

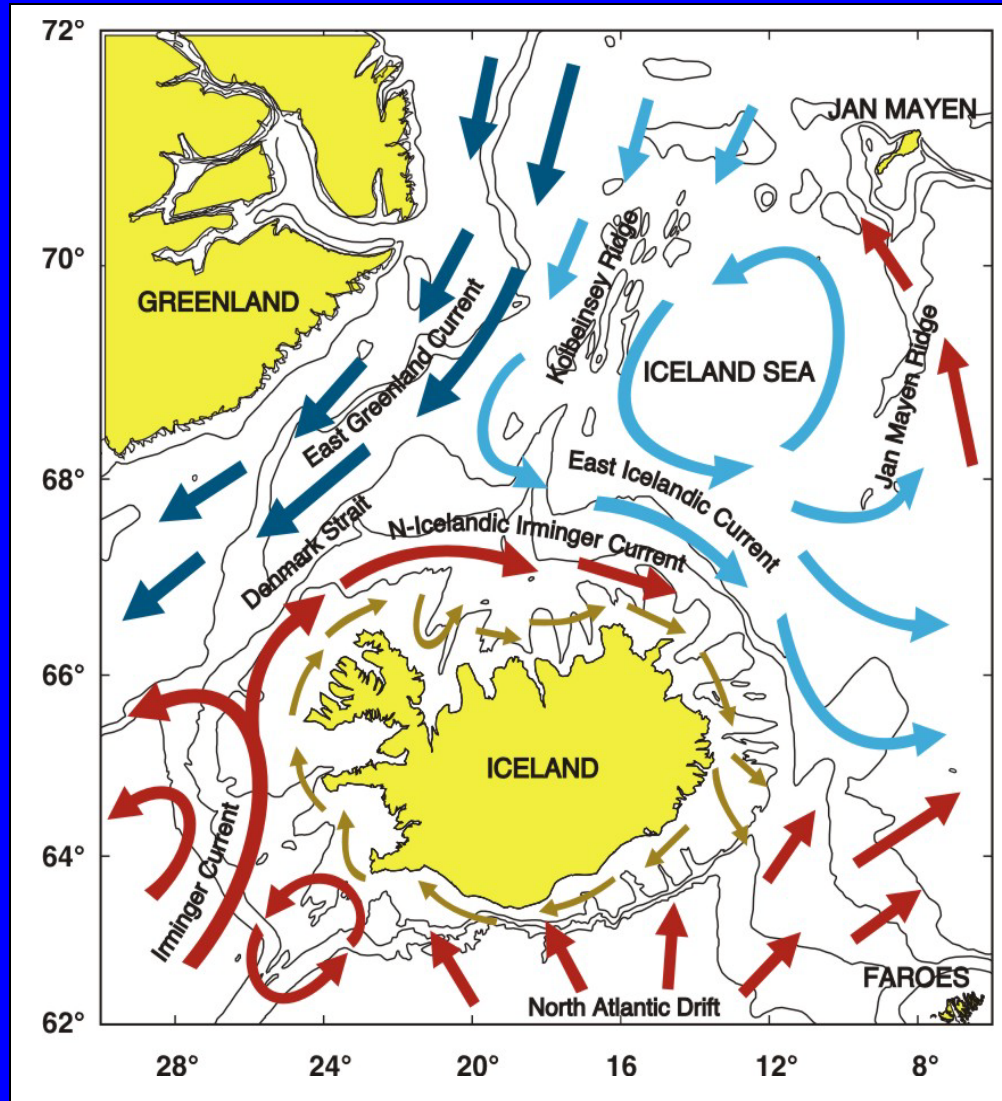
Capelin off Iceland: Biology, exploitation and management

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10th Norwegian-Russian Symposium on
Management strategies for commercial marine species in northern
ecosystems,

Bergen, 27-29 August 2003

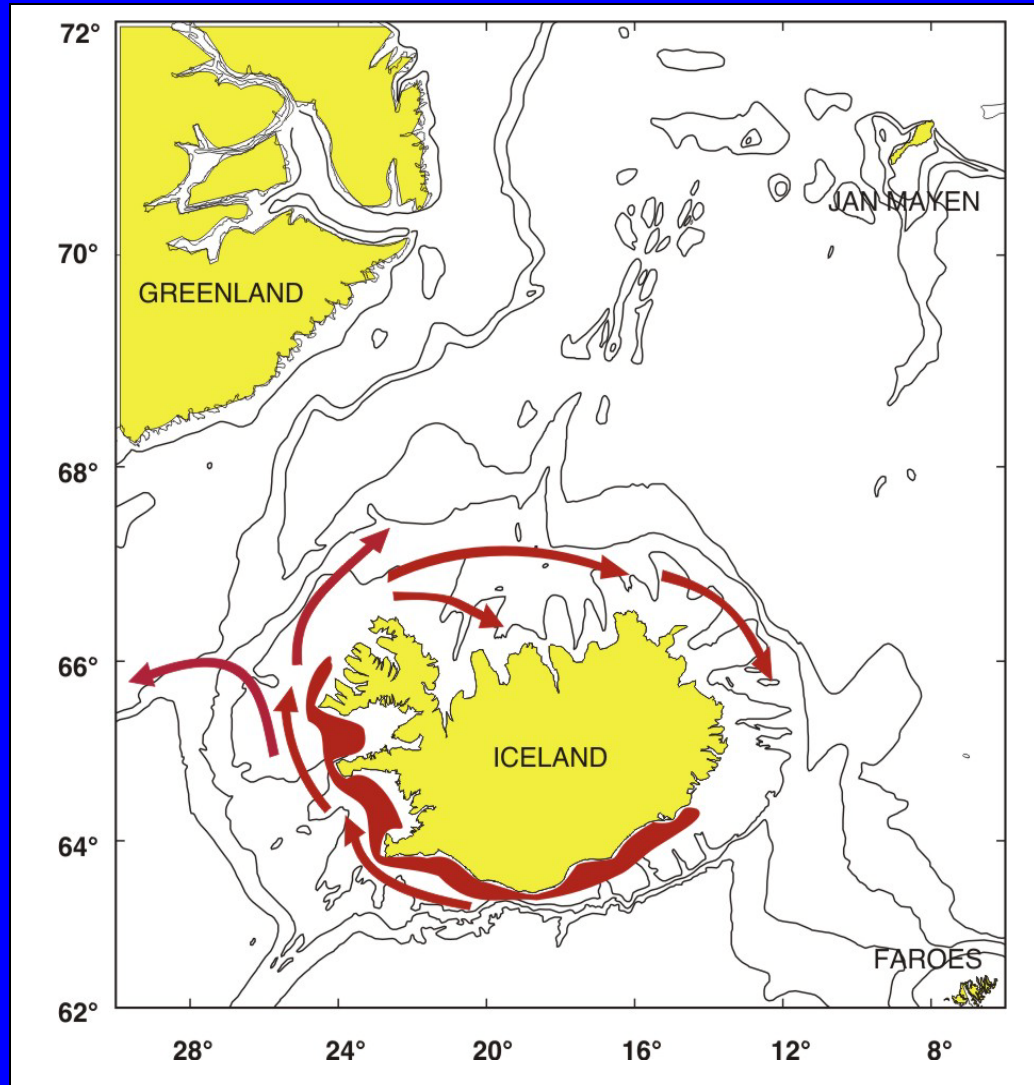
Ocean currents in the Iceland-Greenland-Jan Mayen area



Capelin distribution
and migration

-Closely linked with
ocean currents and
water masses

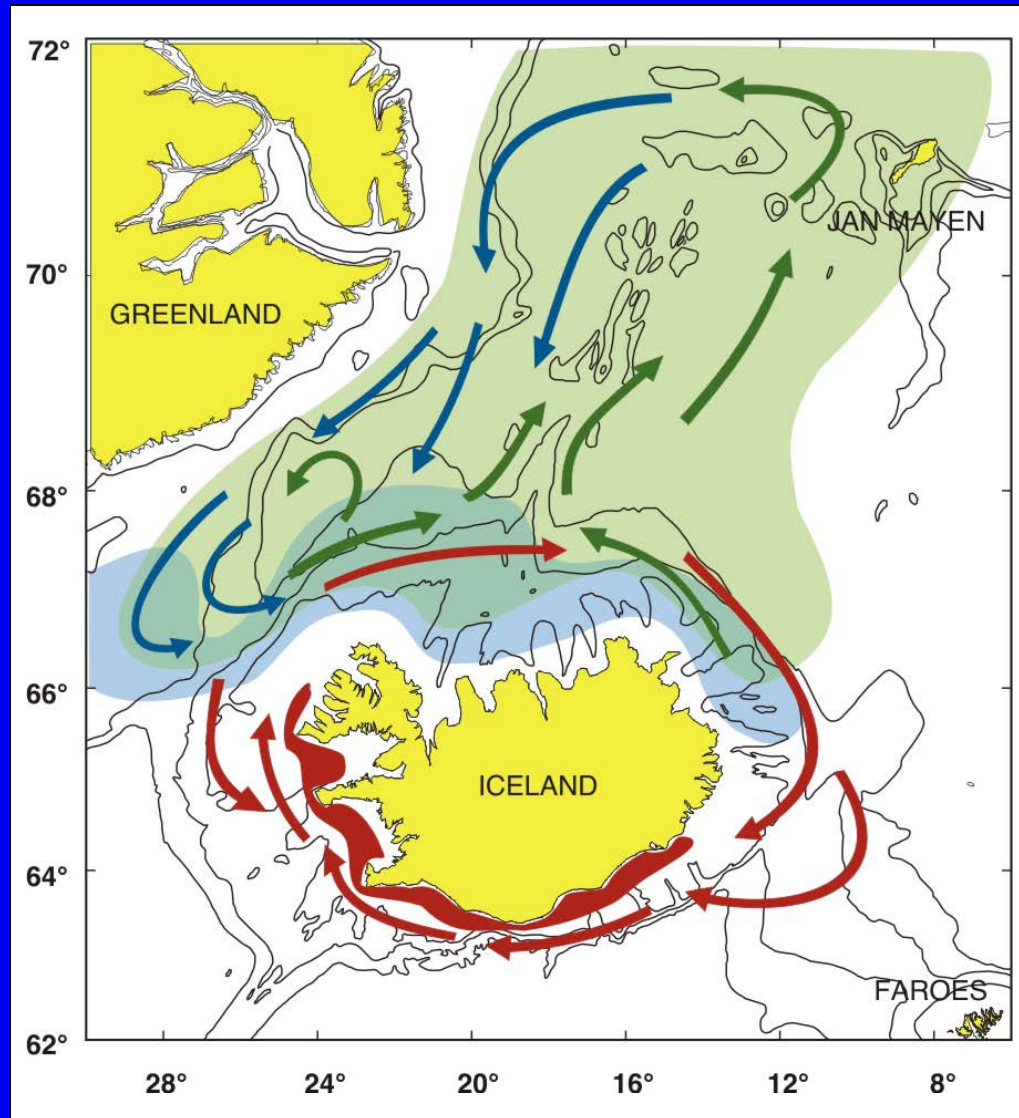
Icelandic capelin: Main spawning grounds and larval drift routes



Icelandic capelin: Life history

- Spawning March/early April at relatively shallow depths in the warm Atlantic waters off S- and W-Iceland
- Larvae and 0-group drift with the surface currents in a clockwise direction to the shelf area north and east of Iceland, and to a varying degree across the northern Irminger Sea and the southern Denmark Strait to the E- Greenland plateau
- Juveniles grow up over or near the continental shelf northwest to northeast of Iceland and on the E-Greenland plateau, northwest of Iceland
- The larger part of each year-class matures and spawns at age 3, the remainder at age 4; there are few spawners aged 2 and 5-year-old spawners are very rare

Distribution and migrations of Icelandic capelin

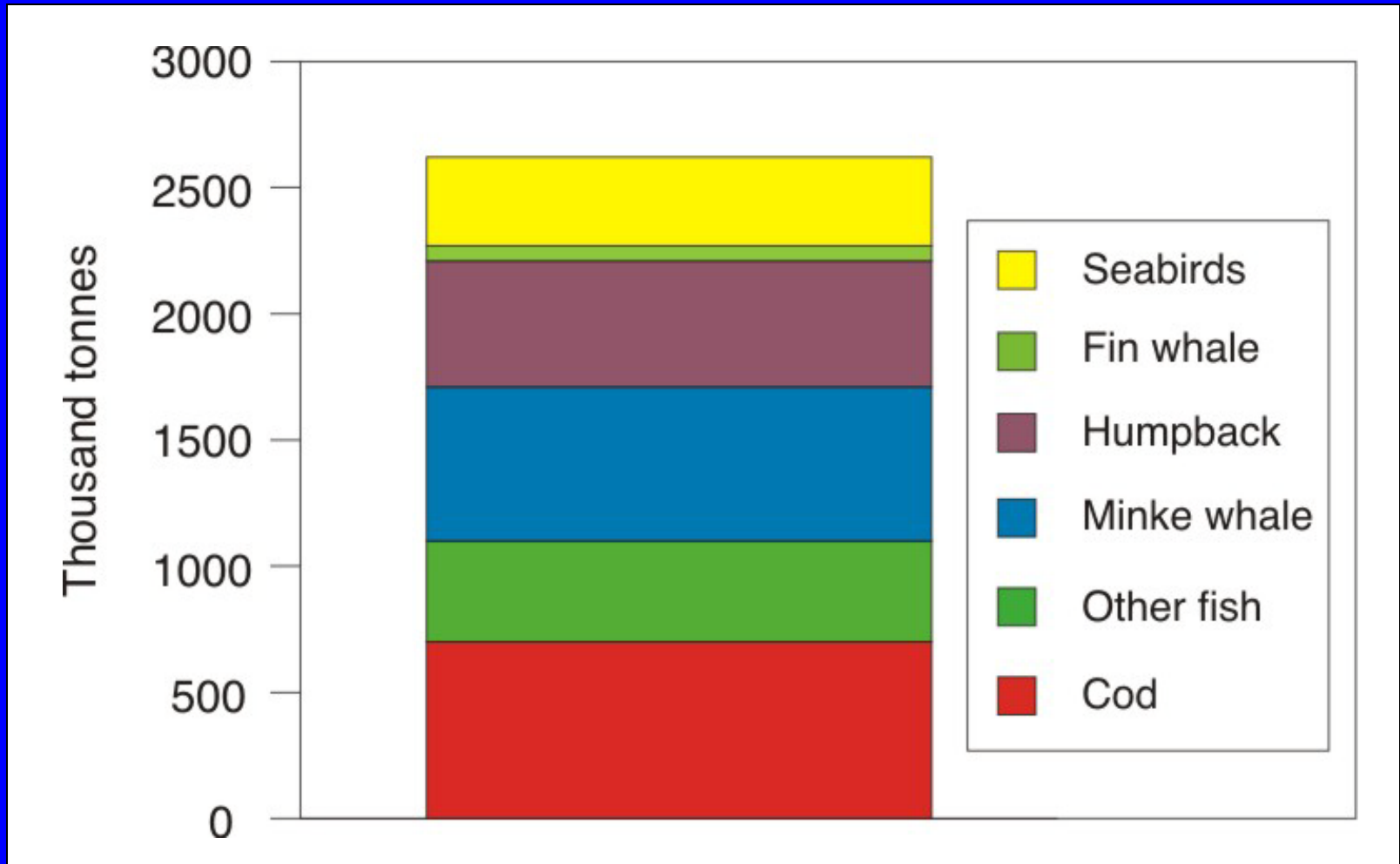


Green shade: Feeding area of adults
Blue shade: Distribution of juveniles
Green arrows: Feeding migrations
Blue arrows: Return migrations
Red arrows: Spawning migrations

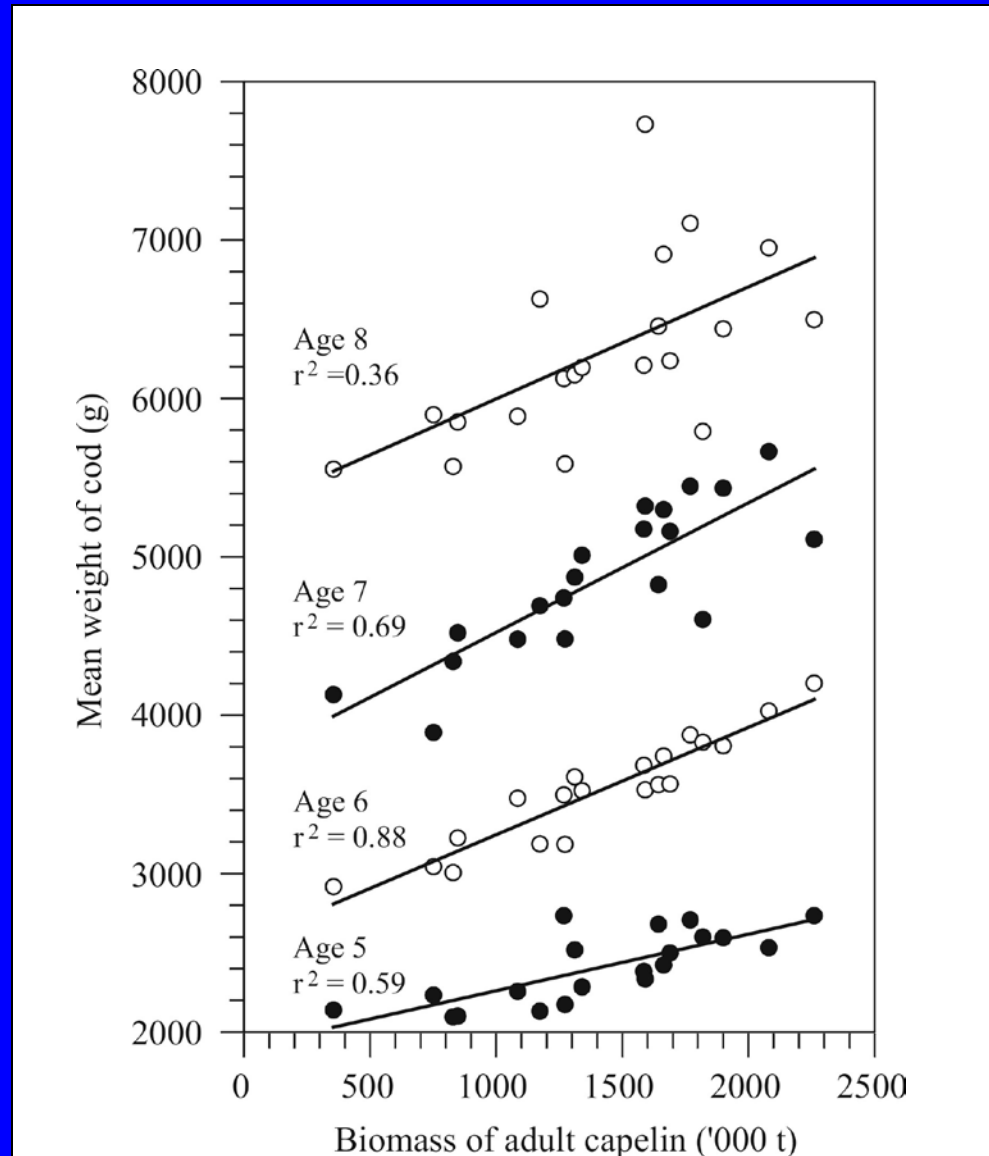
Icelandic capelin: Feeding and spawning migrations

- Maturing capelin aged 2 and 3 years (spawning at ages 3 and 4 the following year) usually undertake extensive northward feeding migrations into the Iceland Sea in spring and summer
- The return migration usually takes place in Sept-Nov
- The spawning migration starts from north of Iceland in Dec/Jan
- Usually spawners follow a clockwise direction along the warm/cold water boundary near the shelf break north and east of Iceland, entering the warm Atlantic waters off the eastern south coast
- Less frequently, large spawning migrations may arrive on the spawning grounds off W- and SW-Iceland directly from northwest

Estimated annual removal by the main groups of predators of Icelandic capelin



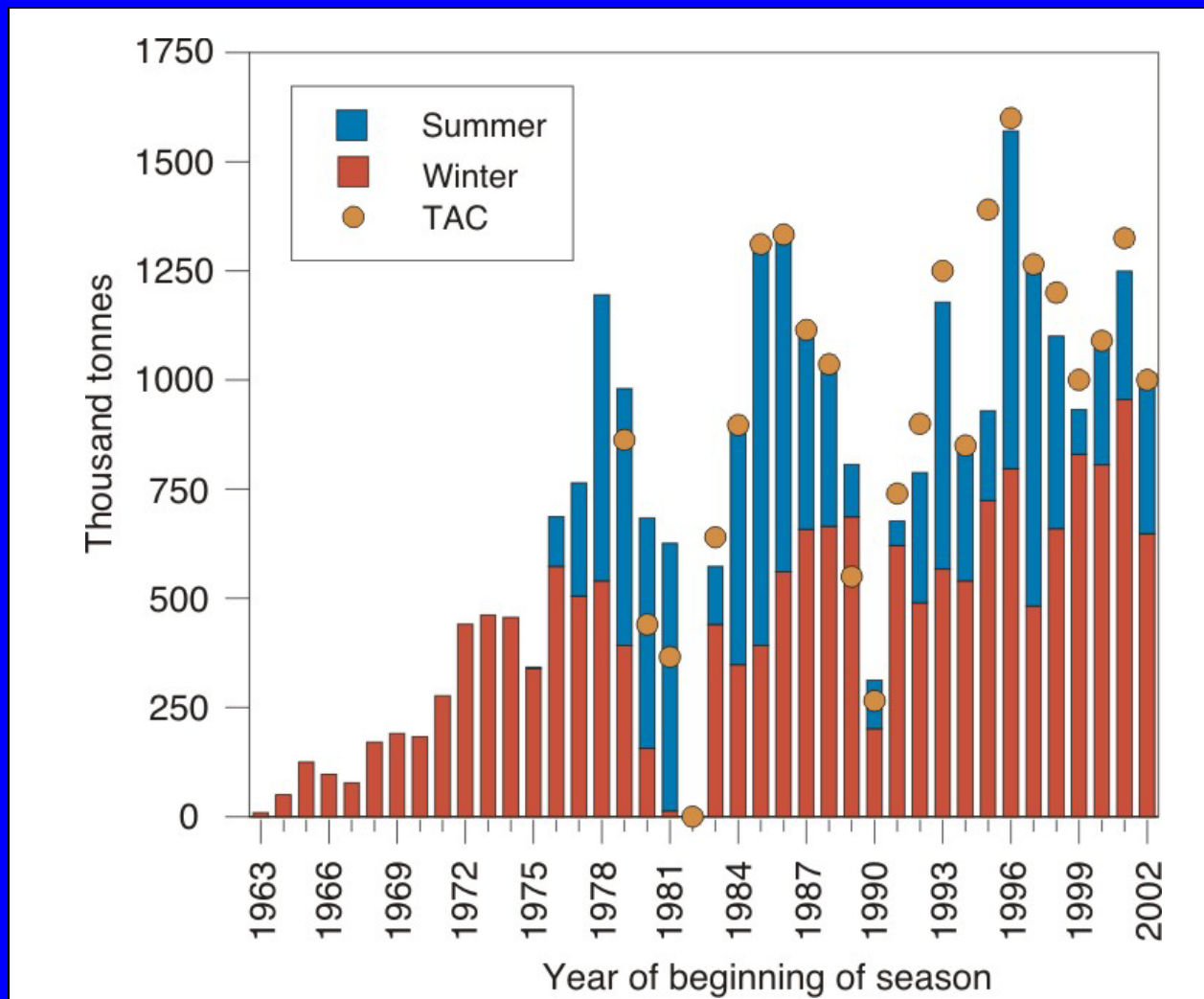
Relationship between adult capelin biomass and mean weight of age 5-8 years cod



Icelandic capelin: Development of the fishery

- Began as a coastal winter fishery in 1964
- Increased gradually and expanded to offshore waters east of Iceland in 1972
- Summer fishery began in 1976 north of Iceland
- In August 1978 Norway joined the summer fishery, operating near Jan Mayen Island
- Since then vessels from the Faroes, Denmark and Greenland have participated in the fishing of this stock
- The fishery in summer and autumn, and in the shallow coastal waters in winter is carried out with purse seines
- In the last few years there has been an increase in the use of pelagic trawls in deep waters east of Iceland in January

The total seasonal TACs and international catches of Icelandic capelin in the summer/winter seasons 1963/64-2002/2003



Models for Predicting fishable Stock abundance Have been under Constant revision And development Since the early 1980s

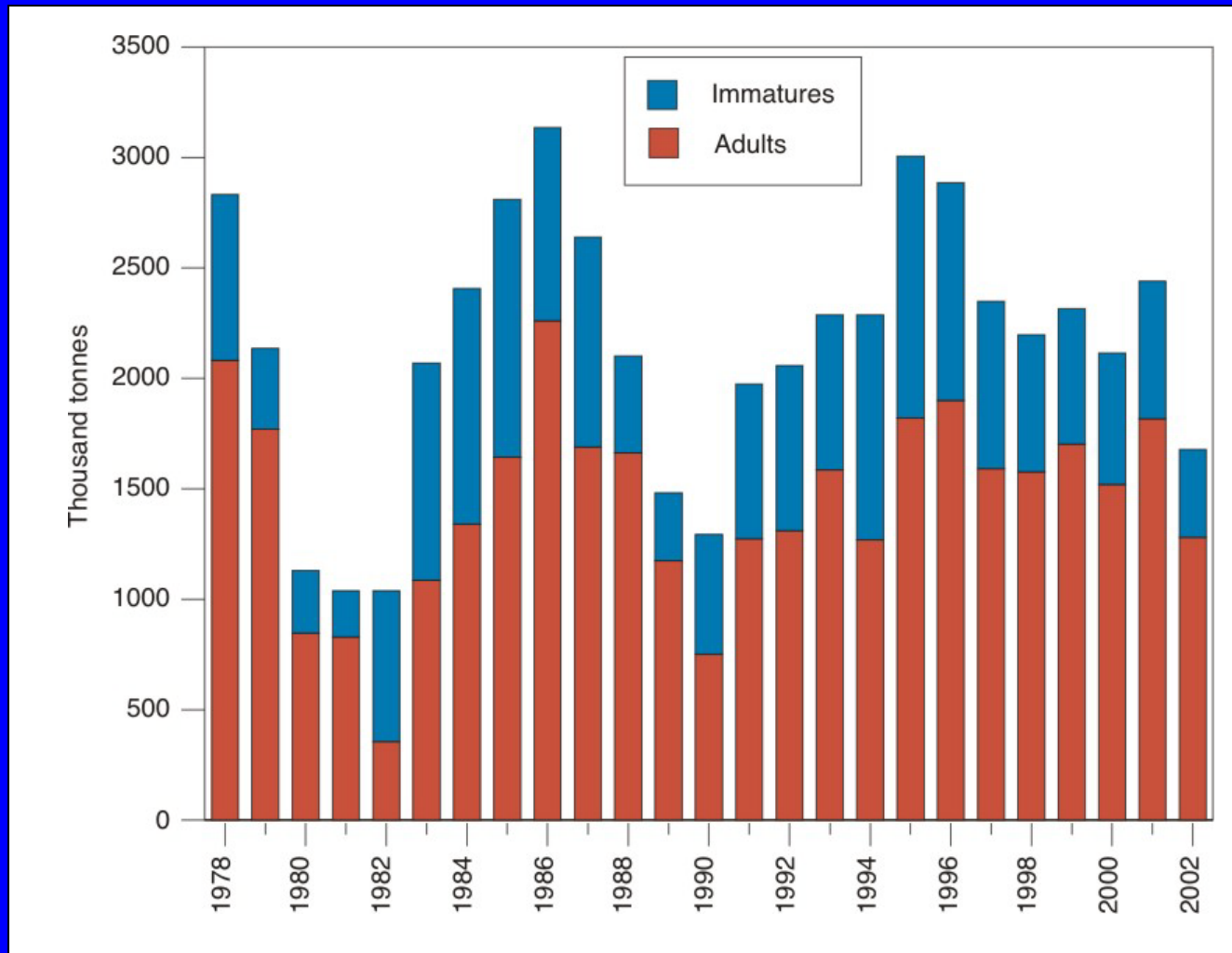
Icelandic capelin: Targets of the fishery and monitoring of the stock

- The fishery targets the adult stock and areas containing juveniles and/or mixture of adults and juveniles are closed to the fishery.
- Iceland, Greenland and Norway have long reached an agreement on how catches are divided between the countries
- The stock (age groups 1-3 in autumn; 3-4 in winter) is monitored by trawl/acoustic surveys, which can be carried out successfully during the period October/November-January/February
- In most seasons the adult stock has been measured in this way at least two times, i.e. in late autumn and in Jan-Feb. Immatures are measured in late autumn

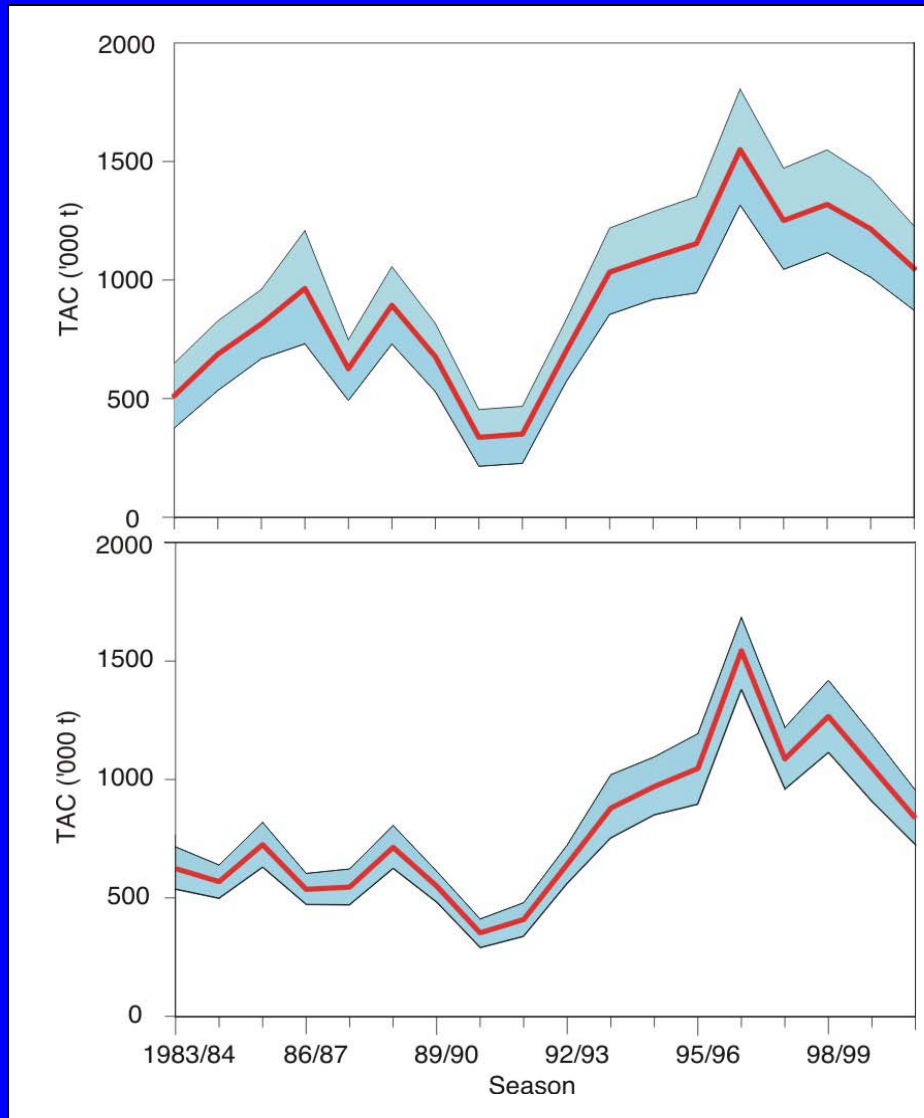
Icelandic capelin: Management strategy and targets

- The prime management objective for short-lived species like capelin is to preserve a large enough spawning stock to ensure propagation under 'normal' environmental conditions
- The target remaining spawning stock for Icelandic capelin has been 400 thousand tonnes since the 1979/1980 season
- Fishable stock abundance is predicted using historic relationships between measured abundance of immature capelin and back-calculated size of corresponding year classes from acoustic surveys, the fishery, natural mortality and growth conditions
- A prediction of fishable stock size is made under the auspices of ICES in spring in the year in which the season starts

The biomass of age 1-3 Icelandic capelin in summer 1978-2002



Historical predictions of fishable (adult) stock biomass for the 1983/84-2000/02



Upper panel:

Younger year class predicted directly from Acoustic estimates. Older year class predicted from total abundance estimate of age group 2.

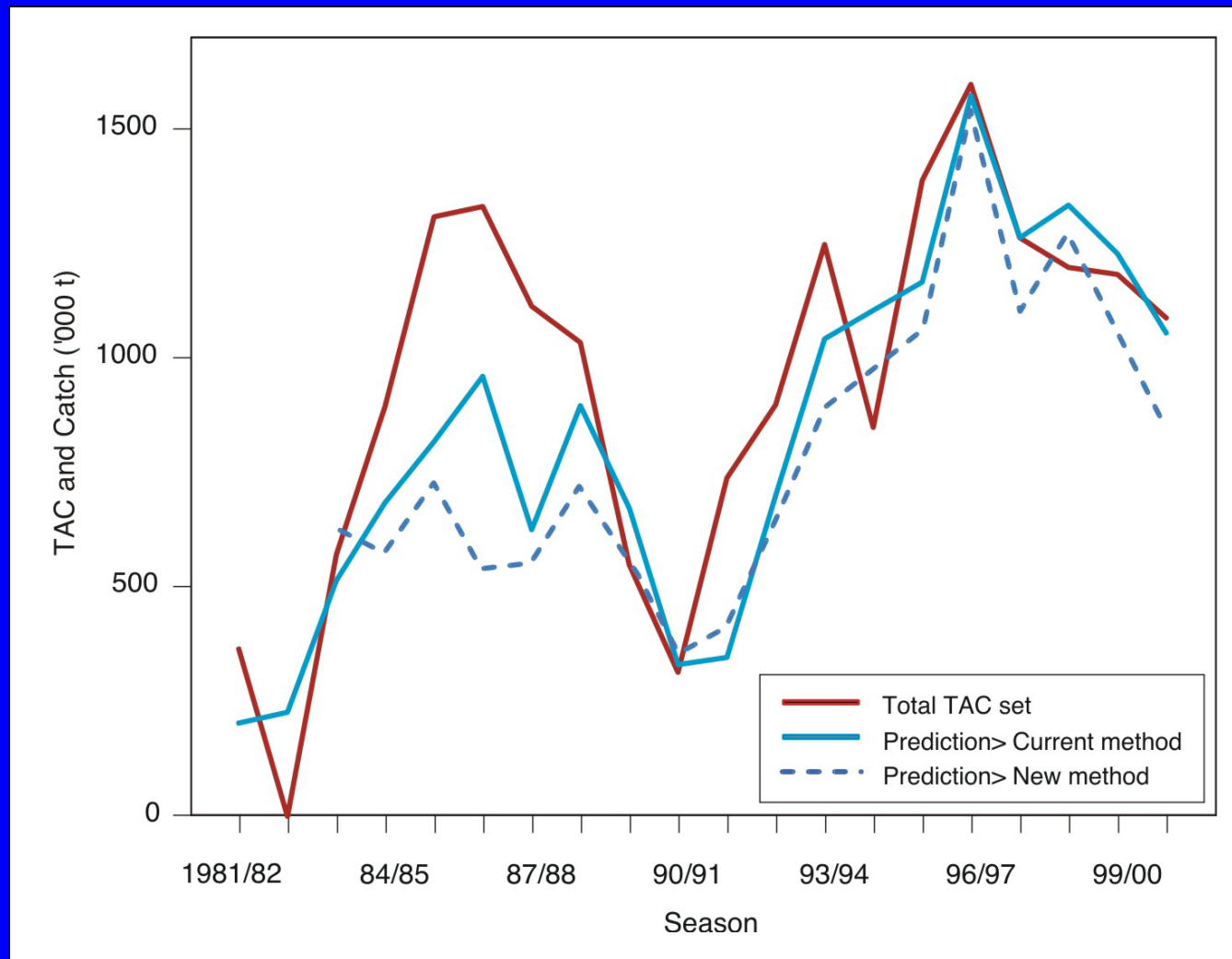
Lower panel:

Younger year class predicted as above. Older yearclass predicted from log transformed numbers measured by acoustics.

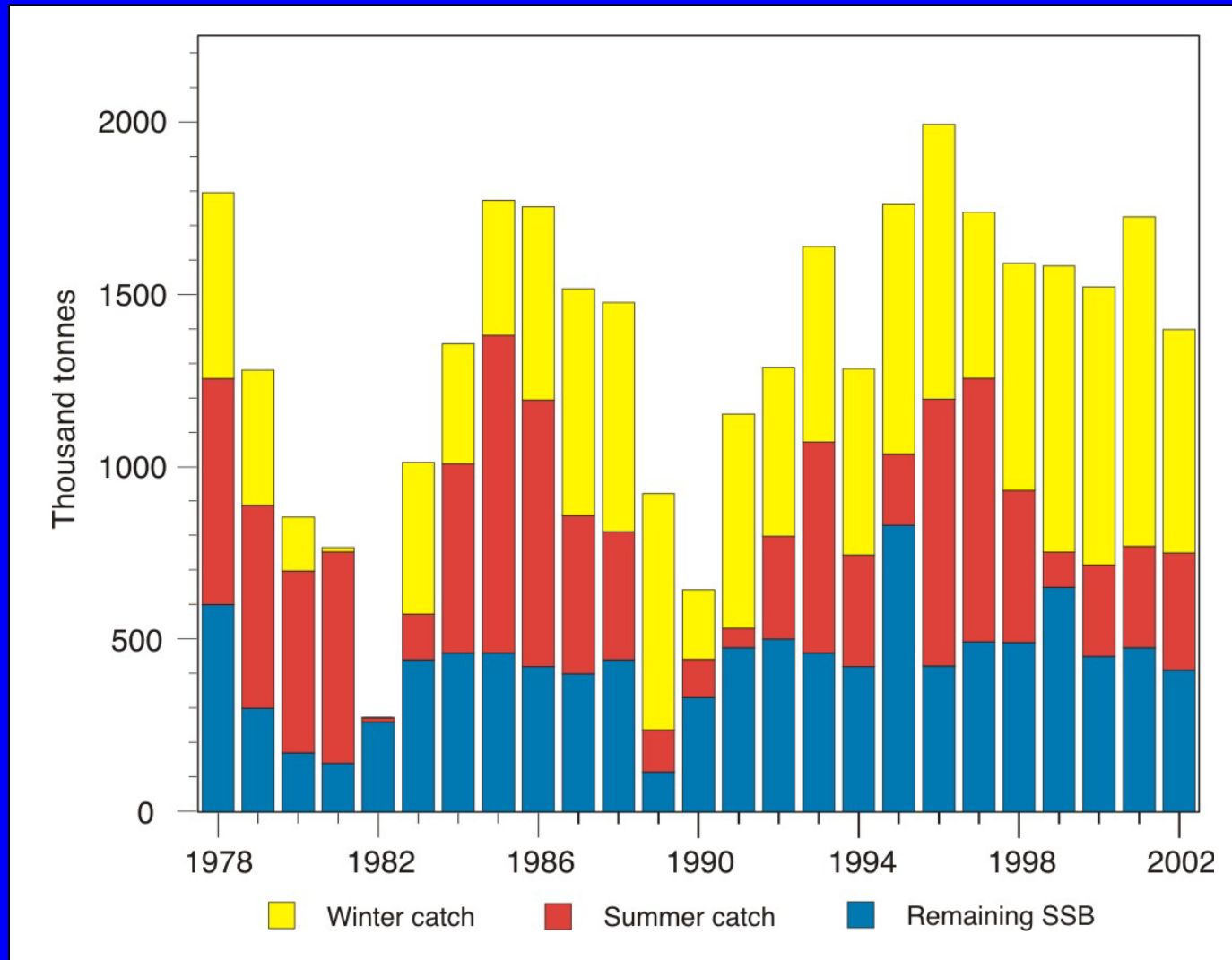
Main difference:

Narrower confidence limits in the new model

Comparison between predicted TACs and TACs set for Icelandic capelin in the 1981/82-2000/01 seasons



Icelandic capelin: International fishery in the 1978/79-2002/03 seasons and the SSB remaining at end of season



Icelandic capelin: Fishery and management

- As a precautionary measure, only two thirds of the estimated TAC is allocated to the fishing right owners
- The final TAC is decided after in-season surveys, either in late autumn or winter
- This procedure has worked quite well during the last two decades-rather successful management