

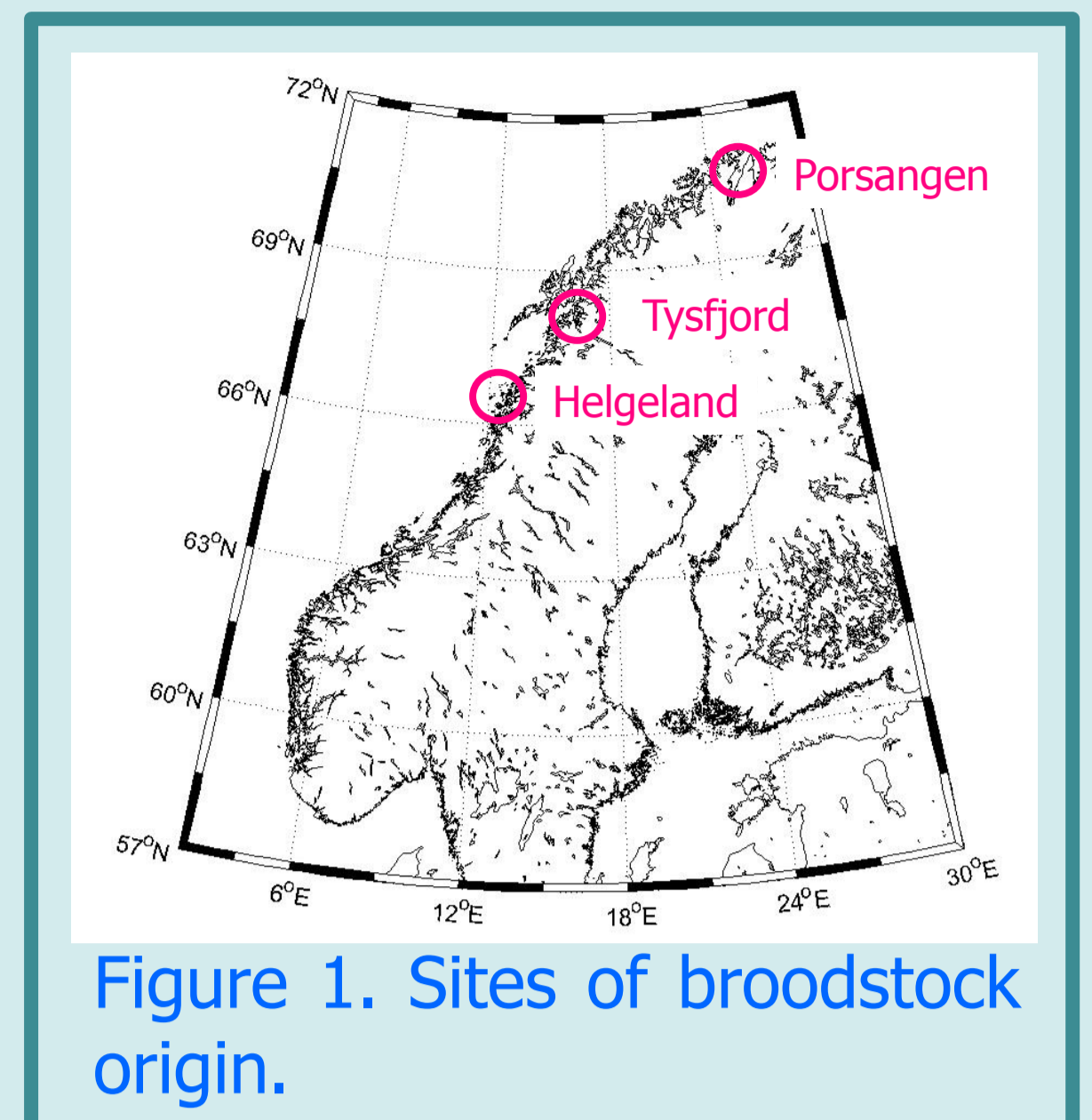
Bio-physical properties of Norwegian coastal cod eggs

Kyungmi Jung, Svein Sundby*, Anders Thorsen*, Arild Folkvord, and Olav Sigurd Kjesbu*
University of Bergen and *Institute of Marine Research, Norway



Kyungmi.Jung@bio.uib.no

Vertical distribution of fish eggs and larvae is a key factor for transport and retention of the offspring and for issues linked to mixing/separation between populations. In combination with site fidelity and natal homing of older cod, it serves as a mechanism maintaining genetic differentiation among local populations. The vertical distribution is determined by the combined effects of local salinity structure of the ambient water and by the specific gravity of the eggs. Here we have studied bio-physical properties of Norwegian Coastal cod (*Gadus morhua*) eggs from different areas (Porsangen, Tysfjord, and Helgeland) in northern Norway during the spawning season, March to April, 2009.



COD EGG BUOYANCY

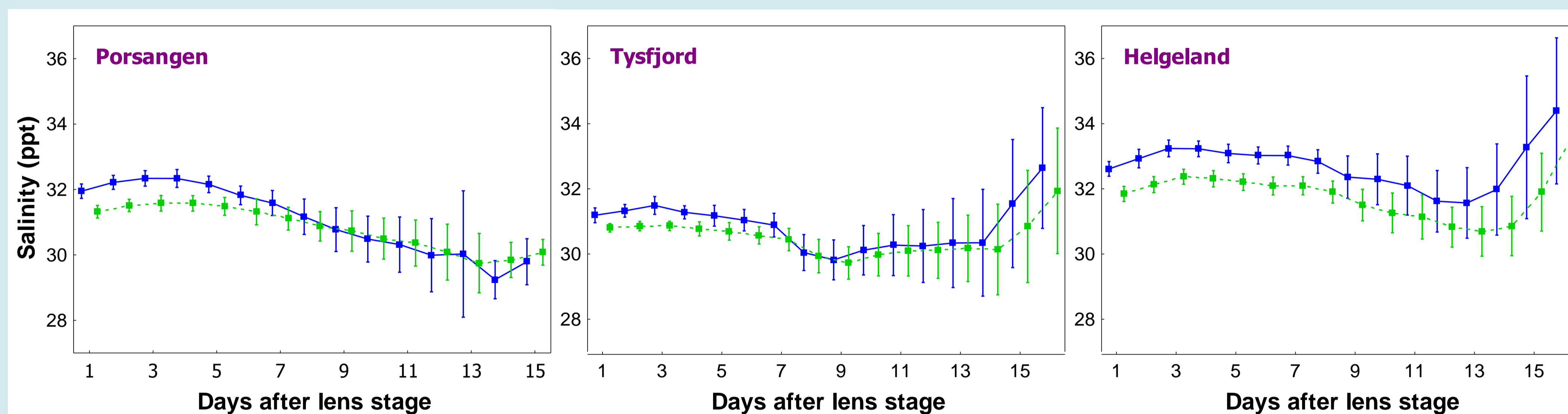


Figure 2. Egg buoyancy expressed in ppt salinity where the eggs are neutral buoyant. (a) Porsangen; (b) Tysfjord; (c) Helgeland. Values are means from two replicate columns. Vertical bars are standard deviation.

DIFFERENCE AMONG COD POPULATIONS

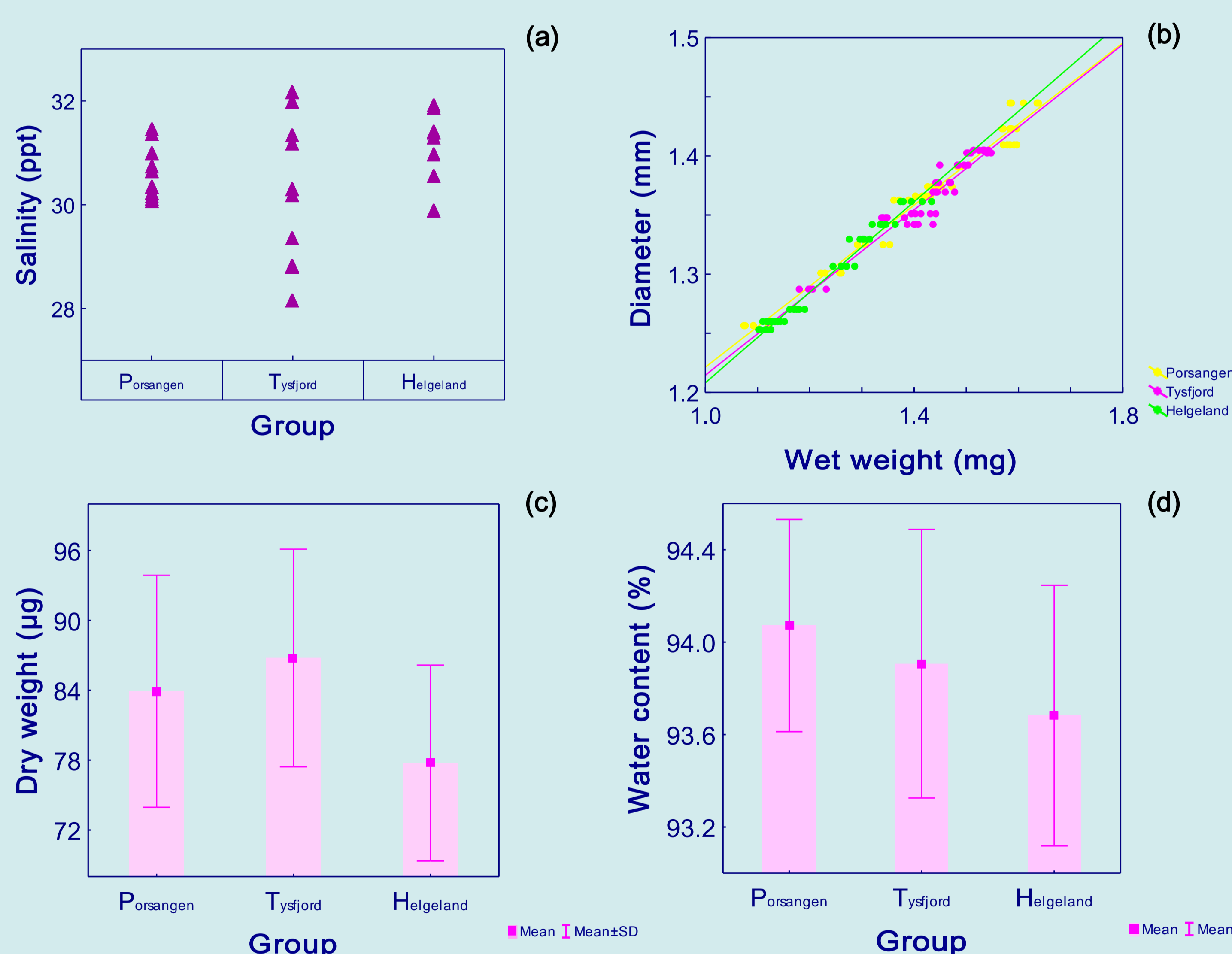


Figure 3. Biological differences among coastal cod populations. (a) Neutral buoyancy variation; (b) Diameter and Wet weight; (c) Dry weight; (d) Water content.

According to neutral buoyancy of developing cod eggs, fertilized eggs first increase the specific gravity slightly until they complete gastrulation, and then become more buoyant. All three groups of eggs showed a similar buoyancy pattern during incubation period, but when approaching hatching the Tysfjord and Helgeland groups of eggs were somewhat heavier than those of the Porsangen group (Figure 2). Tysfjord cod eggs had a wider range of neutral buoyancy, Helgeland cod eggs had a smaller size and contained less water, and Porsangen cod eggs showed the highest water content (Figure 3). With the model simulation, Porsangen and Helgeland cod eggs had a similar pelagic vertical distribution pattern because they had the similar range of buoyancy as well as constant salinity profile with depth, Tysfjord cod eggs varied according to the combination of different buoyancy and salinity structure with brackish water on the surface (Figure 4).

VERTICAL DISTRIBUTION

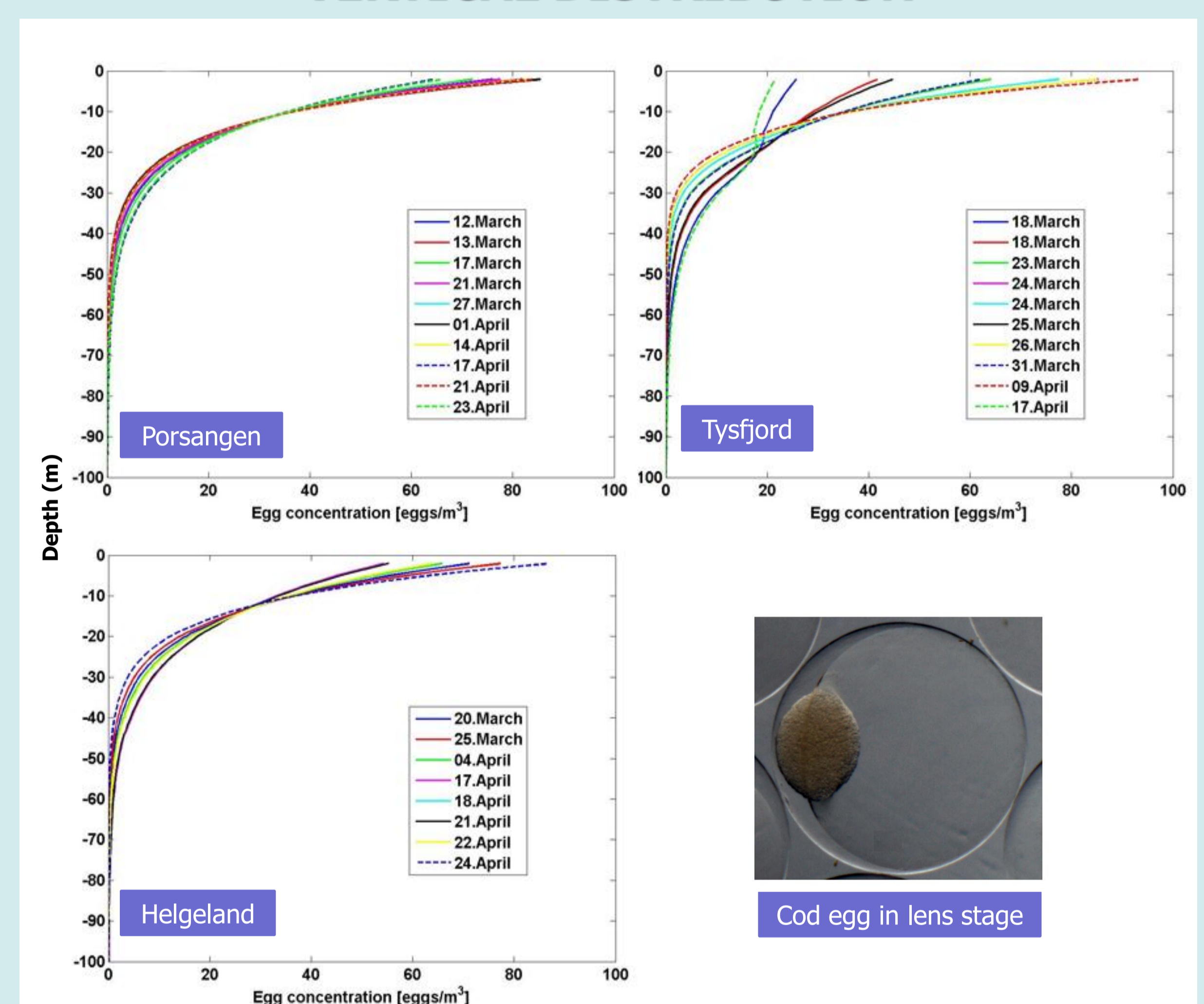


Figure 4. Modelled vertical distribution of cod eggs during the spawning season. Eggs used for this study were in the lens stage. The white boxes show experimental dates. It is based on March or April average salinity profiles of each region.

MAIN FINDINGS

- When it comes to biological features, there are more similarities between the Porsangen and Tysfjord cod eggs. Helgeland eggs are significantly different in a size and water content.
- Based on developmental differences in buoyancy, Porsangen cod eggs would contain more water in later stages to make more buoyant.
- If we assume that most of the coastal cod spawn in the head of fjords, it might be possible in Tysfjord that a heavy fraction from the buoyancy variation can reduce the occurrence of eggs near the surface, resulting in high survival and retention in the fjord. However, Porsangen cod eggs seem to be more vulnerable to offshore transport because there is no halocline in the prevailing salinity structure during the spawning season.