

Age, growth and drift of over-wintering Lemon sole (*Microstomus kitt*) larvae in the northern North Sea in 2016/2017



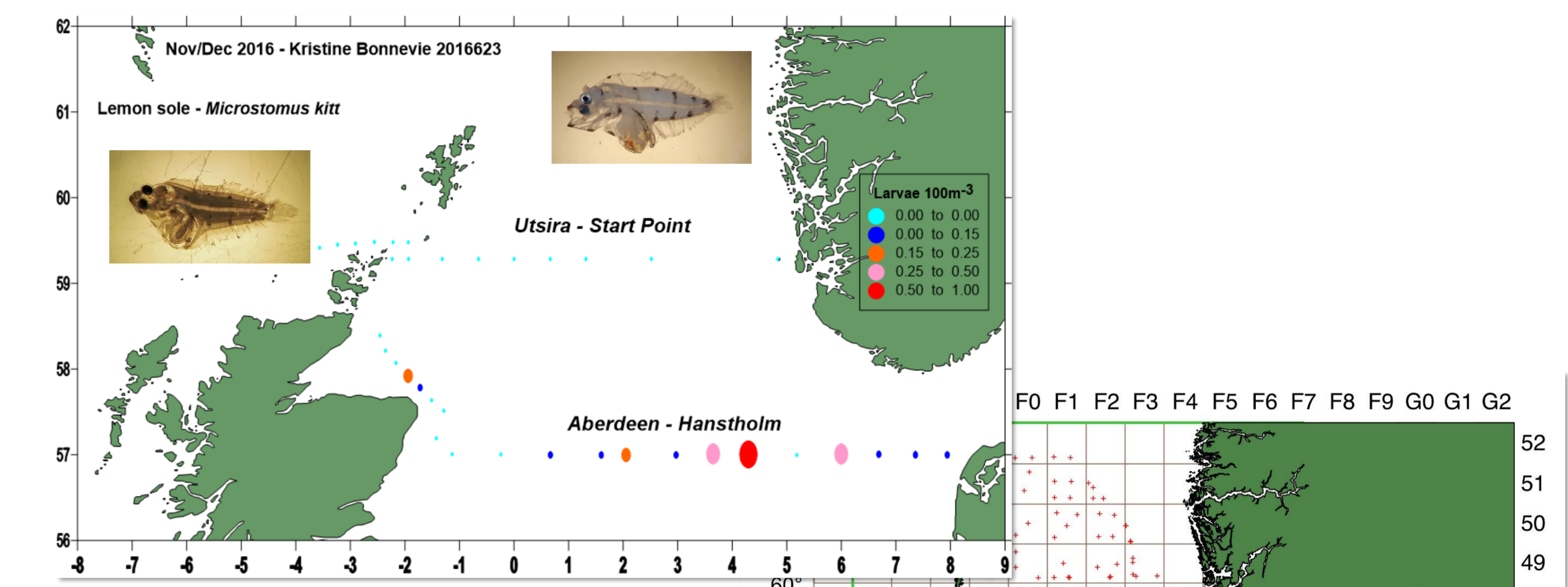
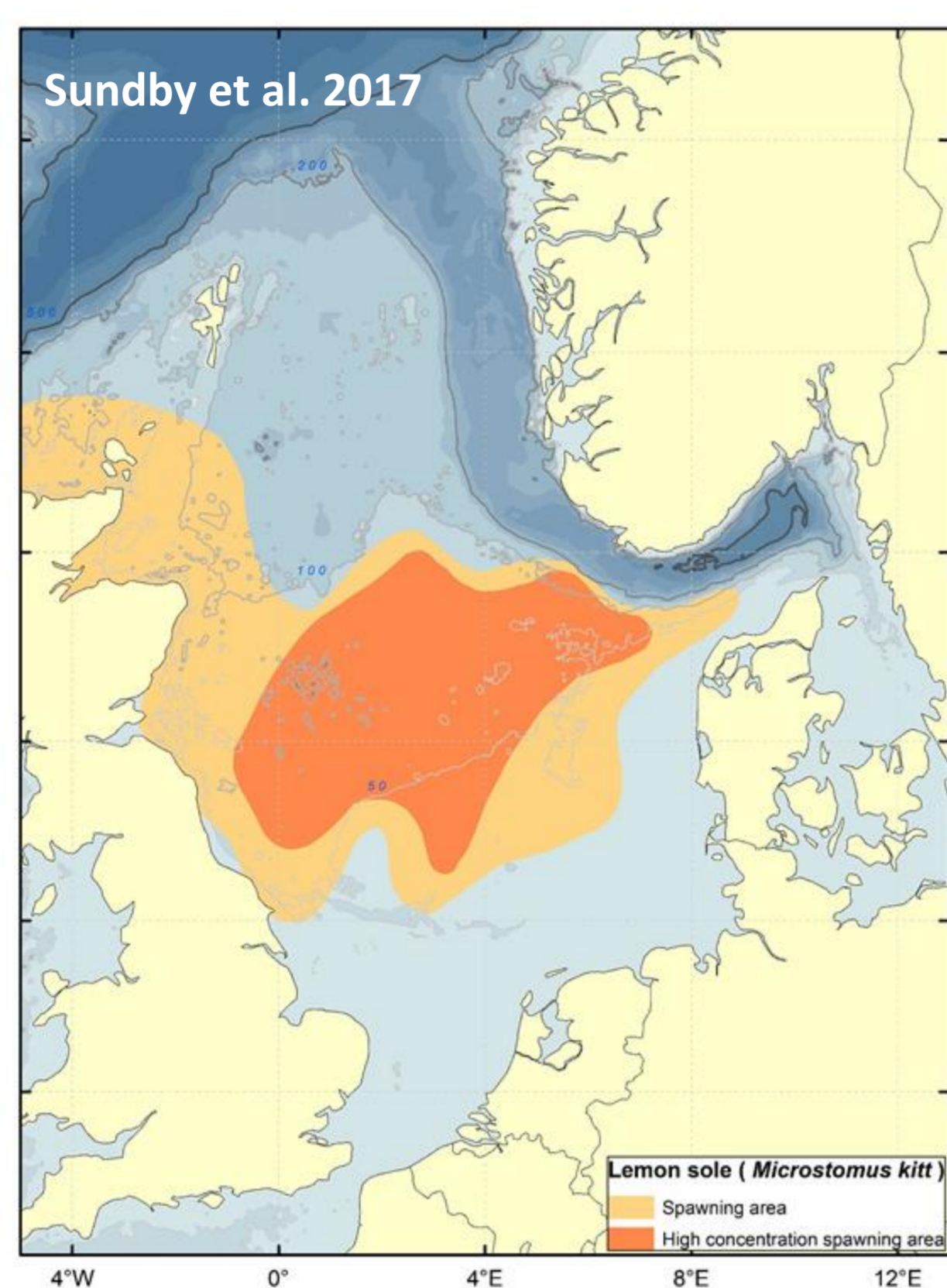
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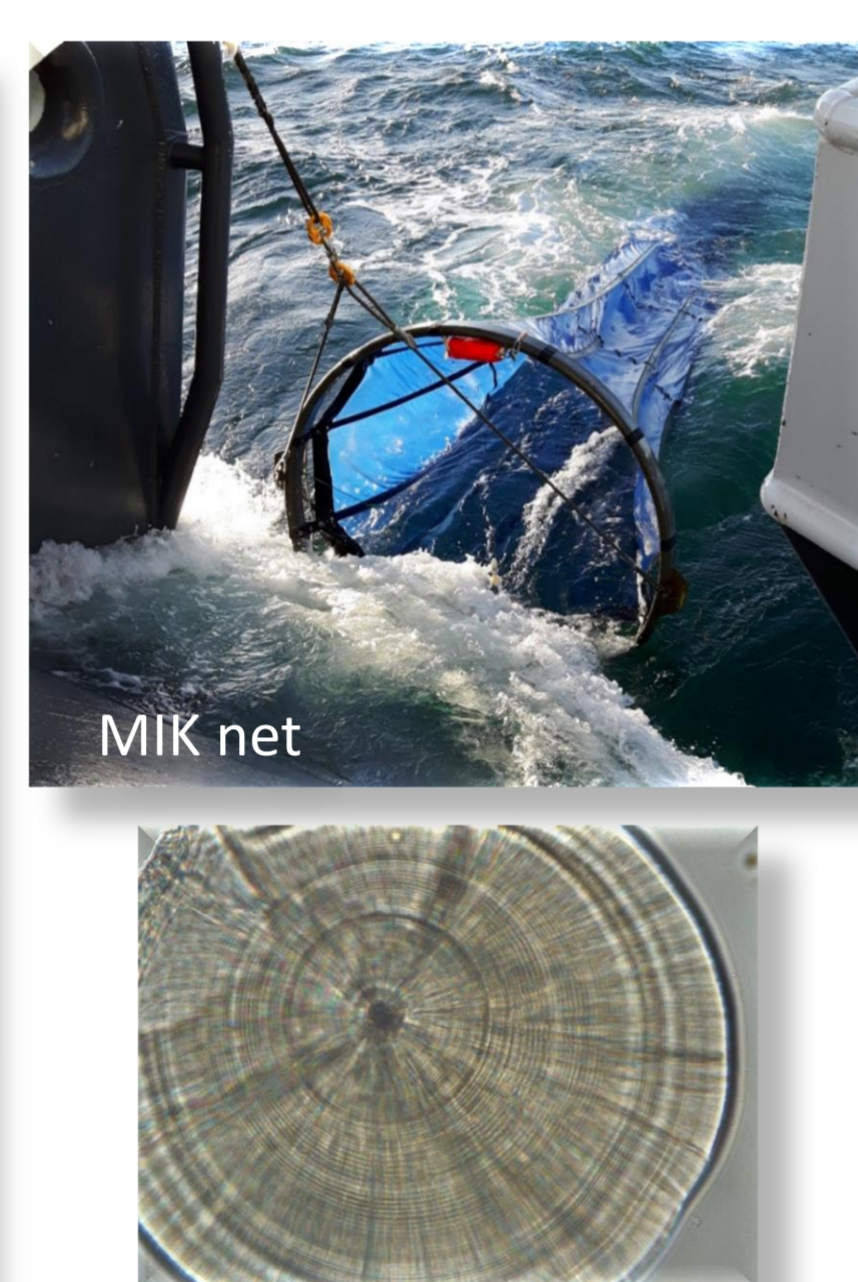
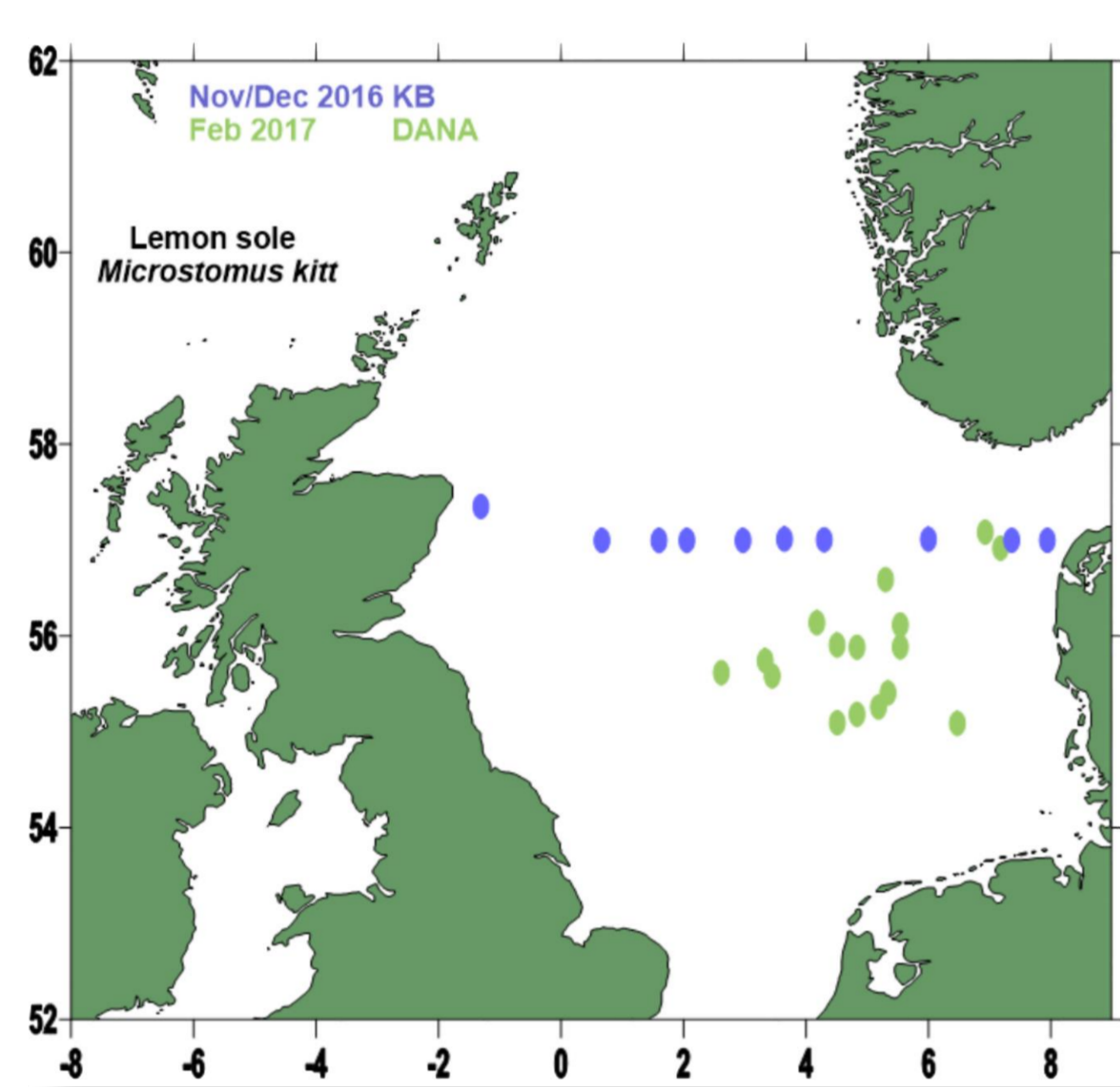
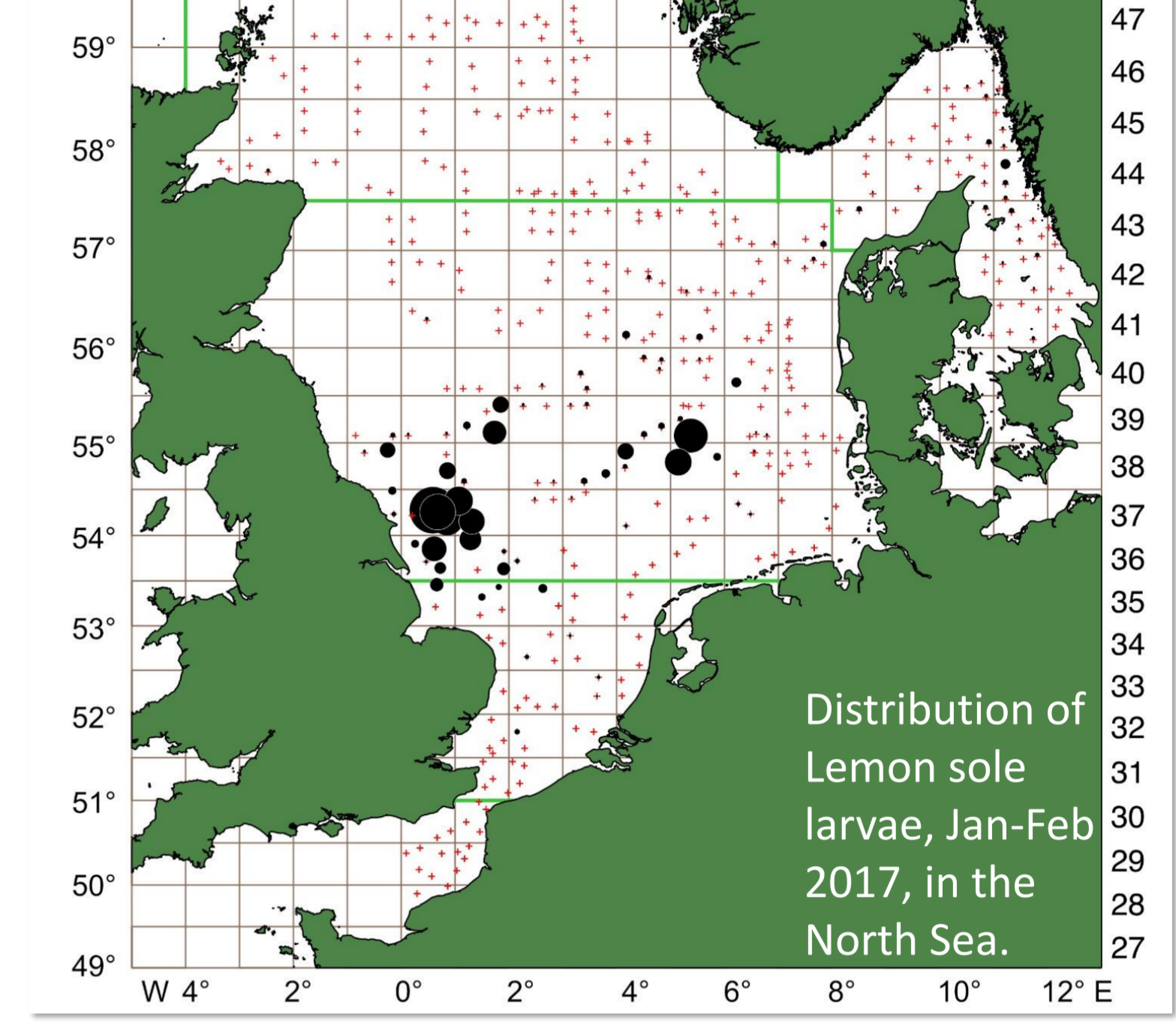


Lemon sole (*Microstomus kitt*) is a commercially valuable flatfish found down to a maximum depth of 1,105m (Goldsmith *et al.* 2015). Its distribution ranges from the Barents Sea and around Iceland in the north, to the Bay of Biscay in the south. Despite its value, there is little information on the early life history stages.

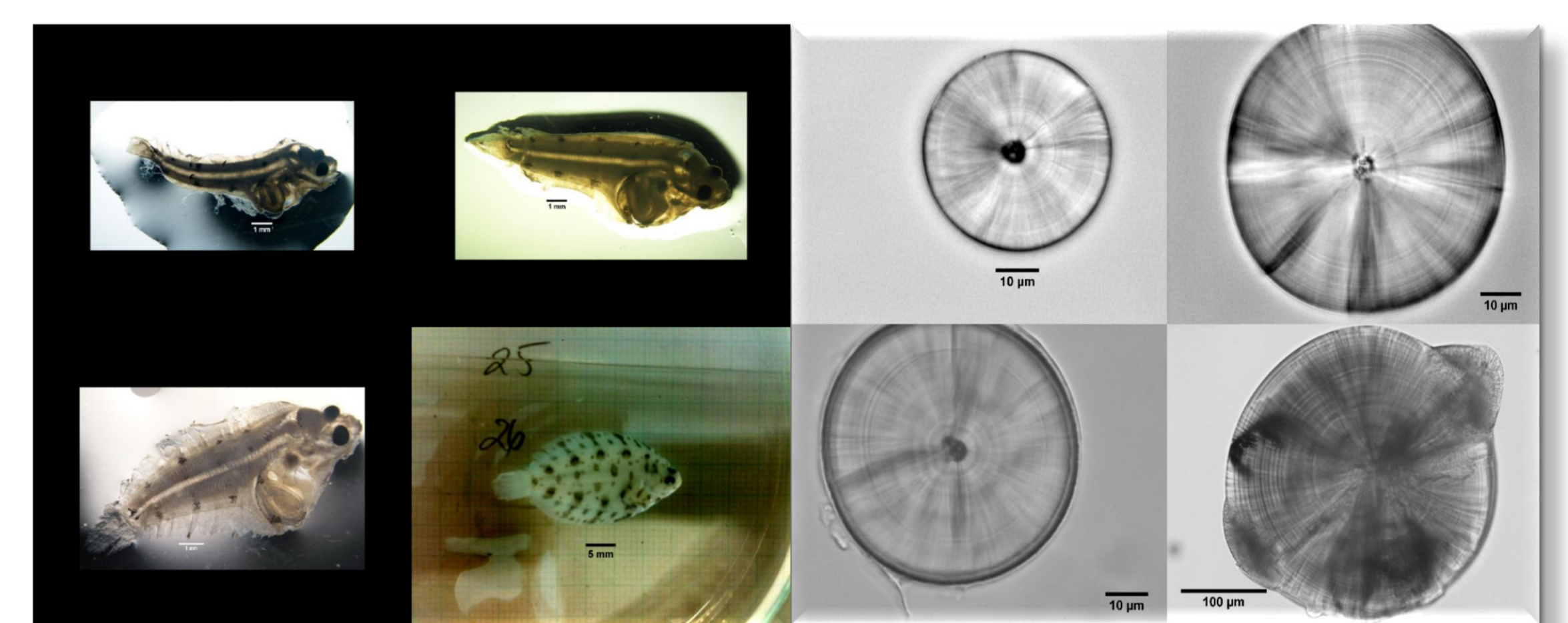
Early studies suggested that spawning begins in early May and last through November (Russell 1976, R onnestad *et al.* 1992). Eggs and larvae were caught mostly in May – July in waters southwest of the UK (Russell 1930). However, ICES egg and larval surveys in the North Sea report catches of lemon sole larvae well into the winter months (ICES WGEGB2 – Egg and larvae surveys in the North Sea). Rae (1965) found lemon sole larvae in the North Sea in deeper waters; they were most abundant between 50 – 100m depth.



Lemon sole larvae were caught in November/December 2016 (RV Kristine Bonnevie = KB) in the northern North Sea and also in similar areas during January/February 2017 (RV Dana = DANA). In both cases the larvae were caught using ICES standard 2m Midwater Ring Trawls (MIK) during the IMR standard transect sampling and the ICES IBTS MIK survey.

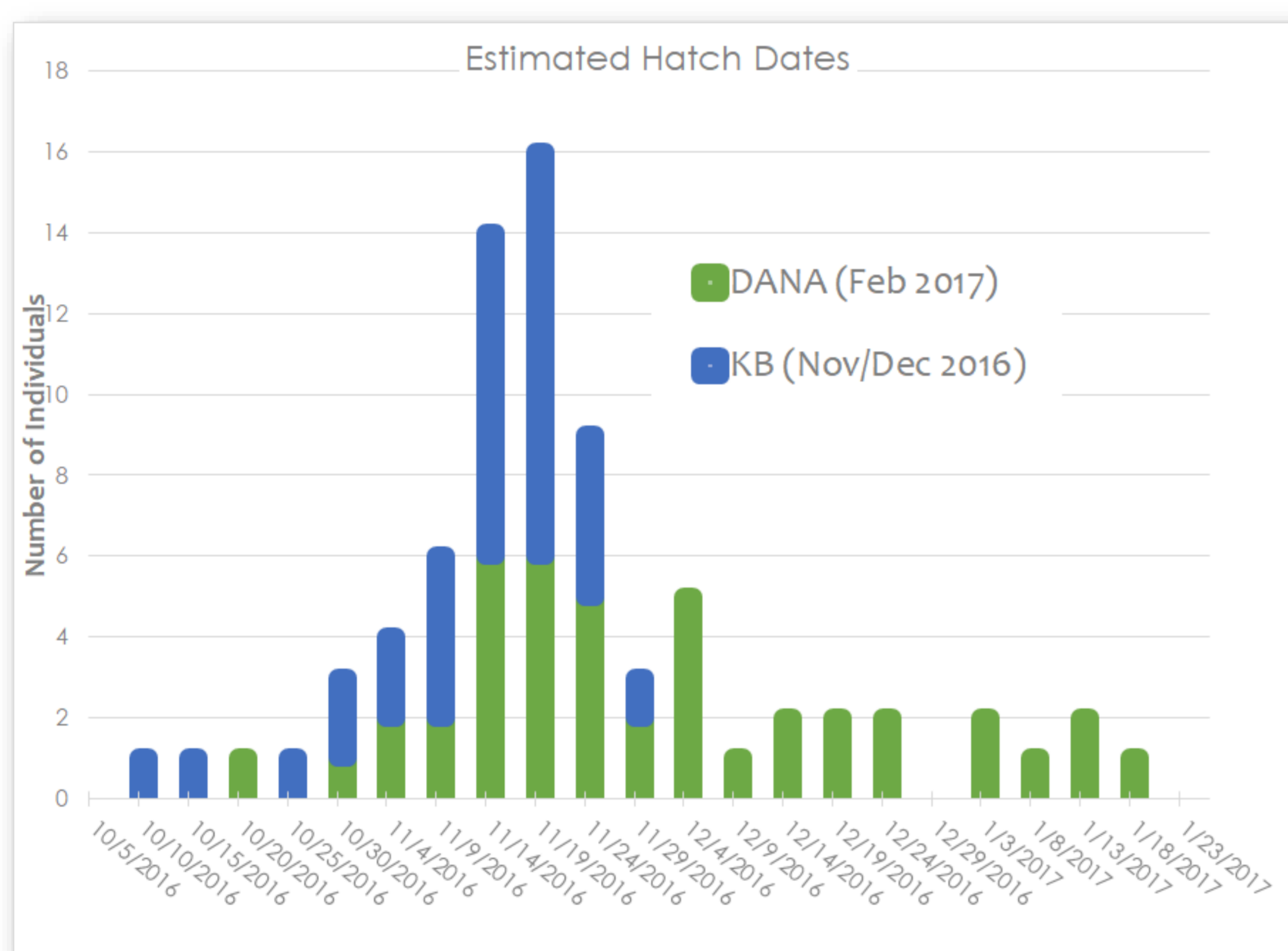


Otolith increments were counted to estimate individual age, assuming that daily increment formation begins at hatching and continues throughout the pelagic stage. Estimated hatching dates were calculated for each individual by subtracting age from date of capture. Approximately 10-13 days elapse between spawning and hatching, at the temperatures of between 7 and 8°C in the lower water column (see Howell 1972; R onnestad *et al.* 1992).

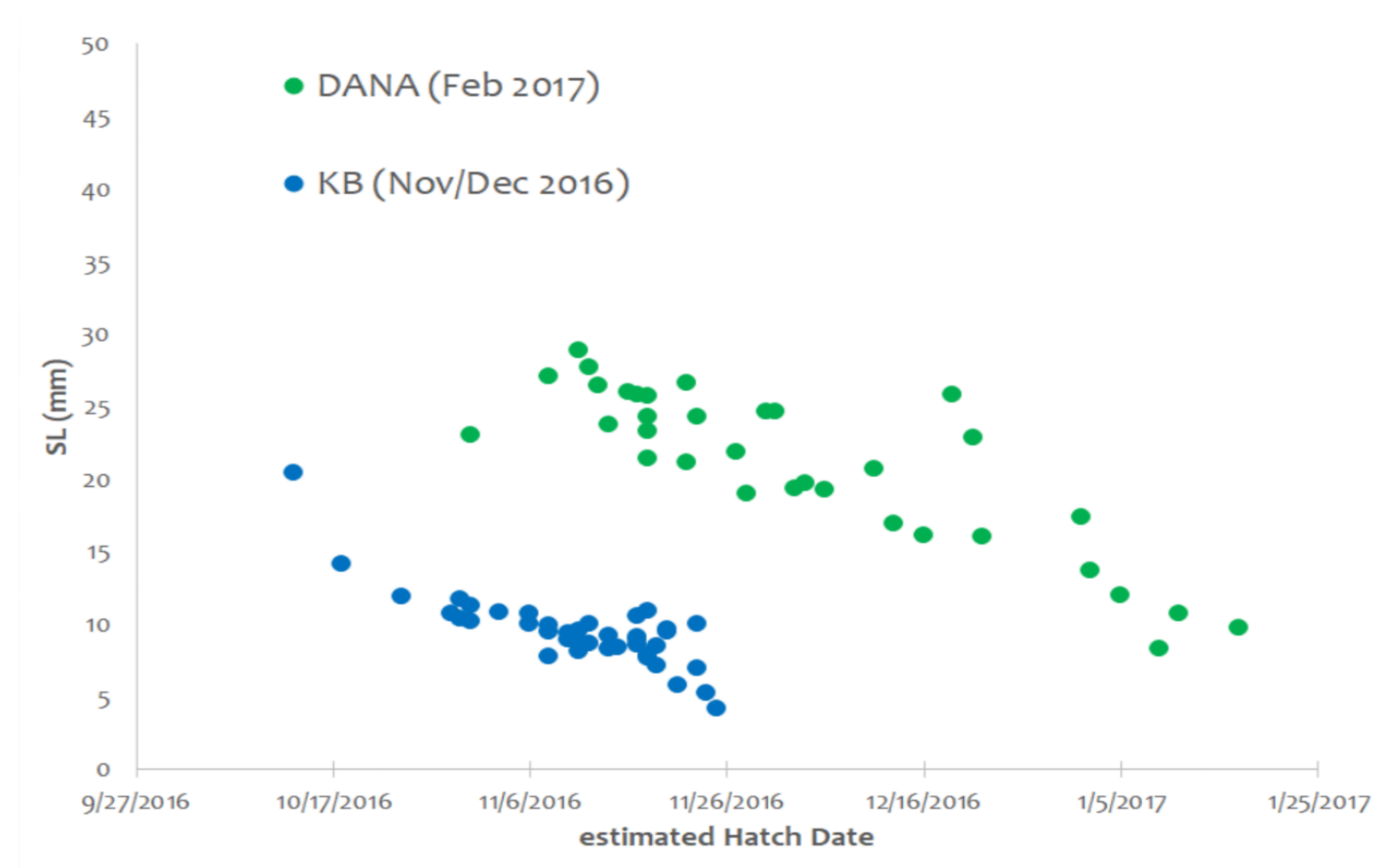


Lemon sole larvae (left) and the otoliths extracted from each larva (right). Note the accessory primordia in the otolith from the largest larva.

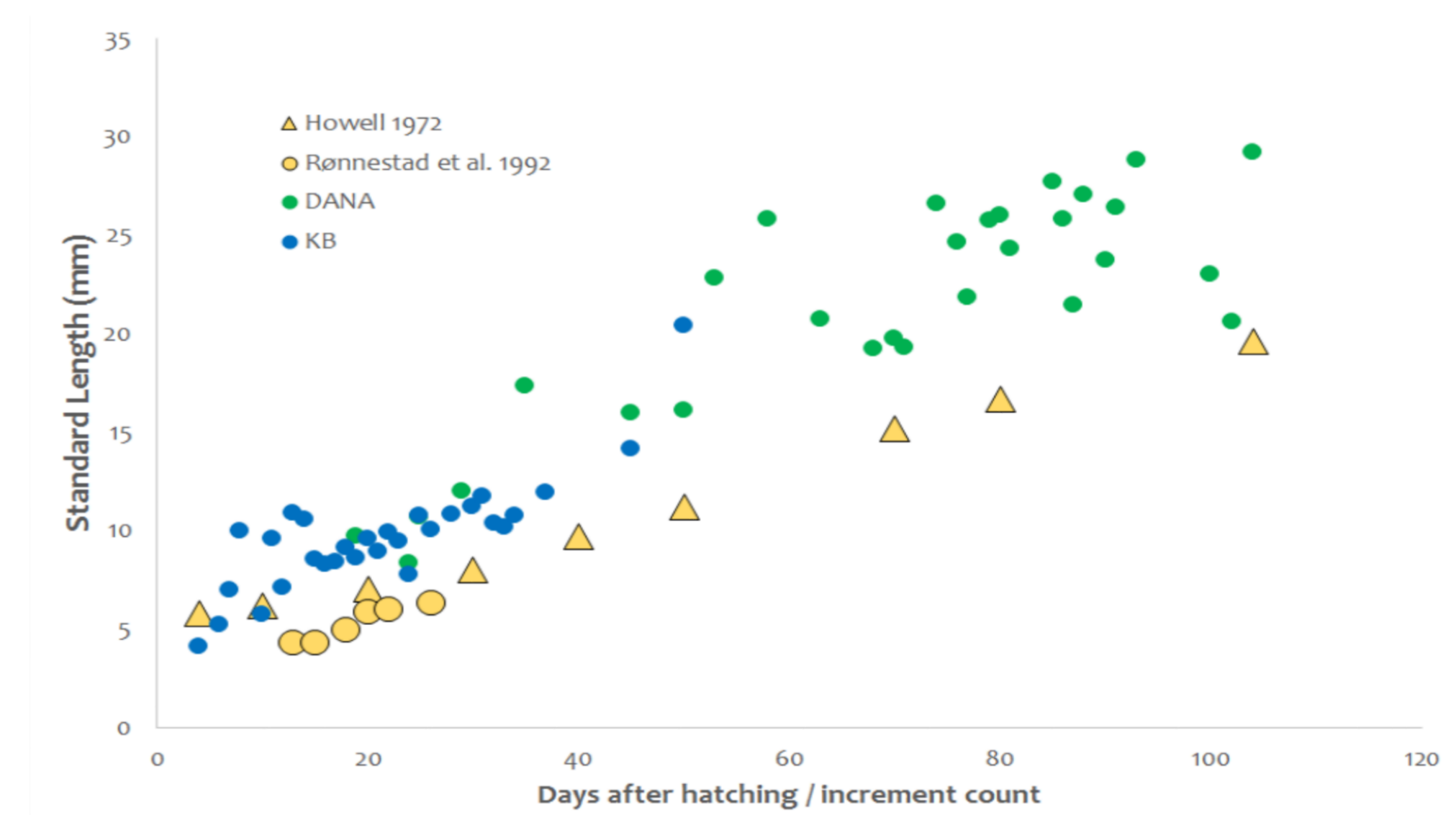
Station locations of larvae used for otolith analyses



Over both survey periods the otolith primary increment data suggests that the main hatching period of the larvae caught was the 9-29th November 2016. Assuming a 10-14 day incubation period for the eggs this would suggest these larvae were spawned in the last week in October or first week in November. The presence of very small larvae in the February sampling, with estimated hatching dates in early to mid January, suggest that spawning may continue in to late December and early January.



The length at increment count/age post hatching was generally larger in the field caught larvae (in blue and green) compared with reared larvae (in orange).



The estimated hatching time extends the predicted spawning season, compared to historical data for this species in the northern North Sea. The drift modelling from the historical spawning grounds, using the age data of the larvae, suggests that all larvae originated from these spawning grounds, irrespective of when they were sampled.

Some Pleuronectids have an extended pelagic stage, and may overwinter in a pre-metamorphic state. The presence of lemon sole larvae in survey samples spanning November – February raises the question of whether the spawning times have shifted in the northern North Sea, and what stages are present in the plankton during winter months. Overwintering as pelagic larvae could also cause problems with the identification of the first annual ring when some fish are aged.

References: Goldsmith, D. *et al.* 2015. 75:5 Lemon sole – *Microstomus kitt*. Pp 462-464. In: Heessen, H.J.L. *et al.* (eds) Fish atlas of the Celtic Sea, North Sea and Baltic Sea. Wageningen Academic, The Netherlands. Howell, B.R. 1972. Preliminary experiments on the rearing of larval lemon sole *Microstomus kitt* (Walbaum) on cultured foods. *Aquaculture* 1: 39-44. Rae, B.B. 1965. The Lemon sole. Fishing News (Books) Ltd, London. Russell, F.S. 1930. The seasonal abundance and distribution of the pelagic young of teleostean fishes caught in the ring-trawl in offshore waters of the Plymouth area. *J. mar. biol. Ass. UK*. 16: 707-722. Russell, F.S. 1976. The eggs and planktonic stages of British marine fishes. Academic Press, London. R onnestad, I. *et al.* 1992. Utilization of free amino acids related to energy metabolism of developing eggs and larvae of lemon sole *Microstomus kitt* reared in the laboratory. *Mar. Ecol. Prog. Ser.* 88: 195-205. Sundby, S. *et al.* 2017. Dynamic mapping of North Sea spawning – Report of the KINO project. *Fisken og Havet* Number 2–2017.

