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Use of a reference fleet of fishing vessels for collection of data

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The Reference Fleet is a small group of Norwegian fishing vessels that are paid to provide The Institute of Marine Research (IMR) with detailed information about their fishing activity and catches on a <u>regular</u> basis.

Their sampling and data management procedures are similar to the system used on board IMR's research vessels. The Reference Fleet was initiated in autumn 2000 and currently comprises nine vessels (see pictures on next slide).

The 9 fishing vessels in the Reference-fleet in 2004:

M/S "Geir" - longline

M/Tr "K.Arctander" – trawl

M/S "Kato" - gillnet

M/S "Hauge Senior" - longline

M/S "Utflesa" -Danish seine/Purse seine

M/S "Førde Junior" – longline

M/S "Leinebris" – longline/gillnet

M/Tr "Prestfjord" - trawl

M/Tr "Varegg" - trawl

A new fishing vessel joining the Reference fleet in 2005:

M/S "Hargun" –
Purse seine/Pelagic trawl

Sampling the commercial fishery by using a Reference Fleet

- In Norway different platforms are used for collecting biological samples from commercial catches, including port sampling of landings and at sea sampling by the coastguard during inspections, and by inspectors from the Directorate of Fisheries.

- In order to obtain better and <u>continuous</u> samples from the offshore fishing fleet, and to gain better knowledge about fleet behaviour and technical developments influencing efficiency and effort, a Reference fleet was established.

- Biological samples (length, otoliths, stomachs, genetics etc) and logbook data are delivered according to contract, which secure a proper statistical coverage for a defined number of species in time and area.

Sampling the commercial fishery by using a Reference Fleet

- The program is mainly financed by a minor extra catch quota which is part of the national TAC set aside for this purpose. The extra quota is mainly composed of cod, and some herring, mackerel and Greenland halibut. The fishermen, however, collect material from all the species they catch.

- The value of the quota is currently shared 60/40 between vessel and IMR, respectively. All the fish is sold by the fisherman in the name of IMR. IMR's 40% is used for paying the fishermen according to priced deliveries, and for running costs.

- Such trust based co-operation between fishermen and scientist seems to reduce controversies

- and rather builds a common understanding and ownership of data from the fisheries, improved stock assessments and fisheries management

Sampling the commercial fishery by using a Reference Fleet

- Each vessel in the Reference Fleet is equipped with an electronic fish sampling board (Scantrol), scales, otolith sampling device and PC with specialised software.

- IMR provides training support, visits the vessels, and updates the scientific equipment on an ongoing basis.

- The agreement between IMR and the Reference Fleet includes an obligation for the vessels to record their catch logbooks electronically.

Sampling the commercial fishery by using a Reference Fleet

- Once a day, maximum 60 individuals of each species (300 shrimp) are length measured (in addition, otoliths may be collected for age determination). Altogether up to seven samples per species per week dependent on the fishery.

- Sample data are recorded electronically and transmitted to IMR via a satellite link (together with the electronic logbooks). This information is continuously added to IMR's research database. Also, there is a direct e-mail connection between vessel and IMR.

- IMR has access to some data from the vessel monitoring system (satellite tracking) operated by the Norwegian Directorate of Fisheries), so far only for contracted vessels.

- The Reference Fleet may also be requested to conduct specific observations. IMR is currently working on an expansion of the Reference Fleet to include vessels from the pelagic sector and the coastal fisheries.

HOW IS THE INFORMATION FROM THE REFERENCE FLEET USED?

- For assessment purpose, i.e., for distributing the total catch on different length and/or age groups.

- Monitoring where various fleets operate at any time and what they catch during the season. This enables the Institute of Marine Research, e.g., to decide how to allocate commercial catch sampling resources in time and space.

- Important biological information is obtained from the Reference Fleet's observations of sea mammals, sea birds, red king crabs and by-catch (i.e., discards) in the shrimp fishery.

- The Reference Fleet may be used as a testing platform of new technology such as electronic logbooks, and observation/understanding of technology creeping.

HOW IS THE INFORMATION FROM THE REFERENCE FLEET USED?

- Through this relationship of trust with the Reference Fleet, it is possible for IMR to discuss controversial issues with the vessel-owner, skipper and the crew, in order to obtain a common understanding between fishermen and scientists.

- The Reference fleet seem to deliver reliable data on by-catch, but is only indirectly useful for estimating discards.

- More validation studies should be conducted to statistically prove how representative the Reference Fleet is for the whole Norwegian fleet in different aspects in order to establish correct raising procedures.

Samples and satellite-tracking of the Reference Fleet in 2004
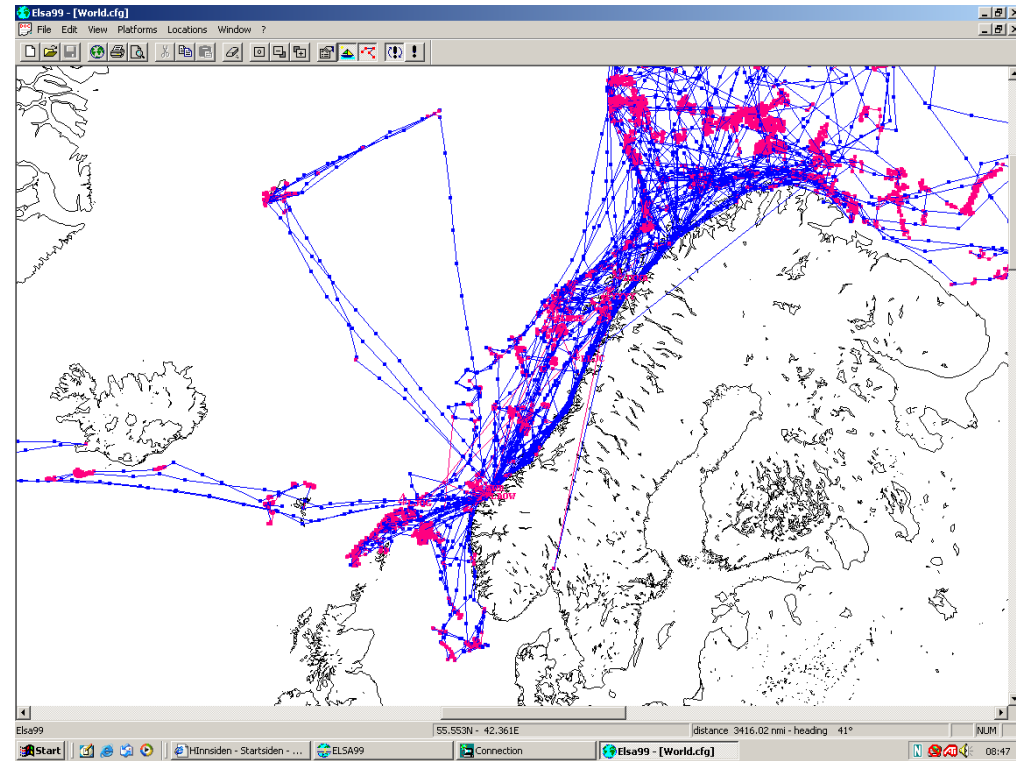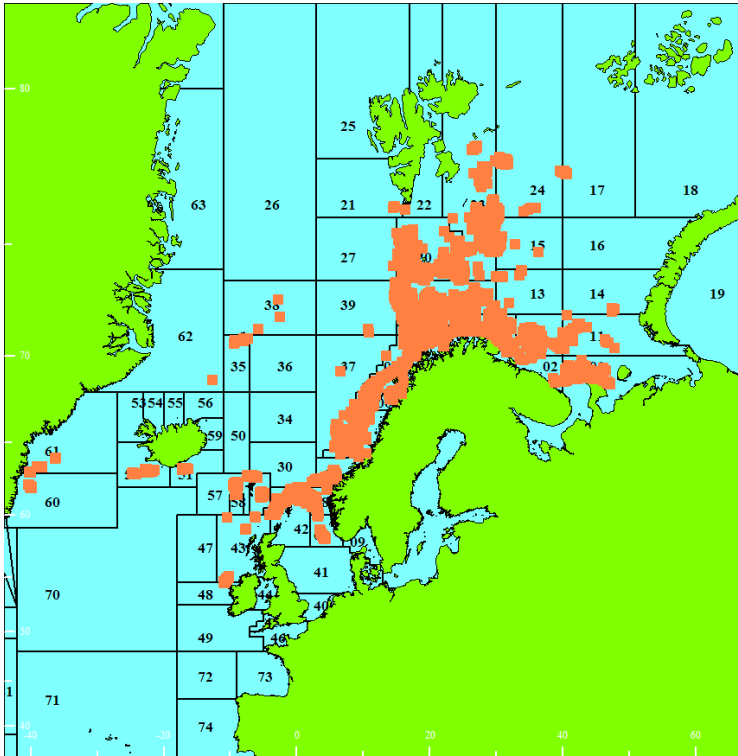
Species – numbers measured in 2004

Species	1st quart.	2nd quart.	3rd quart.	4th quart.	2004 Total
Antimora rostrata		53			53
Helicolenus dactylopterus	8				8
Gr. halibut	1692	5136	8036	6153	21017
Blueling	8	563	2	3	576
Jelly catfish	1837	1943	2955	2053	8788
Anglerfish	211	26	86	21	344
Tusk	5979	4877	5896	2485	19237
Deepsea shark	2				2
Pandalus borealis		9744	6290		16034
Spotted catfish	1636	1246	2938	1007	6827
Long rough dab		52	14		66
Grey catfish	170	214	508	936	1828
Chimaera	800	4		60	864
Haddock	14147	10854	9652	14079	48732
Galeus melastomus			60		60
Somniosus microceph.		1	1		2
Roughhead grenad.	587	106	4061	104	4858
Blue whiting			20		20
Amblyraja radiata	812	11		457	1280
Atlantic halibut	138	481	116	47	782
Ling	4172	2869	5581	464	13086
Capelin	0	122	48		170
Smaller redfish	30				30
Pollock	460	178	547	2	1187
Hake	60				60
Mackerel			613		613
Dogfish	8				8
Raja clavata		53			53
Polar cod		135	85		220
Rajella fyllae	75	1		108	184
Saithe	14781	7159	4058	1686	27684
Herring	247		958	2307	3512
Skates (undef.)		197	602	7	806
Phycis blennoides	204	24	100	10	338
Roundnose grenadier		191	61	18	270
Deepsea redfish	63	1014	228	23	1328
Dipturus batis		9		1	10
Cod	13209	13701	8656	19439	55005
Golden redfish	4387	5239	3603	4061	17290
Argentina silus	10				10
Norway pout				57	57
Total	65733	66203	65775	55588	253299

Sources of variability and determination of an efficient sampling plan

- The fish sampled are not a random sample of individuals from the entire commercial catch, but in statistical terms they are selected from a number of clusters (all the fish caught during a day by a boat form a 'cluster' of fish)

- A variance component analysis is used to quantify the sources of variablity and based on these estimates an efficient sampling scheme can be selected.
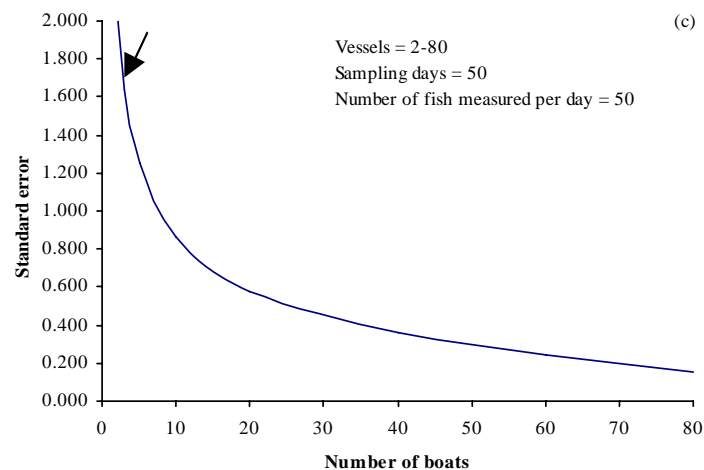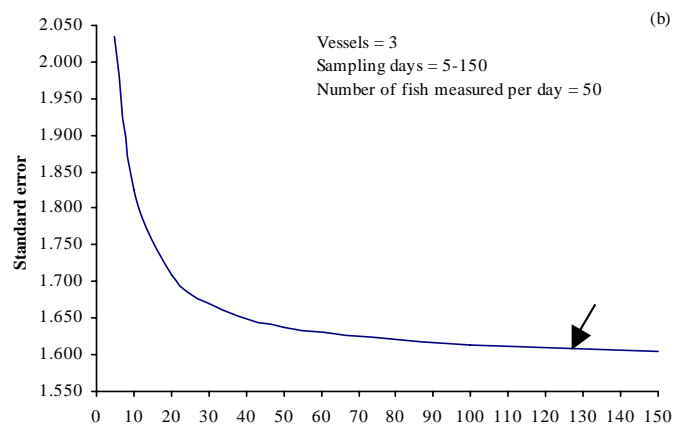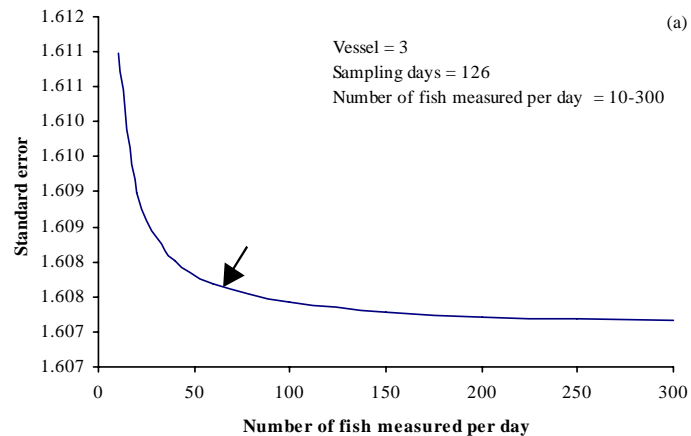
Precision of the estimate of the mean length of tusk (*Brosme brosme*) as a function of;

the number of fish sampled per day (a),

the number of days each boat collects samples (b),

and the number of boats in the reference fleet (c).

The arrows denote the precision of the 2003 data (from Helle and Pennington 2004).

(a)
Vessel = 3
Sampling days = 126
Number of fish measured per day = 10-300

Standard error / Number of fish measured per day

(b)
Vessels = 3
Sampling days = 5-150
Number of fish measured per day = 50

Standard error

(c)
Vessels = 2-80
Sampling days = 50
Number of fish measured per day = 50

Standard error / Number of boats

Impact on stock assessment

- A model (Bayesian hierarchical model) and software have been developed to estimate catch-at-age by combining data from different sources (Hirst *et al*. 2004a,b), and e.g., to estimate the variance with and without data from the Reference Fleet
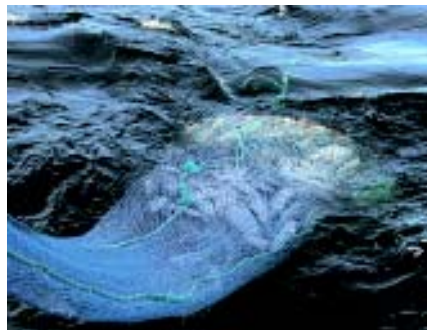
Example: Catch-at age of Northeast Arctic saithe (*Pollachius virens*) with and without data from the Reference Fleet.
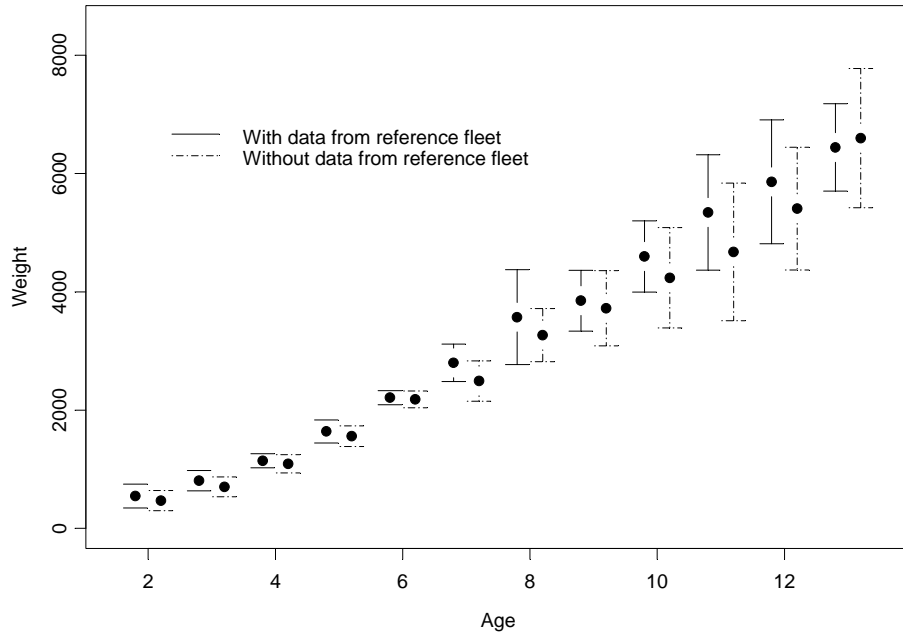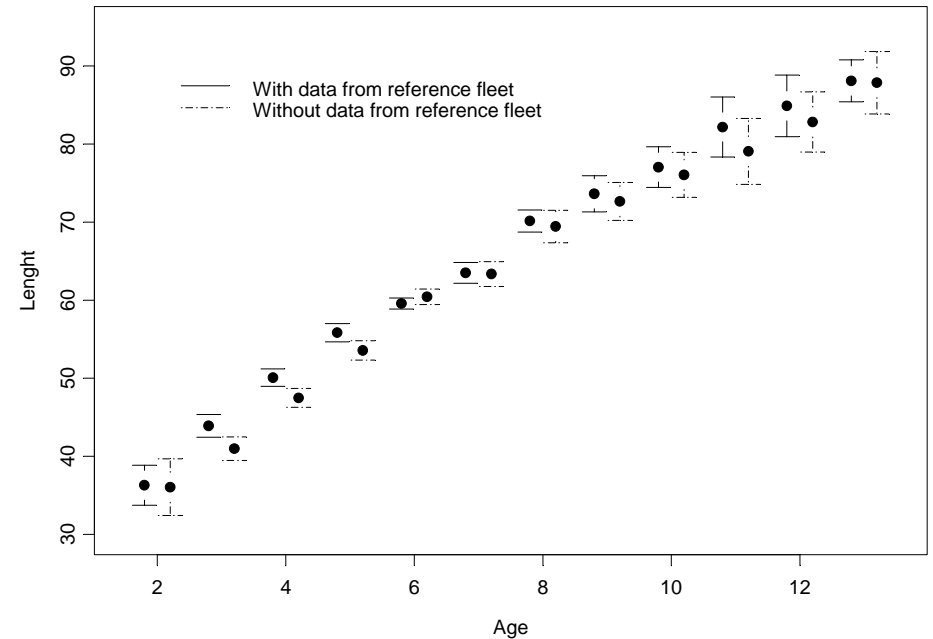

Norwegian catch at age of saithe in 2002
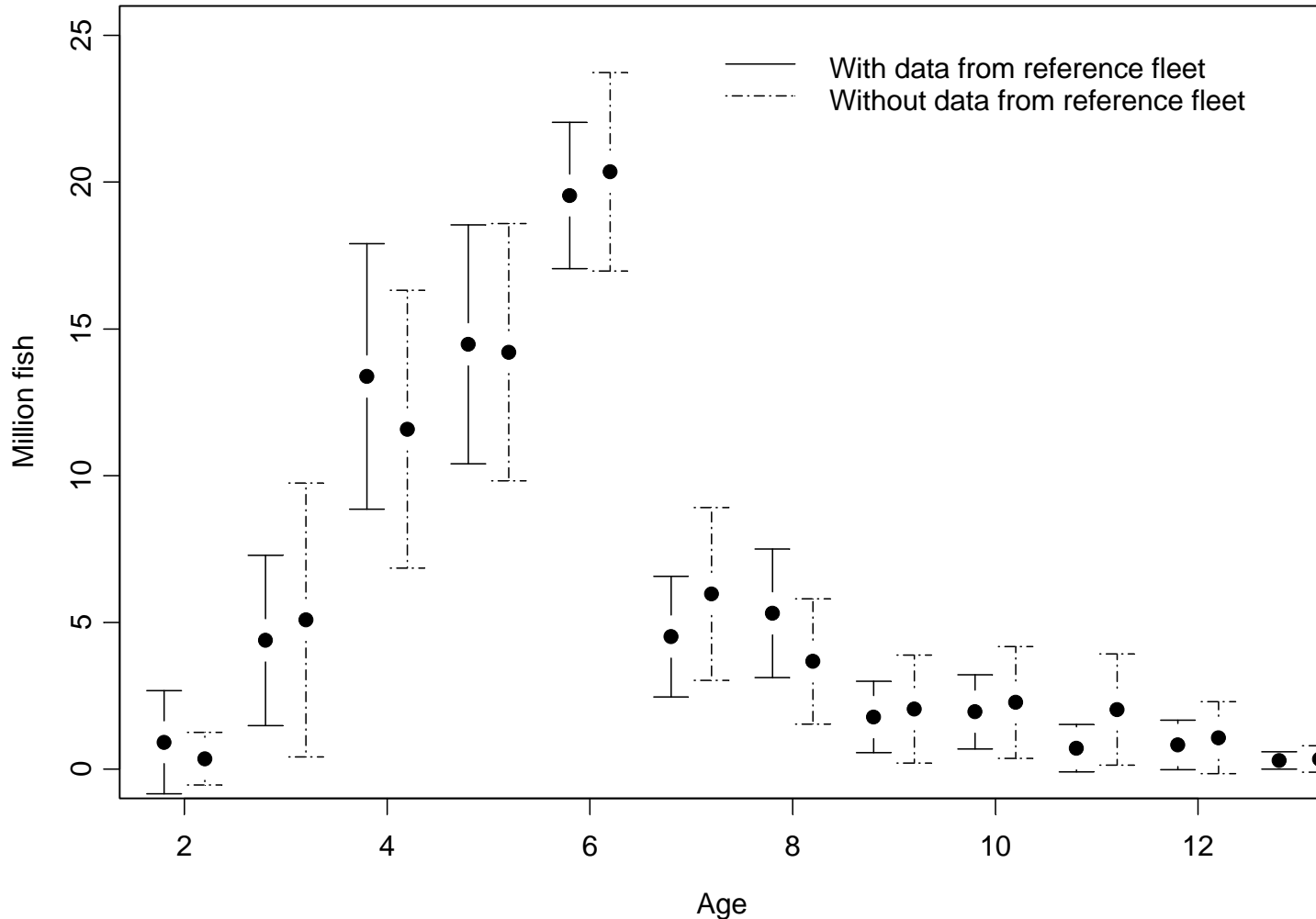
Similar for weight- and length-at-age:

Weight at age of saithe in Norwegian catches in 2002

Length at age of saithe in Norwegian catches in 2002

M/V "VAREGG"

Total length: 62.90 m
Beam: 13.00 m
Gross Tonnage: 1,806

Thank you for your attention!