

Topical developments in Denmark, part 2: food demand for mussel eating birds

Karsten Laursen & Preben Clausen

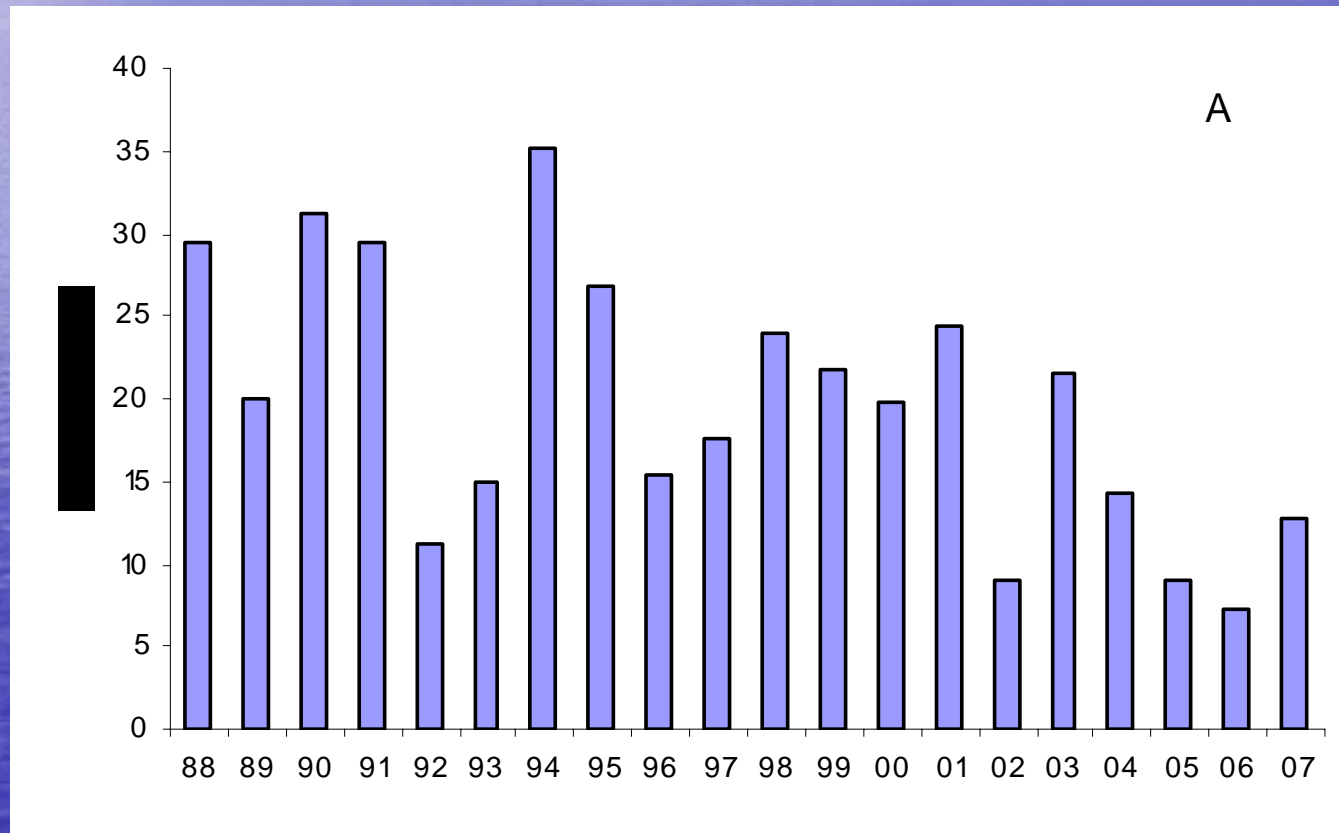
National Environmental Research Institute,
Aarhus University

Trilateral Workshop on
Blue Mussel Fishery Management in the
Wadden Sea, 2008

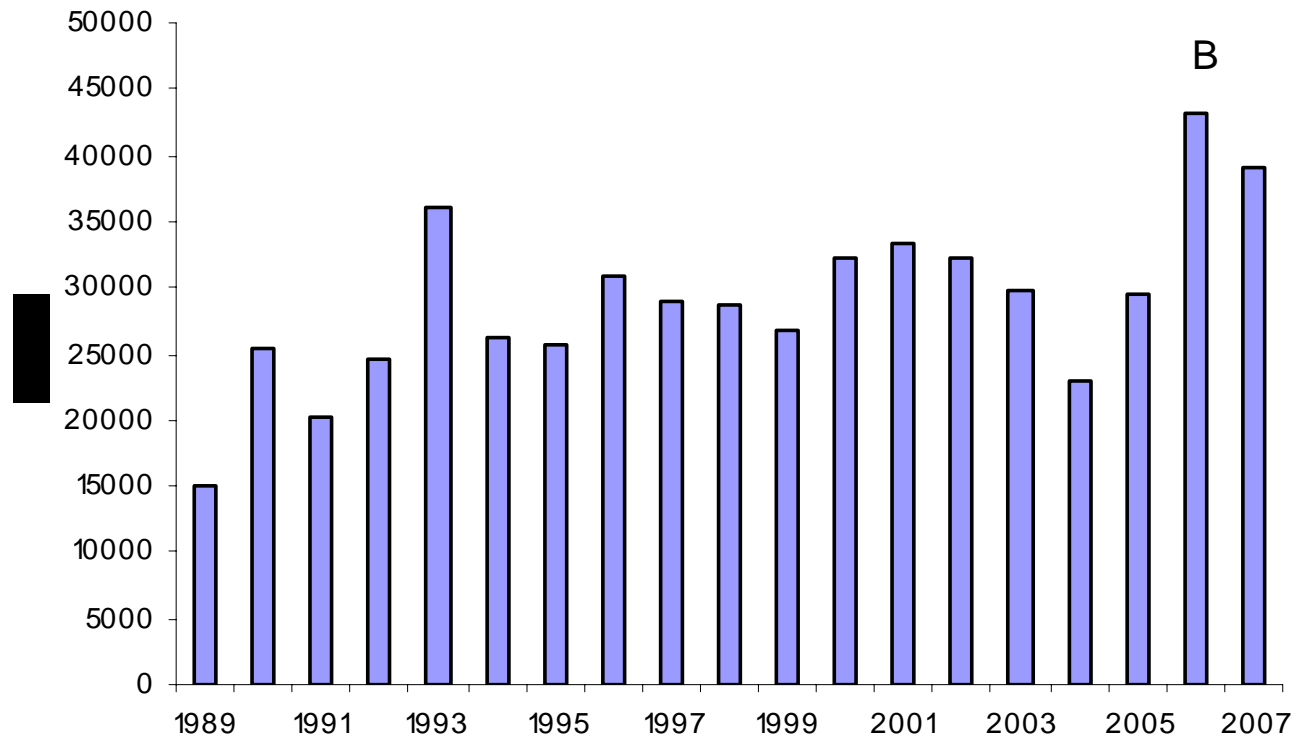
The mussel eating species are:

- Eider
- Oystercatcher
- Herring gull

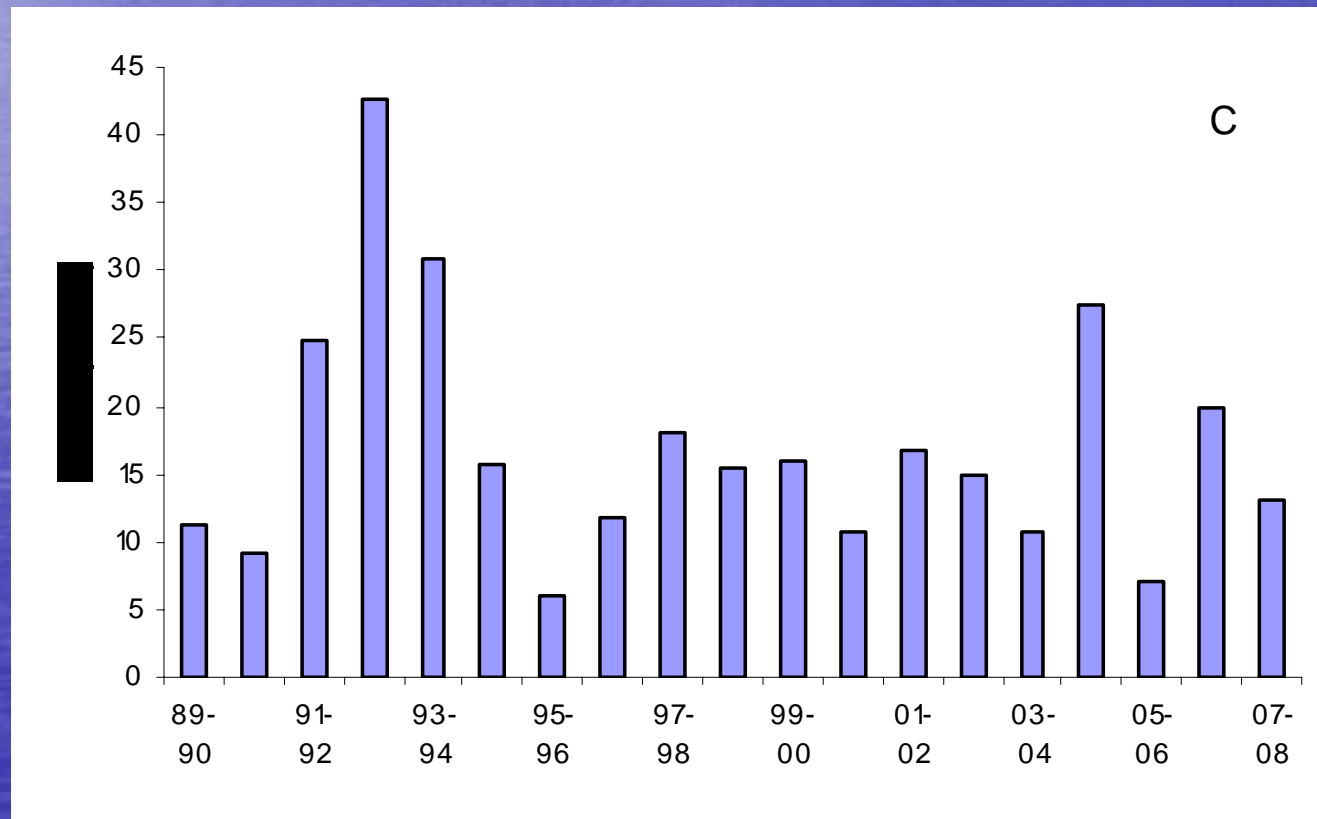
Numbers in the Danish Wadden Sea for: Eiders



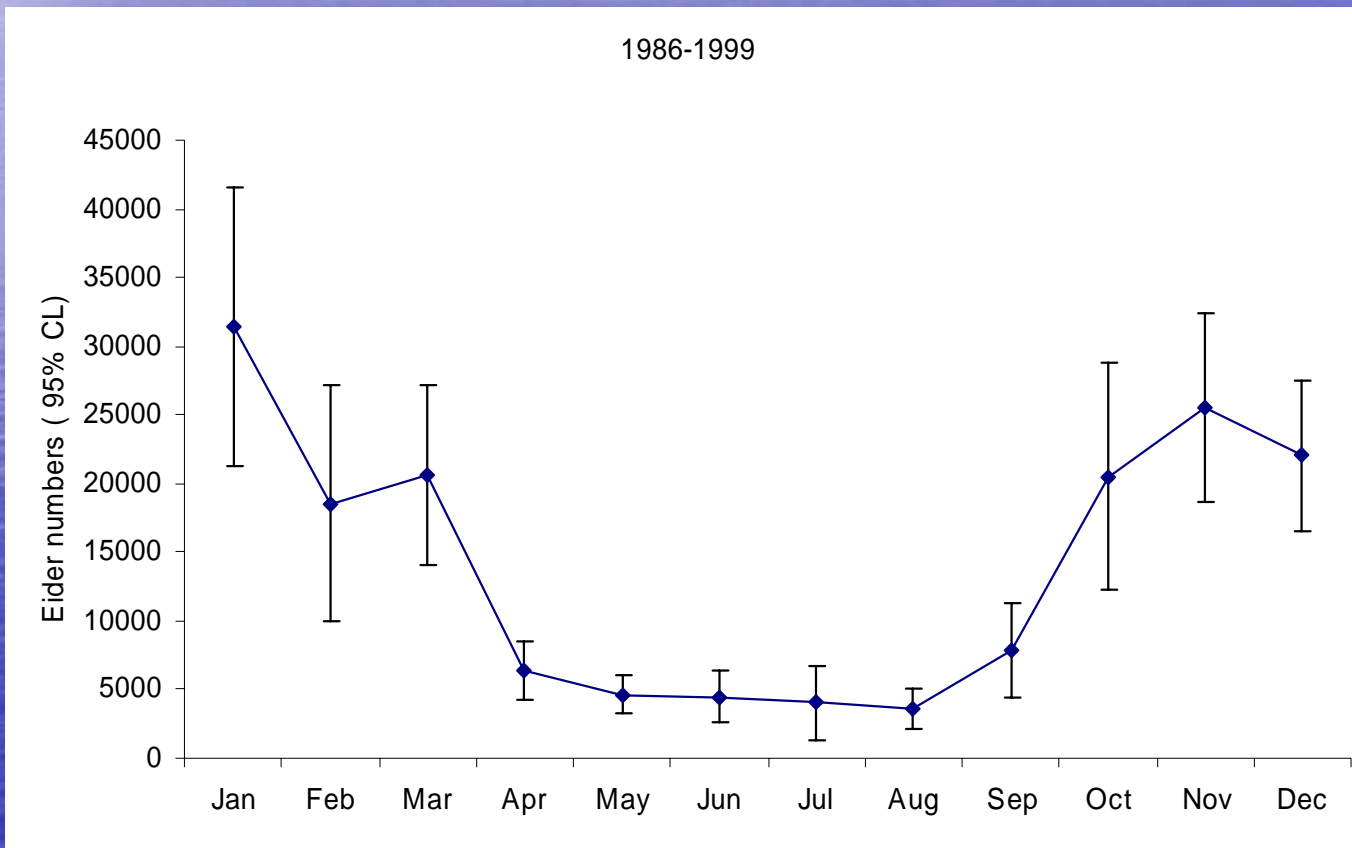
Oystercatcher



Herring Gull



Phenology of Eiders



Daily Energy Expenditure (DEE)

-three methods for calculations

- Drent et al. 1978/79: $DEE = 203.58W^{0.723}$ (W: body mass in kg, DEE in kcal/day)
- Walsberg 1983: $DEE = 12.84W^{0.61}$ (W: body mass in g, DEE in kJ/day)
- Nagy 1987: $DEE = 10^{\log DEE}$

Daily Energy Expenditure

- for the mussel eating species

kJ/day	Oystercatcher	Herring Gull	Eider
Drent et al.	553	826	1521
Walsberg	603	845	1415
Nagy	541	820	1544

-more figures to be added.

Energy demand increases:

- during low temperatures (Stillman et al. 2000)
- when swallowing mussels with cold water (Nehls 1995, Leeuw et al. 1999)
- when diving in cold water (Leeuw et al. 1999)

Efficiency in extraction energy from mussels

- Eiders: 75 % (Nehls 1995)
- Oystercatcher: 85 % (Stillman et al. 2000)
- Herring Gull: 85 % (assumed, feed like Oystercatcher)

Blue mussel proportion in the diet:

- **Eiders:** 18-90 % (Hilgerloh 1999), 68-80 % (Hilgerloh 1997).
Range 18-90 %
- **Oystercatcher:** 50-80 % (Smit et al.1998), 69 % (Hilgerloh 1997), 77 % (Maagaard & Jensen 1994), not profitable food item (Zwarts et al. 1996).
Range: 0-80 %
- **Herring Gull:** < 30 % (Dernede 1994), 10-30 % (Hilgerloh 1997), 3-40 % (Wilkins & Exo 1998), 66-86 % (Kubetzki & Garthe 2003).
Range: 10-86 %

- make a decision:
two options for diet composition

- Option 1: Eiders 60 %, Oystercatcher 17 %, Herring Gull 5 %.

(as in the Environmental Assessment Report, Christensen et al. 2007).

- Option 2: Eiders 60 %, Oystercatcher 40 %, Herring Gull 20%.

How many birds to be supported?

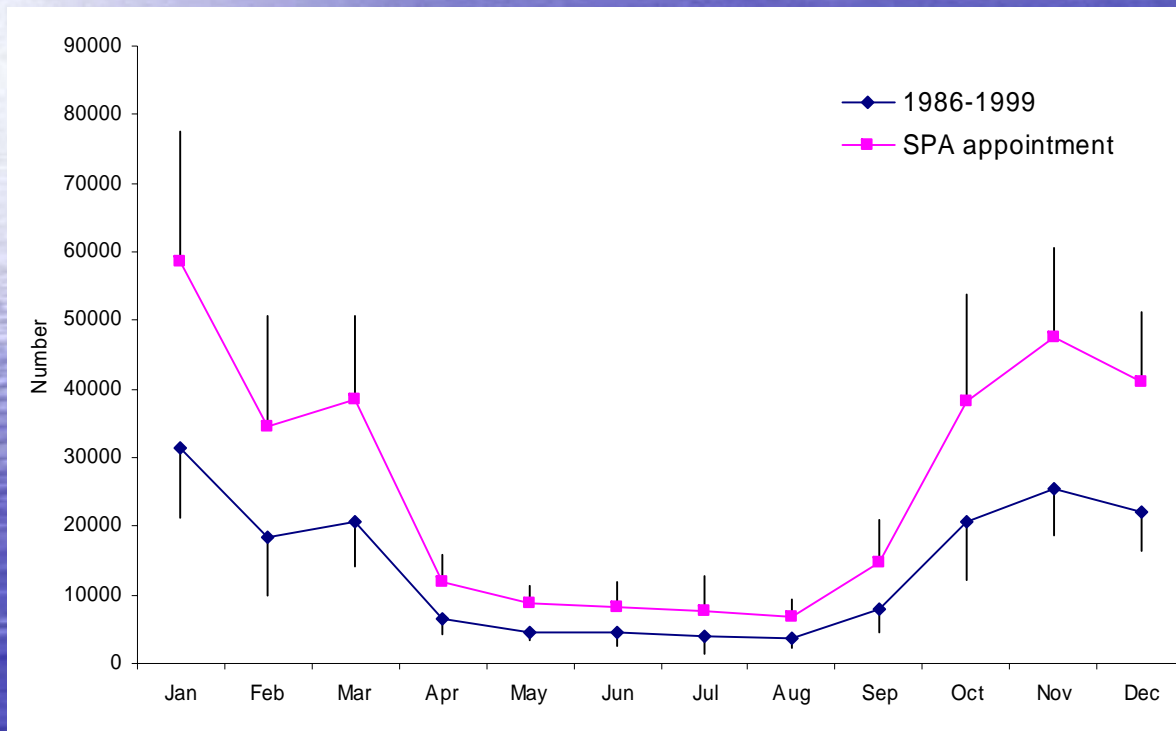
- selection of base line period or figures

- Oldest counts?
- Most recent counts?
- Periods with good coverage?
- SPA appointment criterion?

-make a second decision on bird numbers

- Option 1: 1986-1999
(same period as in the Environmental Assessment report,
Christensen et al. 2007).
- Option 2: SPA appointment criterion

Number of Eiders - for the two options



- Number of bird-days/year
1986-99: 5.2 mio
SPA app: 9.6 mio

Combination of options: diet composition and bird numbers

- Option 1 (same as in EA-Report)
Diet: 60 %, 17 %, 5 %. Bird number: 1986-1999.
- Option 2
Diet: 60 %, 40 %, 20 %. Bird number: 1986-1999.
- Option 3
Diet: 60 %, 40 %, 20 %. Bird number: SPA appointment

Ecological food requirement

- Up to now only the Daily Energy Expenditure (DEE) is considered,
- To DEE extra energy is necessary because
 - density dependent feeding behaviour
 - not all flesh is removed from shells
 - some mussels are stolen e.g. by gulls
 - flesh loss in mussels during winter (due to respiration)

Ecological Food Requirement, cont.

- Oystercatcher: $EFR = 2.5 - 7.7 * DEE$
(Coss-Custard et al. 2003),
- Eiders: Probably the same range (Nehls
2002, Ens et al. 2004)
- Herring Gull: no information (probably like
Oystercatcher)

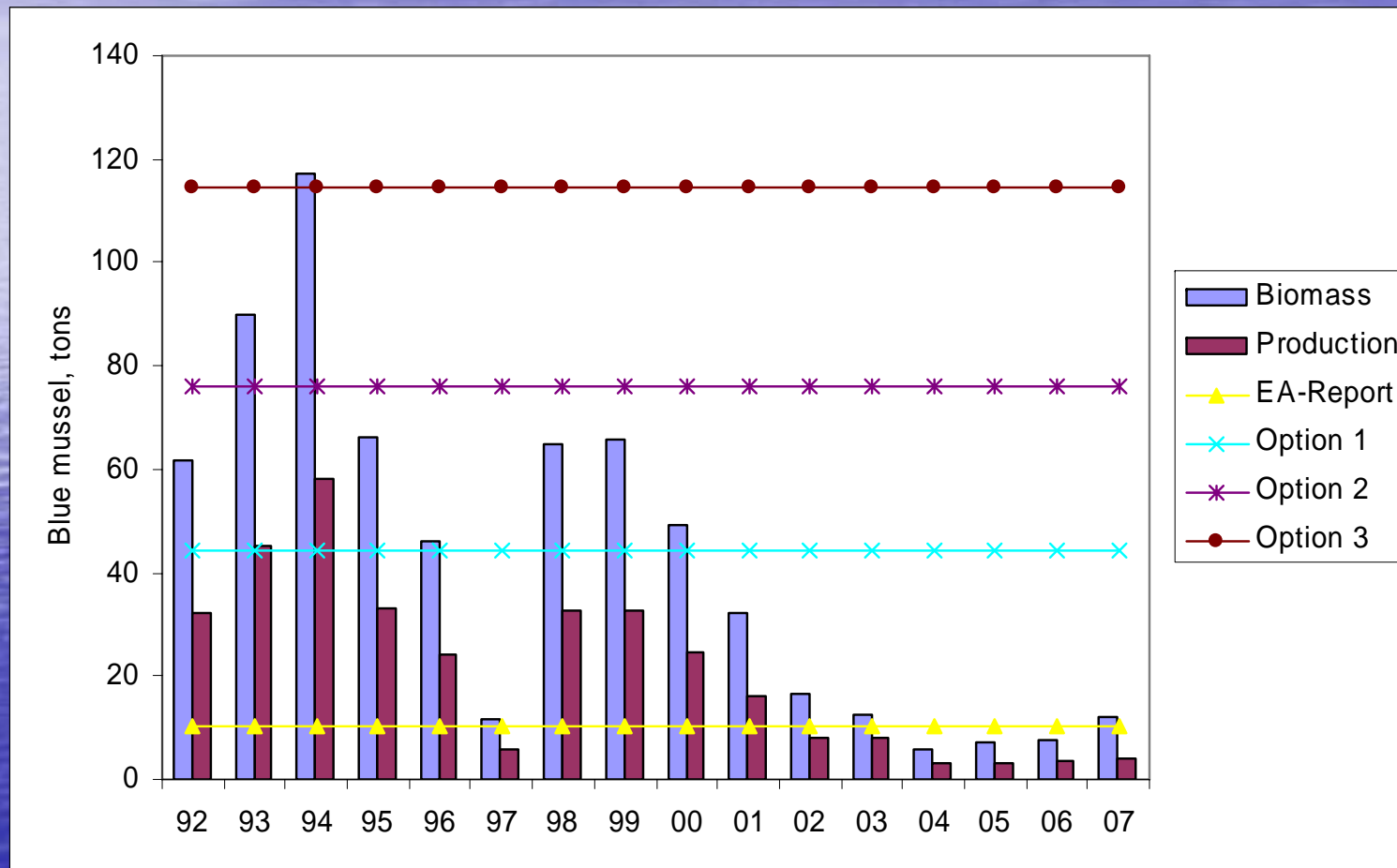
We have to take a third decision,
- how to handle EFR

- Oystercatcher and Herring Gull: 7.7
they feed in the same way, pecking flesh
from the shells
- Eider: 5.5
they swallow the mussels thus minor
losses

Mussel set aside for the three options,
and figures from the Environmental Assessment Report

Ton/year, wet weight	Environmental assessment report	Option 1 60,17,5.1986-99	Option 2 60,40,20.1986-99	Option 360,40,20.SPA
Eider	8,875	27,569	27,569	51,371
Oystercatcher	980	12,445	29,552	44,249
Herring Gull	445	4,375	18,978	18,978
Total	10,300	44,389	76,099	114,598

Mussel demand for birds, and biomass of blue mussel in the Danish Wadden Sea



Conclusion

- Detailed knowledge is available
- The calculations is based on individual decisions
- Considerably uncertainty in some parameters
- Recommendation for a standardized calculation method

Relationship between blue mussel biomass and Eider's number

