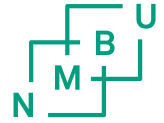# Optimal Contribution Selection in Breeding Schemes with Multiple Selection Stages
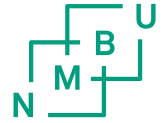
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Background

- Management of inbreeding is vital because
  - Decline in fitness
  - Decline in genetic variation

- Key to animal breeding:
  - balance inbreeding vs genetic gain
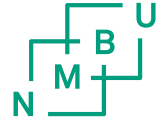 - Optimal Contribution (OC) selection

Background

- But OC selection assumes
  - one (final) selection step of parents

- In practice : often pre-selection steps
  - account for consideration of relationship in final step

AIM

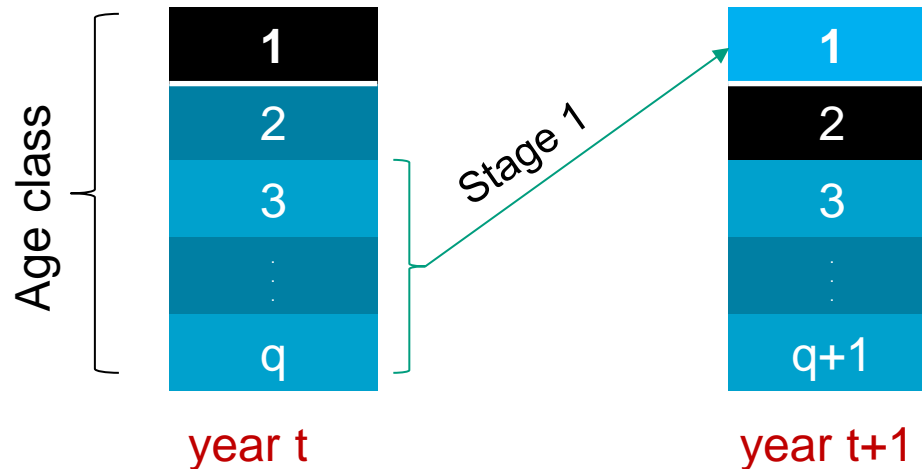- Extend OC towards several selection stage

How?

- use OC selection at each stage?
  - But what ΔF (restriction) to use?


- Solution: simultaneously optimize all stages

OC selection & overlapp. gens

–Split population in q age classes (years)

–Control aver. relations & max gain in year t+1

- Years 1..q simply get one year older: 2..q+1
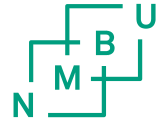- Year 1 is defined by selection of parents => **optimise**

Several selection steps

- Optimise all selection stages same time:
  - Some age_classes just become 1 year older
  - Some age classes involve a selection stage
  - Relationships of entire population are contrained
  - Gain of entire population is maximised
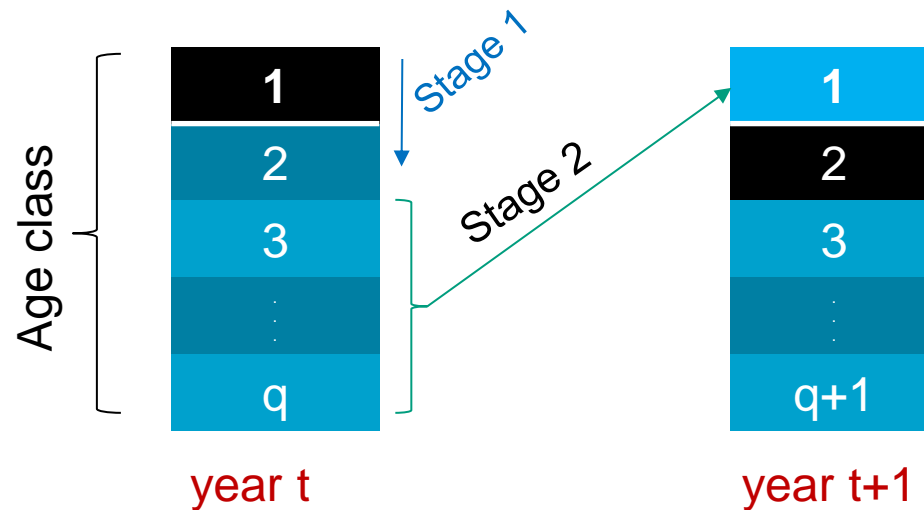
Result: simulation (mimic sheep selection)

- **Dataset**
  - # of candidates
    - Stage 1: 500
    - Stage 2: 33

- **Case 1:**
  - **Stage 1: truncation**
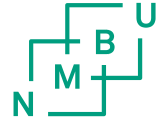 - **Stage 2: single stage OC selection**

- **Case 2:**
  - **Multi-stage OC selection**

	Case 1	Case 2*
Stage 1	273	273
Stage 2	19	21
Genetic gain	2.41	2.40
Relationship	0.1650	0.1579

* **ΔF=0.01**

- **Results are same with respect to ΔG**

- **Lower relationship with multi-stage OC**

Result: real sheep breeding dataset

- **Dataset**
  - # of candidates
    - Stage 1: 1977
    - Stage 2: 346

- **Case 1:**
  - **Stage 1: truncation**
  - **Stage 2:single-stage OC selection using stage 1 information**
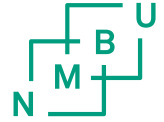
- **Case 2:**
  - **Multi-stage OC selection**

	Case 1	Case 2*
Stage 1	273	273
Stage 2	26	15
Genetic gain	15.92	19.25

* ΔF=0.01

- **Higher ΔG with multi-stage OC**
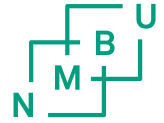
20.9%

Discussion

- Simultaneous optimization possible

- But, may not be practical
  - Assumes simultaneous selection at all stages
  - Practice do the preselection stage first
  - If the actual selection is different from optimum
    - re-run OC with single (final) selection stage

Conclusions

❖ multistage OC: optimises multistage selection

- Control of relationships
- Maximise gains

❖ Sheep breeding example: extra gains

❖ More than two selection stages :

- Straightforward extension

Thank you!

Acknowledgements: NSG