"Regards Croisés" sur l'Influenza aviaire

15-19 / 12 / 2008 • Montpellier • France

Rencontres scientifiques autour de deux projets de recherche :
Scientific meeting around two research projects:
GRIPAVI (CIRAD, MAEE) & ARDIGRIP (AIRD)

Importance of data (introduction to quantitative analysis) and expert opinion

Quantitative risk assessment

- Deterministic
- Stochastic

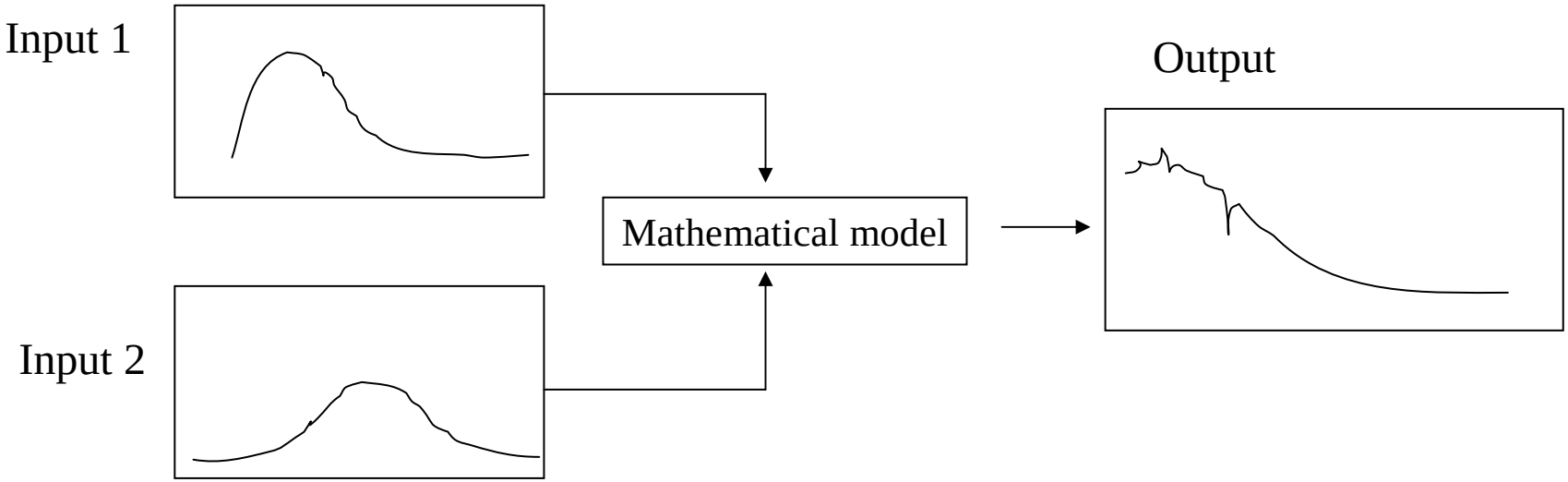
Deterministic modelling

- As well describe as « single point modelling »
- Using the « best guess » estimate to determine the model outcome
- « what if scenario » various combination for each input variable to estimate the variation of the real output

QRA modelling: the simulation

- Extension of « what if » testing Model inputs are specified as probability distributions
- Model is run for a number of « iteration », at each iteration each probability distribution is sampled in a manner which reproduces the distribution's shape.
- For each iteration the output estimate of risk is calculated
- The result is a probability distribution for the output estimate of risk.

QRA modelling: the simulation



There are two types of sampling method used commonly in simulation:

Monte Carlo - easiest method and the oldest one

Latine Hypercube – More recent, more efficient but lost interest when the model is very complex.

Deterministic ⇨ stochastic

Example:

Number of infected cattle (r) in a group of 100 (n) - CBPP prevalence is 1% (p)?

Deterministic	Stochastic
r=n x p=1animal	Binomial(100, 0.01)

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Importance of data

Objectives

- Risk analysis need quantitative data
- Quality of data and data processing are the main constraints for the use in risk analysis
- Make the accurate choices between different set of data often in contradiction.

Source of data

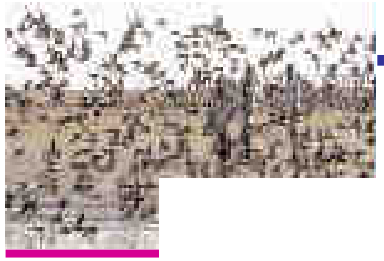
- Surveillance systems in national level
- Epidemiological surveys
- Commercial surveys
- Scientific publications
- Proceedings of congress or workshop
- Official report of government
- Data from exportation/importation and quarantine offices
- …

Data availability - limits

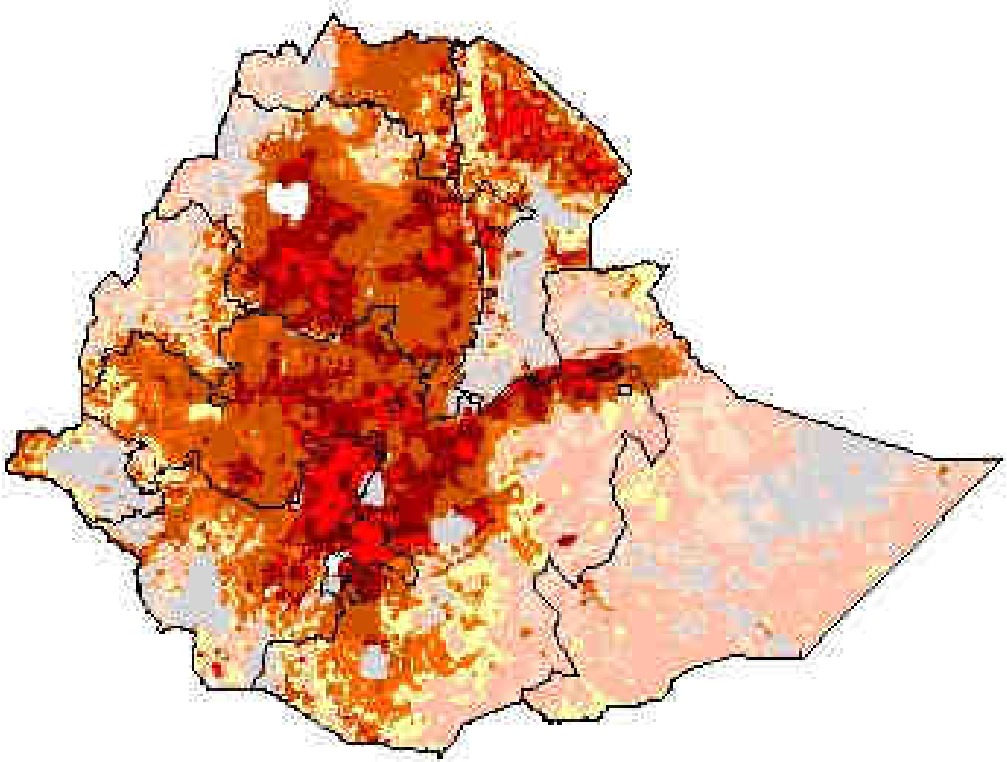
- **Data not collected or not distributed**
- **Not published or not officials**
- **Data confidential**
- **Not available in an useful format**
- **Not standardised in the methodology of collection or production**

Gathering of data

- Data and tools are becoming more and more available with scientific literature, internet …
- At international level FAO/WHO and OIE are centralising data and software for national application with as well guidelines:
  - Global Livestock Production and Health Atlas (GLiPHA) , FAOSTAT (FAOSTAT-Agriculture),WAHID (ancien Handistatus), SIST (Afrique)…
- The optimal use of these sources of information can help the implementation of Quantitative Risk Assessment even when data are limited.
- But be caution of the veracity of these data!!!

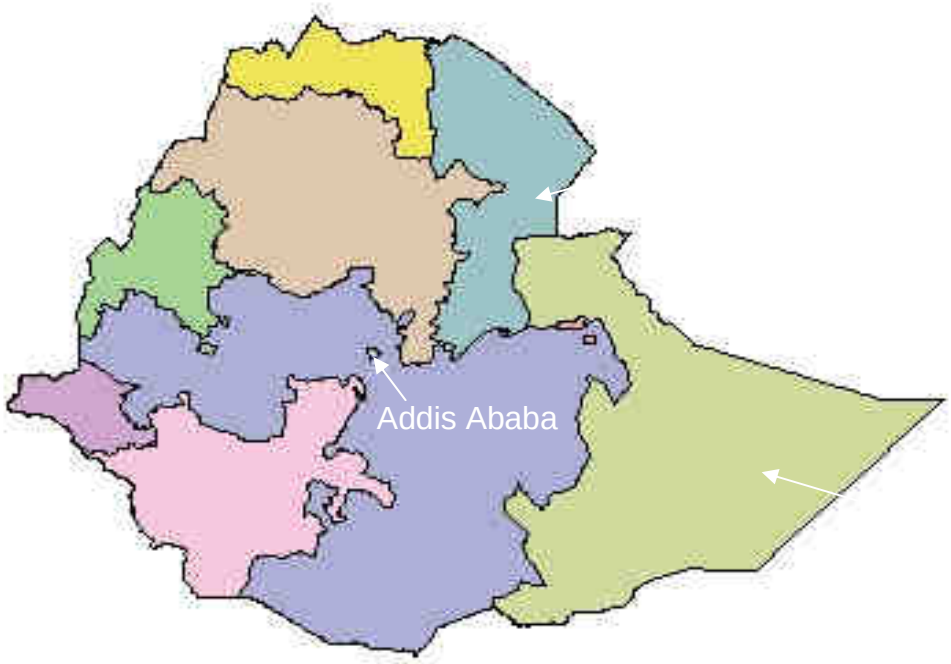


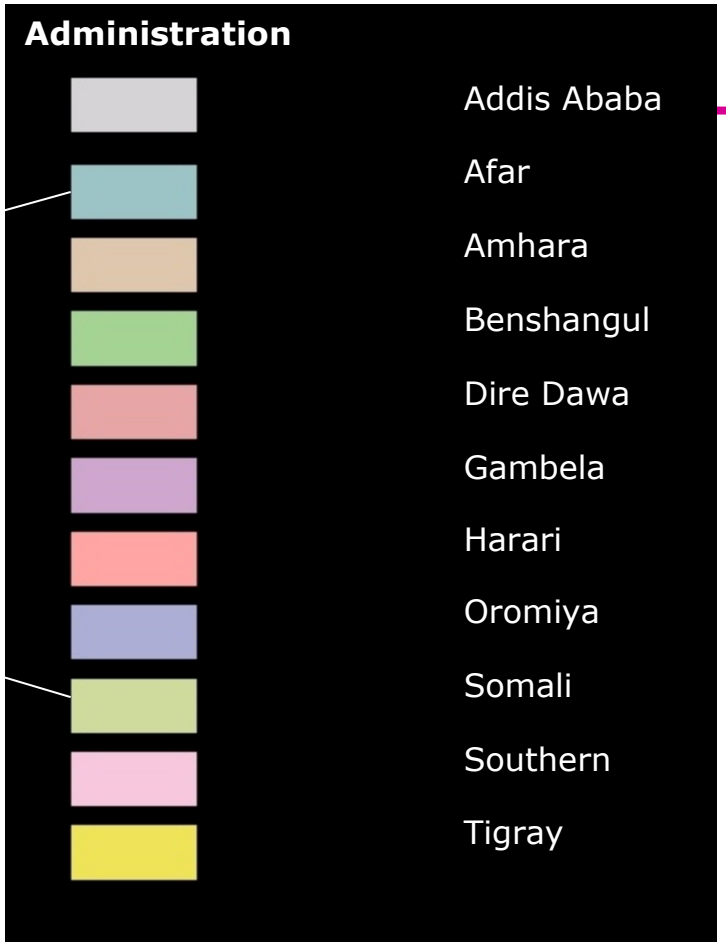
Total livestock population



Density of livestock bovine in Ethiopia

Total livestock population





Administrative divisions of Ethiopia

Etter et al., 2006: Data from Central Statistical Authority, Addis Ababa, dec. 2004
→Estimation for the Afar and Somali regions (conventional and aerial surveys)
→Extrapolation from 2001/2002 data for urban livestock populations

Total livestock population

Etter et al., 2006: Data from Central Statistical Authority, Addis Ababa, dec. 2004
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Résultats :

- densité de la région Afar = 38 bv/km^2
- densité de la région Somali = 3bv/km^2

Données FAO (2000)

- densité de la région Afar = 4.4 bv/km2
- densité de la région Somali = 1.2bv/km2

Risk Assessment needs distribution

In quantitative analysis we are using distributions of variability and uncertainty.

Reporting are often incomplete with only partial data :

- Only means are available
- Sometime confidence intervals but with no explanation on the statistical analysis used ($m \pm s$; $m \pm 1.96s$; $m \pm 1.96s/\sqrt{n}$)

To overcome these gaps :

- Try to calculate distribution from the data previously collected
- Often necessary to do again the statistical analysis
- Try to find original data set or contacting the person who conducted the analysis.

Risk Assessment needs distribution

Example 1:

- A study on FVR was carried on, one activity was the capture of Aedes species: 8 traps were set up around a a pond and mosquitoes were collected after one night (after a long period without rain).
- We do the same study around 10 different ponds.
- We are repeating the study 5 days after an heavy rain.
- We are collecting the following results (see table)
- The data give us the vector distribution before and after a rain.
- Conclusion : period of rain is increasing the presence of vector

Pond	Mean Log_{10} of Aedes counting	
	Dry period'	After rain
1	0	3.7013089
2	2.5774918	2.8095597
3	0	3.0326188
4	2.30103	3.4895366
5	3.63367041	3.9037409
6	3.03622954	3.8473876
7	2.70070372	3.4742163
8	1.79934055	2.9943172
9	2.36921586	3.2711443
10	0	2.8312297
Mean±ET	1.84±1.29	3.34±0.39

Risk Assessment needs distribution

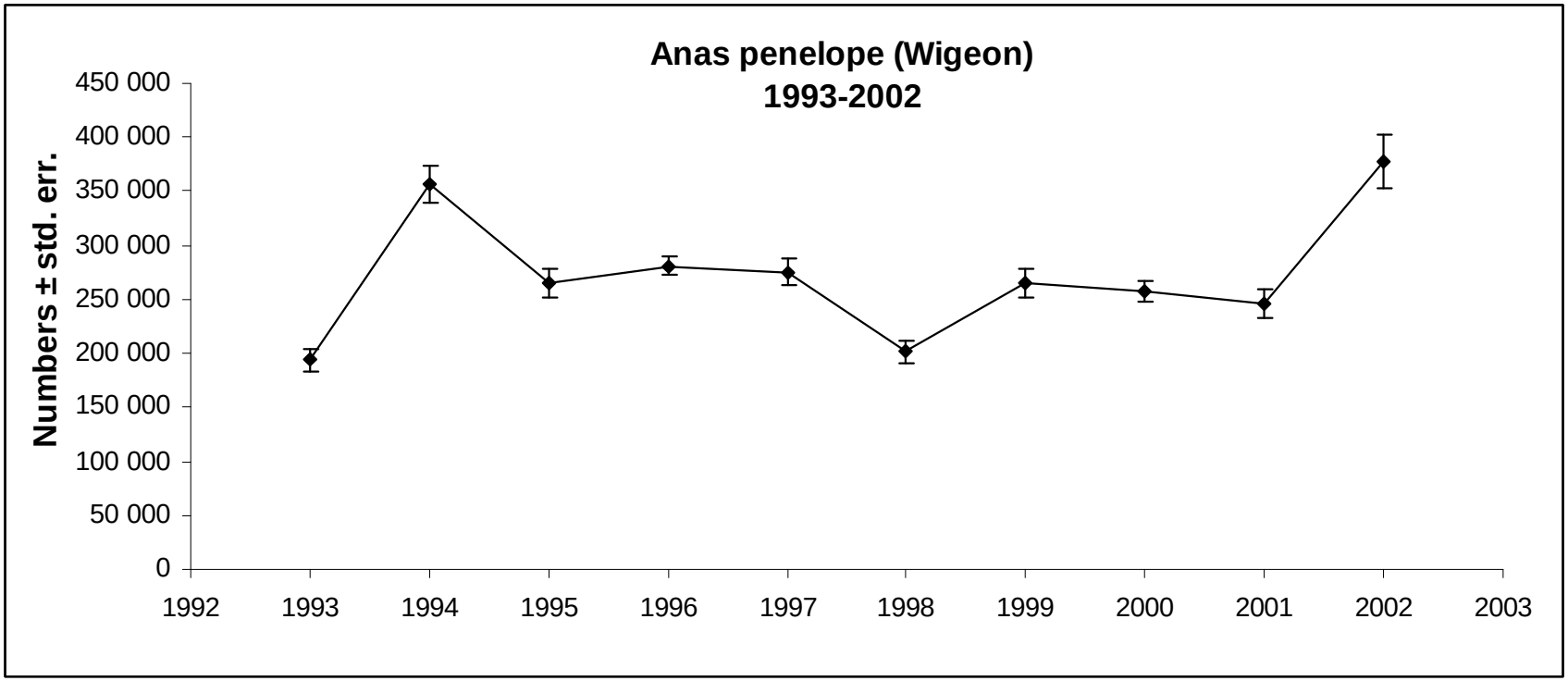
Number of sites :	381
Number of years :	10
Number of observed zero counts :	778
Number of observed positive counts :	2008
Number of missing counts :	1024

Year	Count	std. error
1993	193 792	11 114
1994	357 067	16 908
1995	265 441	13 074
1996	281 048	8 209
1997	274 679	12 488
1998	201 239	11 224
1999	265 783	13 543
2000	256 726	9 303
2001	245 721	13 988
2002	377 125	25 223

Population of Eurasian Wigeon *Anas penelope* in West Mediterranean region

(http://www.wetlands.org/publication.aspx?id=6a62403b-3992-4554-aeb9-1f6f96fac28b)

Risk Assessment needs distribution



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Quality of data

In reports and scientific papers :

- Unknown about the uncertainty of the method used
- Misleading interpretation or representation of results
- Use of inappropriate methods

So during risk assessment we need to:

- To confirm methodology used and assessing consequences on data interpretation
- To involve statisticians when new analysis are needed
- Sometimes to propose new surveys in order to collect better data.

Quality of data

Examples:

- Movement of animals with several times the same name of villages (with no geographic localisation)
- Or same geographic location with different spelling
- Uncertainty from test (Se, Sp), correction for the true prevalence
- Using statitistical test which are not relevant for small population size (if <30)

Selecting data between contradictory data set

Example:

- Study done with vets on the phone:

Q: On which proportion of farmers reporting respiratory symptoms in their poultry are you advising to do a post-mortem and to take samples?

R: 89% in average.

- Case-control study. Farmers with poultry reporting respratory symptoms.

Q: Did receive advice for post-mortem and samples collection?

R: 22%

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Experts Opinion

What is ‘expert opinion’ (1)

- best guess
  - if you have data, use it instead
- expert
  - what makes an expert?
- about something
  - used with models of all descriptions, but not restricted to quantitative estimation
    - law, on any topic
    - OIE – disease status determination

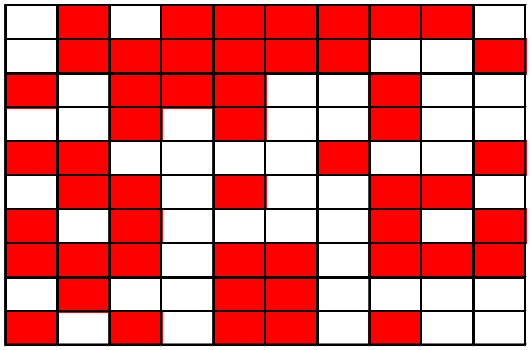
What is ‘expert opinion’? (2)

- source of information for quantifying model parameters and variables
- used when
  - data has not been collected
  - too expensive to obtain data
  - existing data no longer relevant
  - data are sparse
  - new area of investigation – no data

Constraints of using experts opinion

- Relying only on memory
- Difficult to remove personal bias Difference of experts' quality
- Political issues
- Don't like extreme values
- Think that uncertainty is not admitted
- Express what they think we are waiting for
- Sparse events?

Risk estimation



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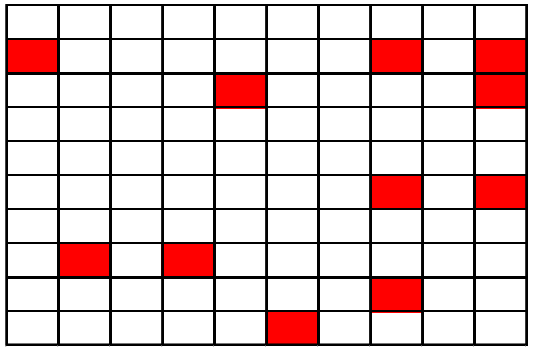

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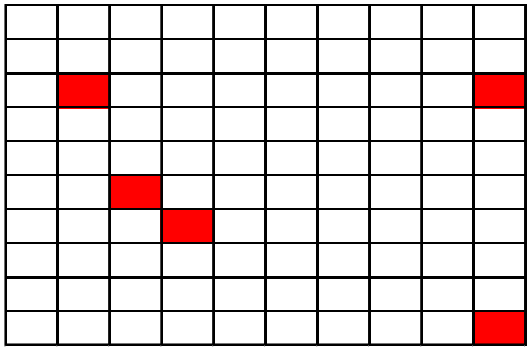

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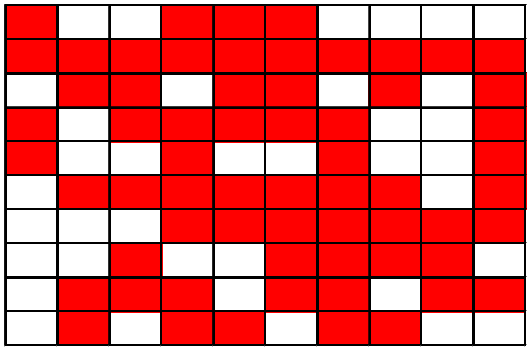

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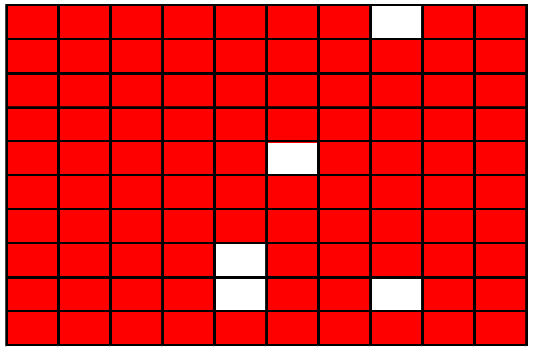

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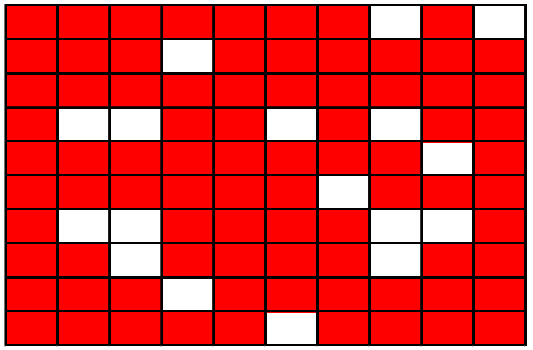

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Experts and their opinions

Expert's opinion needs to be:

- credible
- transparent
- science-based
- justifiable

So the expert must be

- experienced
- recognised

And a group of experts *(collective noun = ?)*

- diverse
- representative
- numerous?

Expert selection

- objective, defensible
- criteria defined, stated in methodology
- number of experts sought
  - analogous to sample size determination
  - factors to consider
    - precision of estimate required
    - variability in the field/area
    - consequences of getting it wrong
- selection process outlined
- reasons for selection/rejection of candidates

Size of expert panel

- The size of the panel depends on:

1) the type of problem for which expert judgment is being elicited;

2) the nature and degree of uncertainty about the problem;

3) the range of relevant expertise needed to assess the problem.

- The narrower the task and the more defined the nature and extent of uncertainty, the narrower is the required the range of expertise. In such circumstances a small expert panel is adequate.
- Expert elicitations usually rely on relatively small expert panels, typically fewer than a dozen respondents

Describing the opinion

- ‘best guess’ implies uncertainty which needs to be captured in the description of the opinion
- parameter estimation
  - incorporate expert’s lack of knowledge about the true value into a probability distribution
- variable estimation
  - randomness of the variable being estimated
  - expert’s lack of knowledge about the parameters that describe that variability

Eliciting opinion from your expert[a]

- discuss available data
- look at ways of presenting data for greater ease of interpretation
- use familiar terms
  - min, most likely, max (not mean)
- ask order: max, min, most likely
- use units that expert prefers and convert later

[a] Adapted from Vose

Coping with more than one expert

- introduces two complications
  - variability between experts
  - your uncertainty about how to deal with it.
- behavioural approach
  - panel of experts define a single probability distribution representing their consensus
- mathematical approach
  - variety of approaches
  - six elegantly illustrated by KDC Stärk (2000)

Behavioural approaches

- everyone needs the same information pertinent to the problem, then debate the uncertainties
- control of group dynamics is crucial
  - overwhelming personalities
  - flock effect (clustering of estimates)
- if agreement cannot be reached, may need to proceed to mathematical approaches

Analysis and aggregation

- Much of the literature on expert elicitation focuses on how to aggregate expert judgment to achieve a reliable consensus on parameters or distributions of interest.
- Two approaches:
  - Delphi processes are a widely used behavioural approach to aggregation that use highly structured, iterative group processes to reach consensus among experts.
  - Several alternative means of aggregating expert judgment through weighting expert judgments have been developed.
  - Depending on the purpose of the elicitation, aggregation may not be appropriate. In many expert elicitations, the range of expert opinion may be at least as valuable as the aggregate assessment (Keith 1996).

Delphi Method

- The Delphi Method is a procedure for arriving at a group decision or set of opinions which does not involve a face-to-face meeting but where the group members respond to a written questionnaire survey in several rounds.

Example:
In a questionnaire on bird flu, you could have answered the following.

Consider 10 chickens from backyard farms. These animals have contact with a chicken from a neighbouring farm, infected with Avian Influenza. How many of these 10 chickens become infected with bird flu?

Minimum number of chickens	Maximum number of chickens	Most likely number of chickens
7	10	9

Confidence in your answer	Indicate, using a number from 1 to 5, how confident you are in your answer (1=not confident; 5=very confident)	4

From S. Costard (2006, RVC)

Example

- Poultry population in Ethiopia:
  - Best estimate?
  - Experts: Max, min, most likely

31 Millions 2004/2005 from CSA

Thank you

- Acknowledgements:
  - Agnes Waret
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