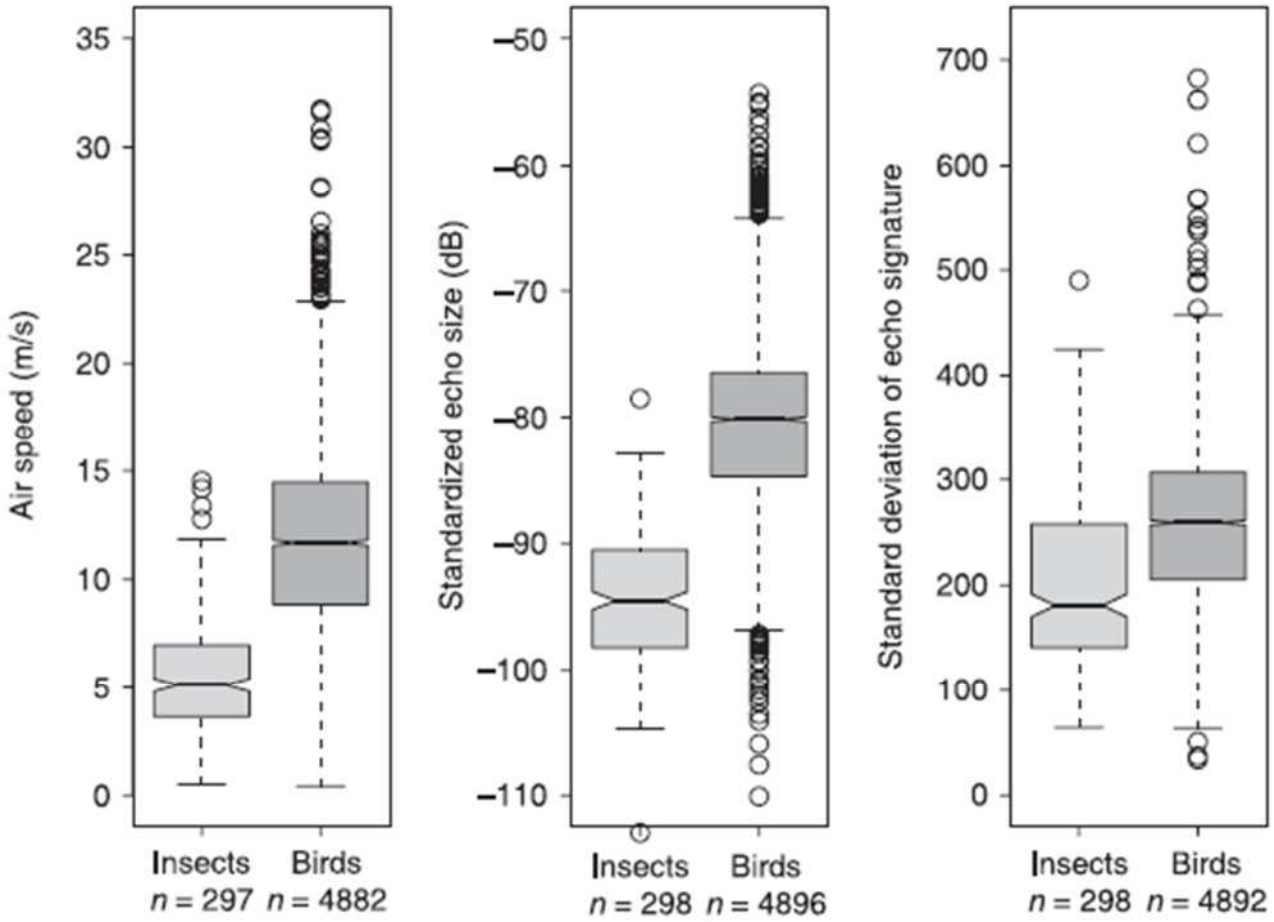
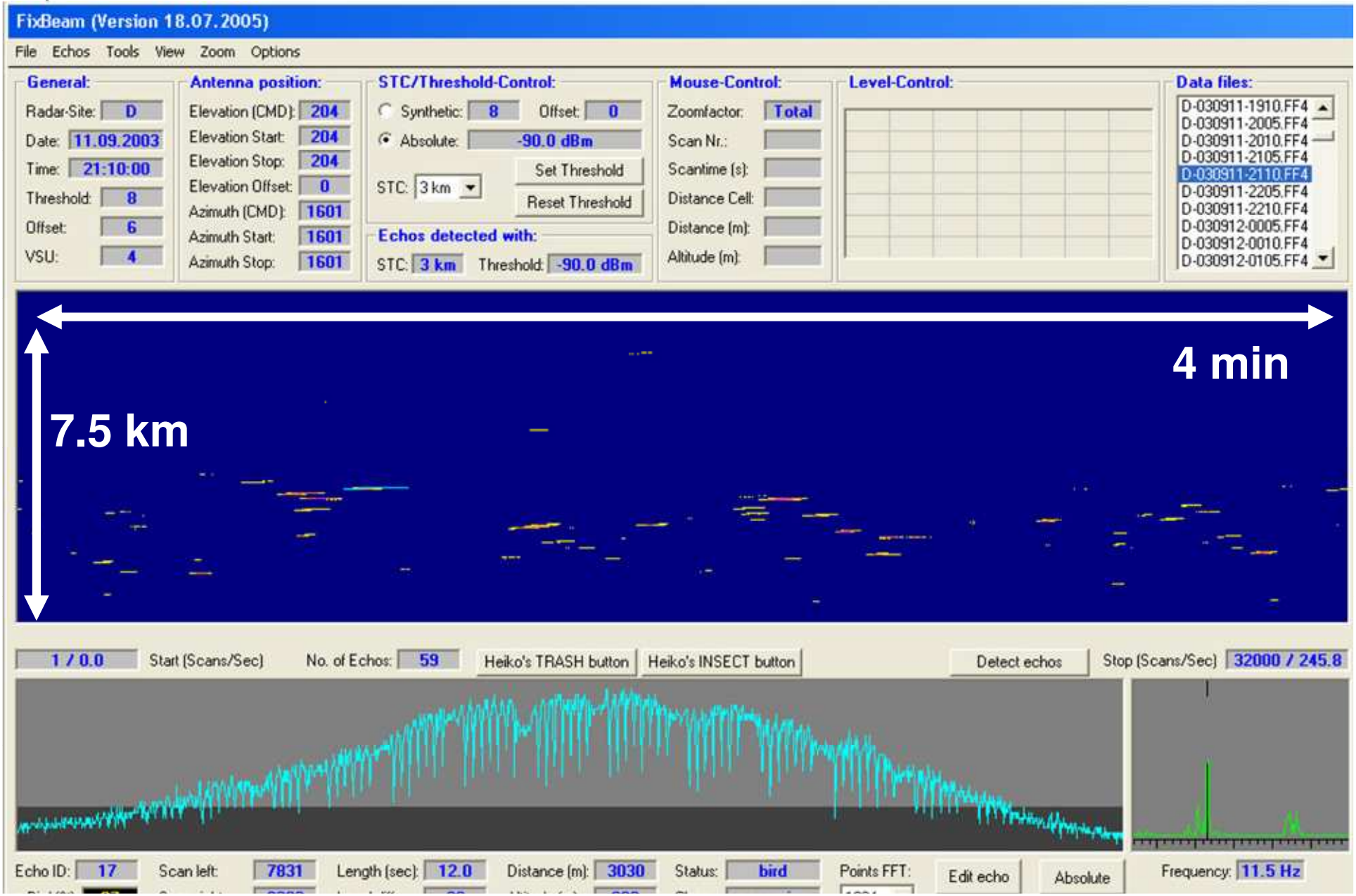
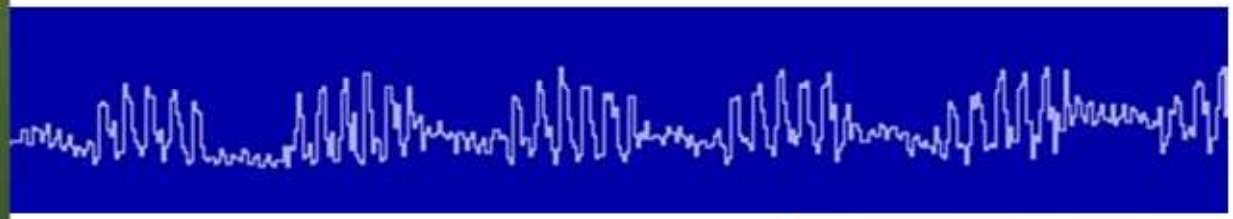
Target identification

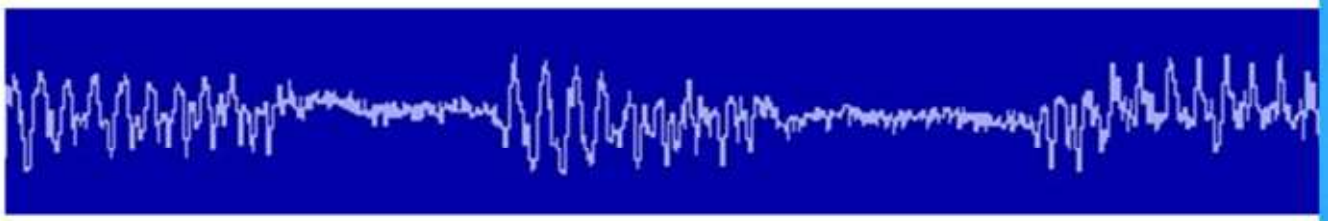


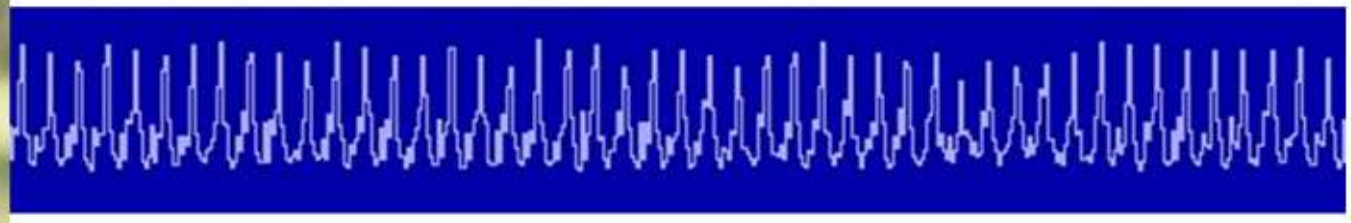
Echo signature



Echo classification







Echo classification – step by step

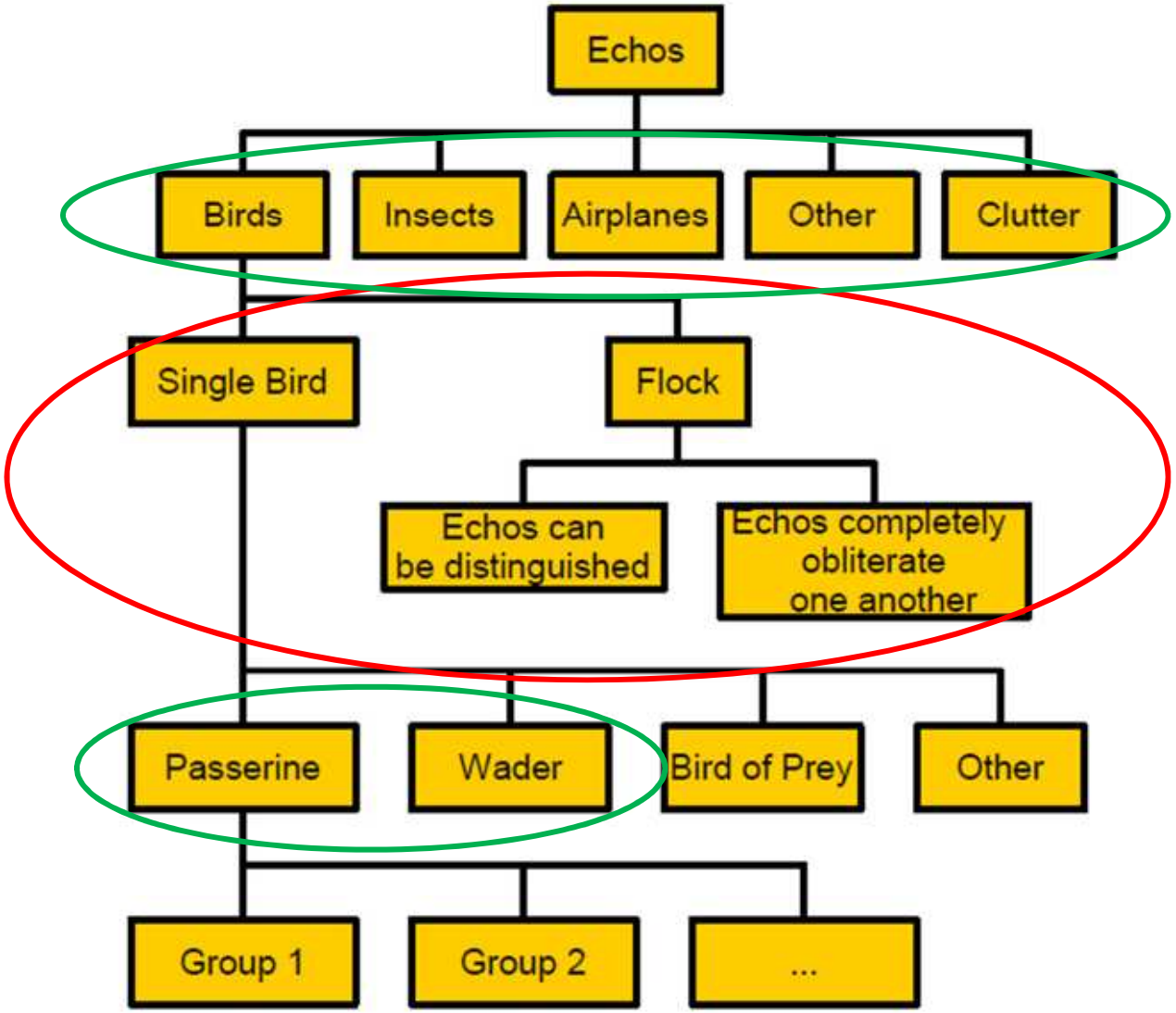
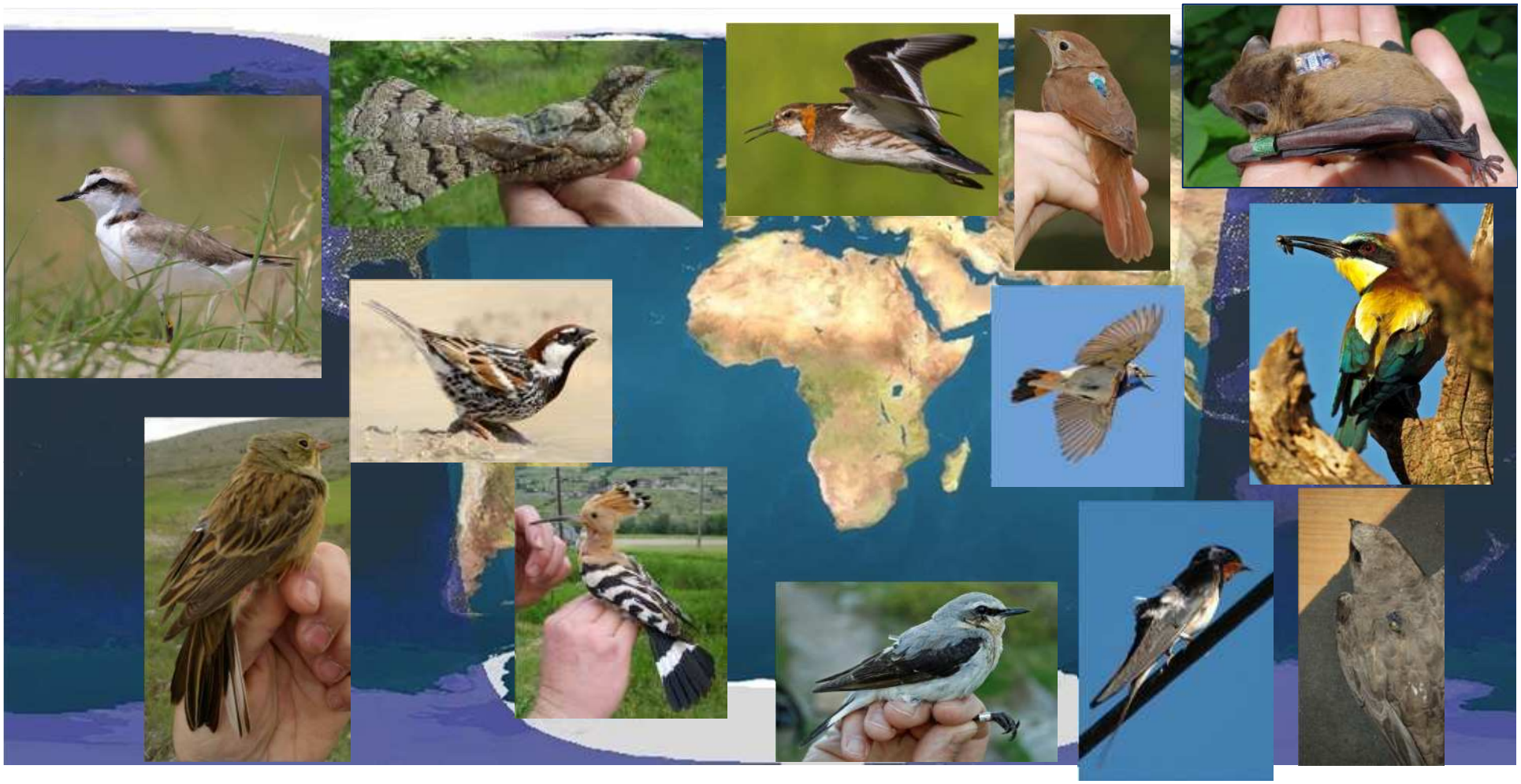


Illustration 1: Classification of Echos

vogelwarte.c..

Individual tracking

Single tracks recorded by satellite, GPS, Geolocator or anything else



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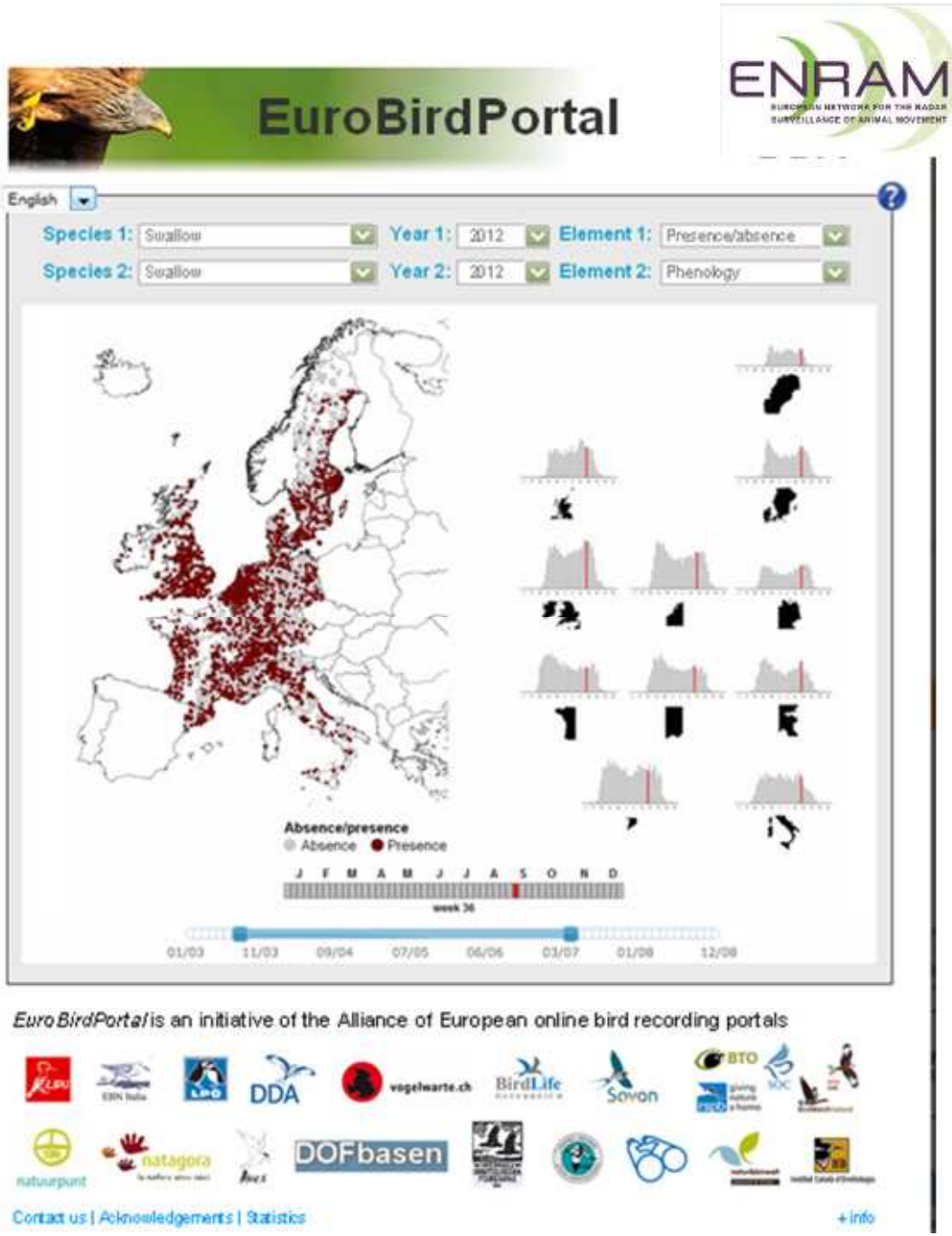
Ground truthing

Trapping
- constant effort sites
- seasonal trapping

Visual observations
- Regular mig. Counts
- Random counts

Other methods
- acoustic counts
- (laser?)



Discussion

- Which parameters can you collect easily with your radar?
- What is the expected overlap with a weather radar nearby?

- Which parameters will be compared between the systems?
  - Quantitative?

    MTR, absolute/relative, height, other?
  - Qualitative?

    birds vs non-birds vs insects?

    Large vs small birds vs flocks?

    Tracking of (known) single targets?

Effect of average target size on density estimate?

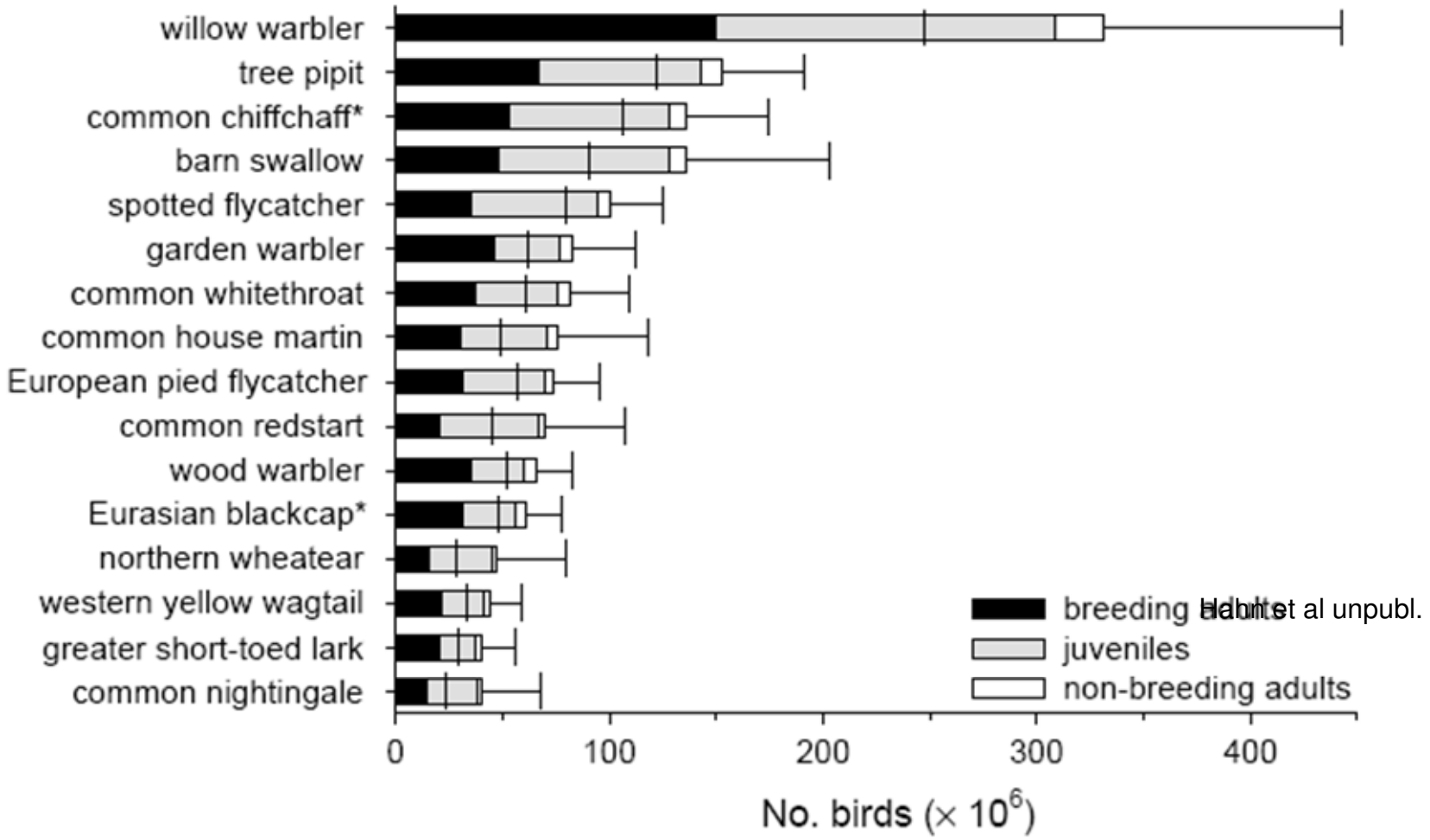
- RCS from Birdradars
- Ground truthing (mass species)

Effect of flight altitude? ➔ low level?

Minimum and maximum measures of densities?

Insects and birds in parallel?

Most bird species involved are small



Hahn et al unpubl.

Hahn et al. 2010