

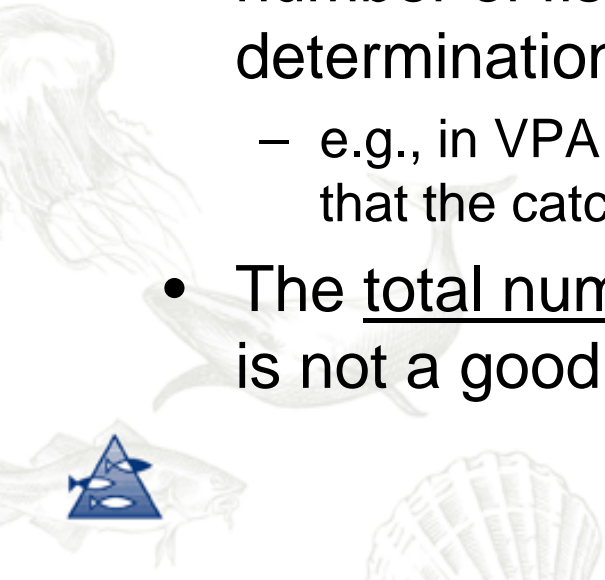
# Practical Implementation of Statistically Sound Catch Sampling Programs in ICES

Chaired by

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# Background

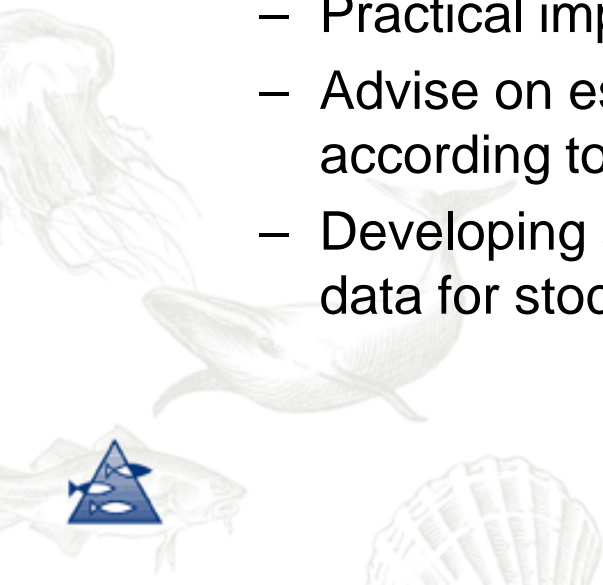
- Historically, many at sea observer and onshore sampling programs in Europe were designed ad-hoc, e.g. setting quota of samples by métiers, which can cause bias.
- For data going into stock assessments it has often been assumed that the quality is good when a large number of fish has been sampled for length and age determination
  - e.g., in VPA based assessments it has typically been assumed that the catch-at-age is estimated without sampling errors
- The total number of fish measured for length and aged is not a good quality measure in itself



# WKPICS Workshops

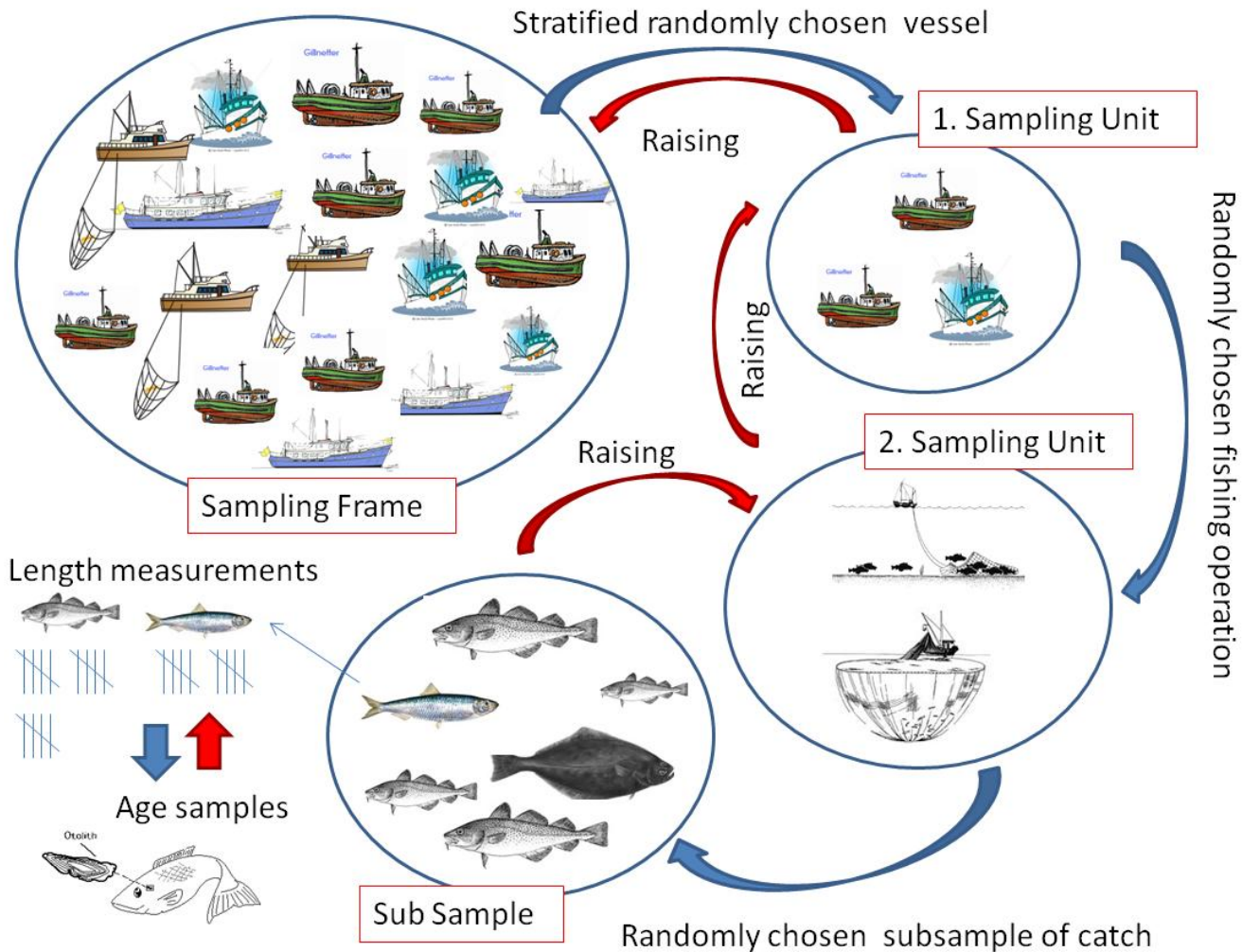
2011-2013

- This series of workshops, along with WKPIDS, was initiated by the ICES Planning Group (PGCCDBS) to improve the design, practical implementation, and documentation of catch sampling programs to standardize processes and assure the quality of catch data. This included:
  - Developing sampling design guidelines
  - Practical implementation of statistically sound programs
  - Advise on estimators for extrapolating sample data according to the sampling design
  - Developing a quality assurance framework for improving data for stock assessment and management advice

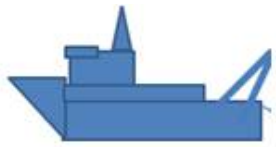


# Multi-stage cluster-sampling is the norm

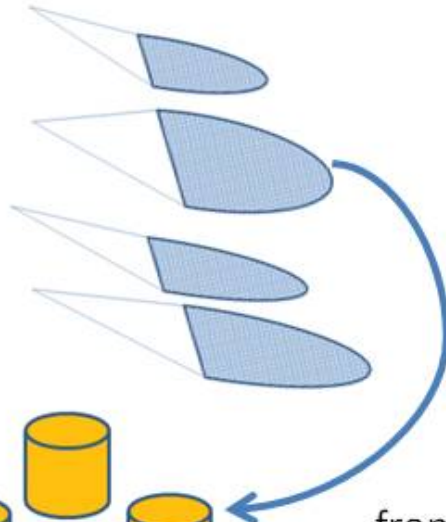
A small sub-sample of fish from many trips is better than many fish from few trips



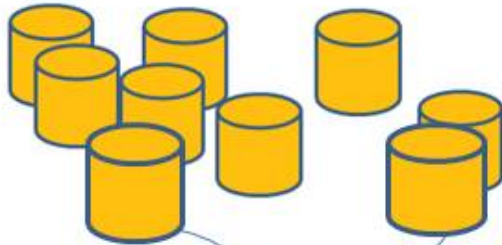
# At-sea sampling



A single fishing trip may have...



$h$  hauls some or all of which are sampled



from which there are  $B$  total discards in baskets...

from which  $b$  sampled baskets are picked at random.



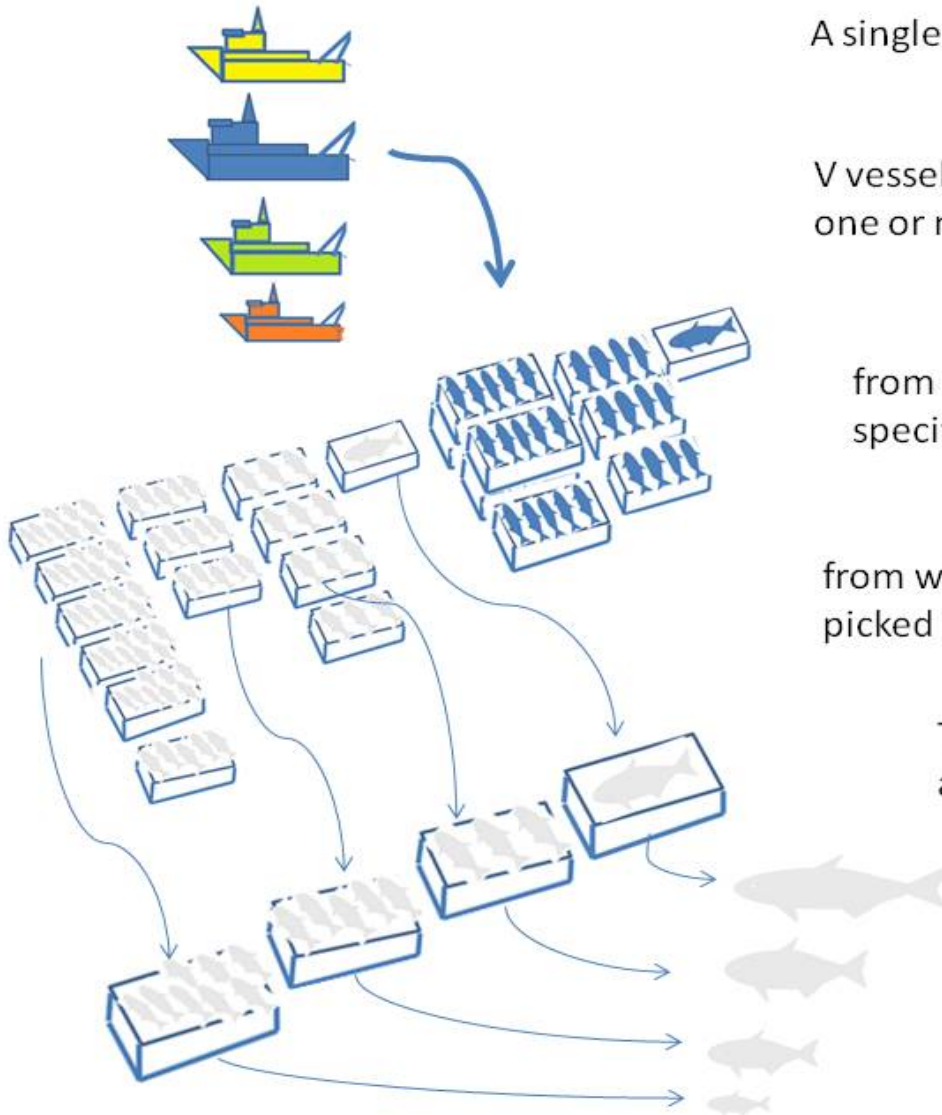
The baskets have  $F$  fish of species  $S$   
some or all of which may be measured...



and from which  $f$  fish have age  
samples collected.



# Port sampling



A single visit to a port may have...

$V$  vessels landing catches of which one or more is picked at random....

from which there are  $B$  boxes of species specific size categories ...

from which  $b$  sampled boxes are picked at random.

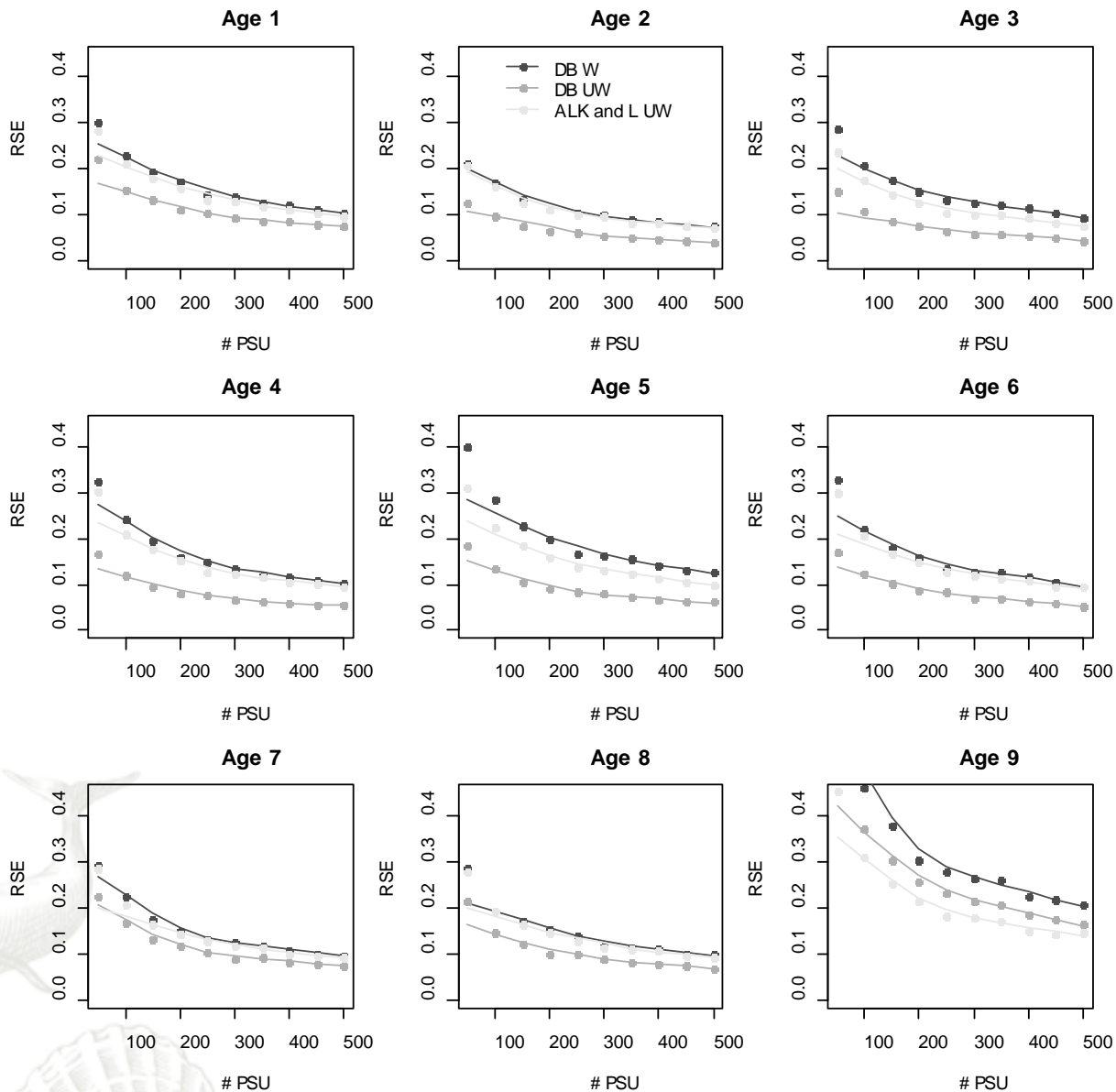
The boxes have  $F$  fish some or all of which may be measured...

and from which  $f$  fish have age samples collected.



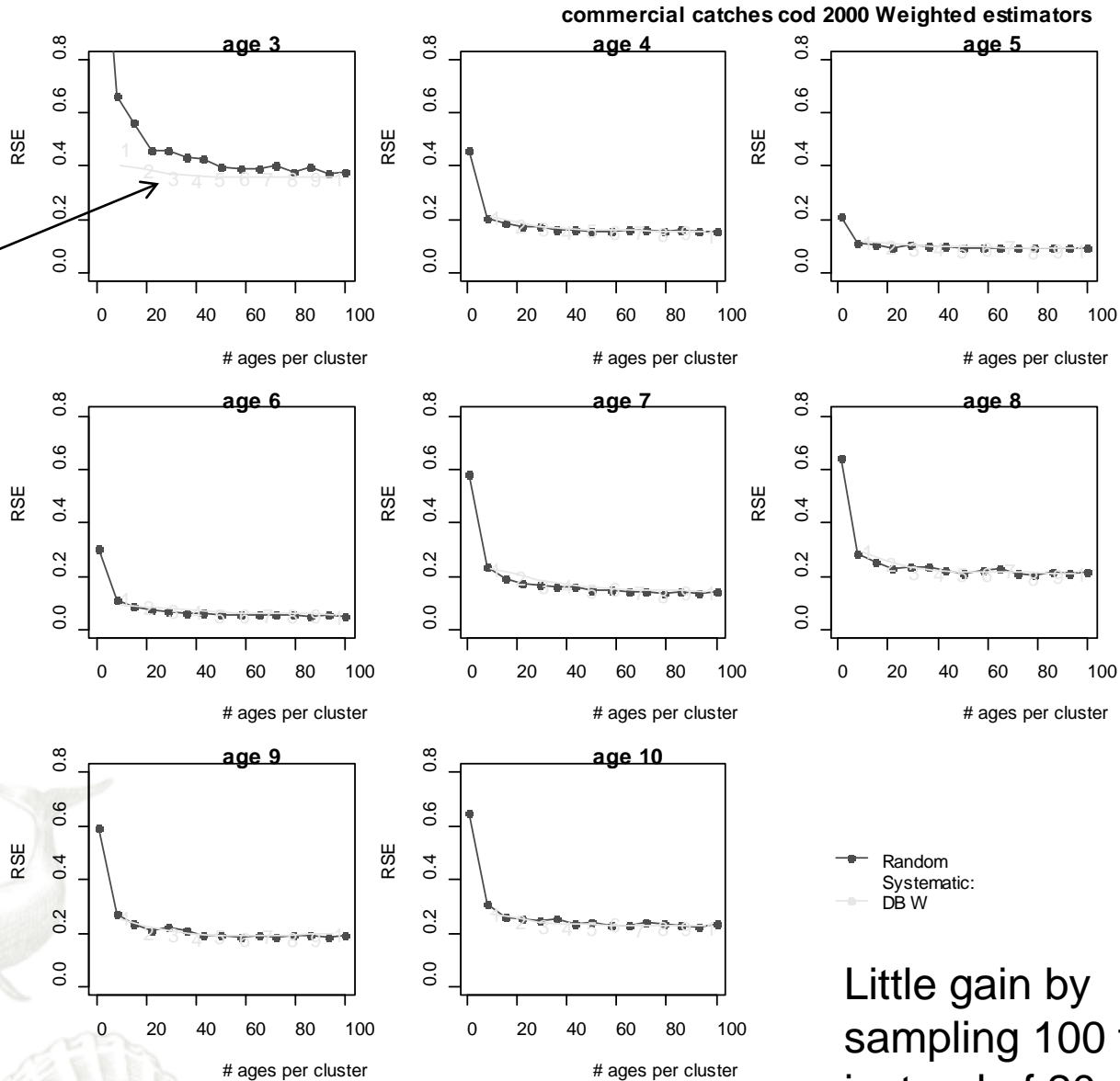
# # Trips or hauls sampled drive the precision in age-composition

Example from Barents survey, NEA Cod



# # otoliths subsampled from each catch (PSU) has less effect on precision

Simulated length stratified sampling, 1-10 ages per 5cm length class



Little gain by sampling 100 fish instead of 20



# WKPICS has developed guidelines for sound catch sampling programs

## Achievements include:

- Detailing “best practice” that covers the design, implementation and analysis stages of catch sampling schemes.
- Outlining four classes of probability based sampling schemes with examples of sampling units and stratification for multiple stages
  - Many EU countries have tested these designs through case studies, where methods for data “raising” and precision estimates are documented
- Providing advice on appropriate data quality indicators
- Reviewing the regional approach and the optimization of national sampling schemes to meet regional goals.



Principal design classes for at sea and on-shore commercial catch sampling. The primary sampling units may be sub-sampled in multiple stages, using simple random, stratified random, or systematic sampling.

Design class	Sampling frame of <i>PSUs</i>	Comment, example	Examples of stratification of <i>PSUs</i>	Case study
A	Vessel*time	Sample a number of <u>trips</u> or fishing operations across all vessels. In the analysis, trips or fishing operations are treated as <i>PSUs</i>	Vessel-characteristics (gear, length), quarter	NL case study Skagerrak regional case study NOR case studies
B	Vessels	Sample a group of <u>vessels</u> Special case: If all vessels are sampled, each vessel is effectively a stratum, and trips are sampled over time from each vessel	Fleets (offshore/coastal), gear, target fishery	NOR case study
C	Sites * time	Random sample of <u>port-days</u>	Geographic (markets), Quarter	SE case study
D	Sites	Sample a group of <u>ports</u> Special case: If all ports are sampled, each port is effectively a stratum, and vessels/trips are sampled over time from each port	Geographic, quarter, effort, or landings at the sites	ES case studies Scottish case study



# Conclusions

- Using case studies the WKPICS has been able to
  - demonstrate the practical issues in trying to implement the probability based approach
  - provide guidelines and standards which allow countries to optimize their resources to provide quality assured harmonized data.
- Many countries have gradually improved their programs based on these workshops
  - Move away from “quota sampling” that specify numbers of fishing trips or fish to sample within dynamic fleet activities (e.g. by métiers)
  - The design-based approach has been adopted by EU DCF
- But this process is not finished yet and the baton will be picked up by ICES WGCATCH.



# Thanks

- To all the dedicated scientists that have participated in the ICES effort over many years to improve the quality and efficiency of commercial catch-sampling programs
- To Marie Storr-Paulsen and Alistair Pout for illustrations of sampling designs

