Norwegian Institute for Water Research

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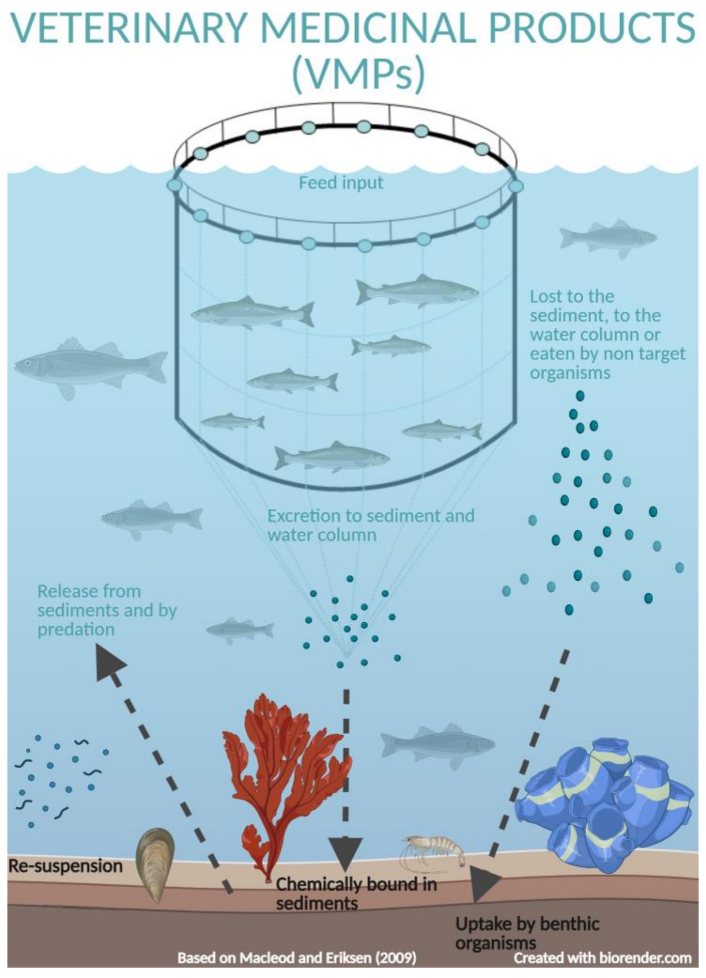
Effects of Teflubenzuron on the early development of the sea urchin *Brissopsis lyrifera* and the brittlestar *Amphiura filiformis*

Background



The salmonid aquaculture industry can be affected by biofouling and diseases.

Different types of antifouling compounds and veterinary medicinal products (VMP), have been used to control biofouling and parasites such as sea lice.

Teflubenzuron (TEF) is one VMP that has historically been used in Norway, but it is very persistent (half-life of 170 days in sediment) and has potentially toxic effects on non-target organisms.

The main objective of this study was to assess the effects of TEF on two benthic organisms, representative of the Nordic environment. The sea urchin *Brissopsis lyrifera* was chosen because it can alter sediment grain distribution, while the brittlestar *Amphiura filiformis* is a burrowing organism that uses its arms for suspended feeding.

Fig 1. Source of veterinary medicinal products and organic matter in the marine environment.

Approach

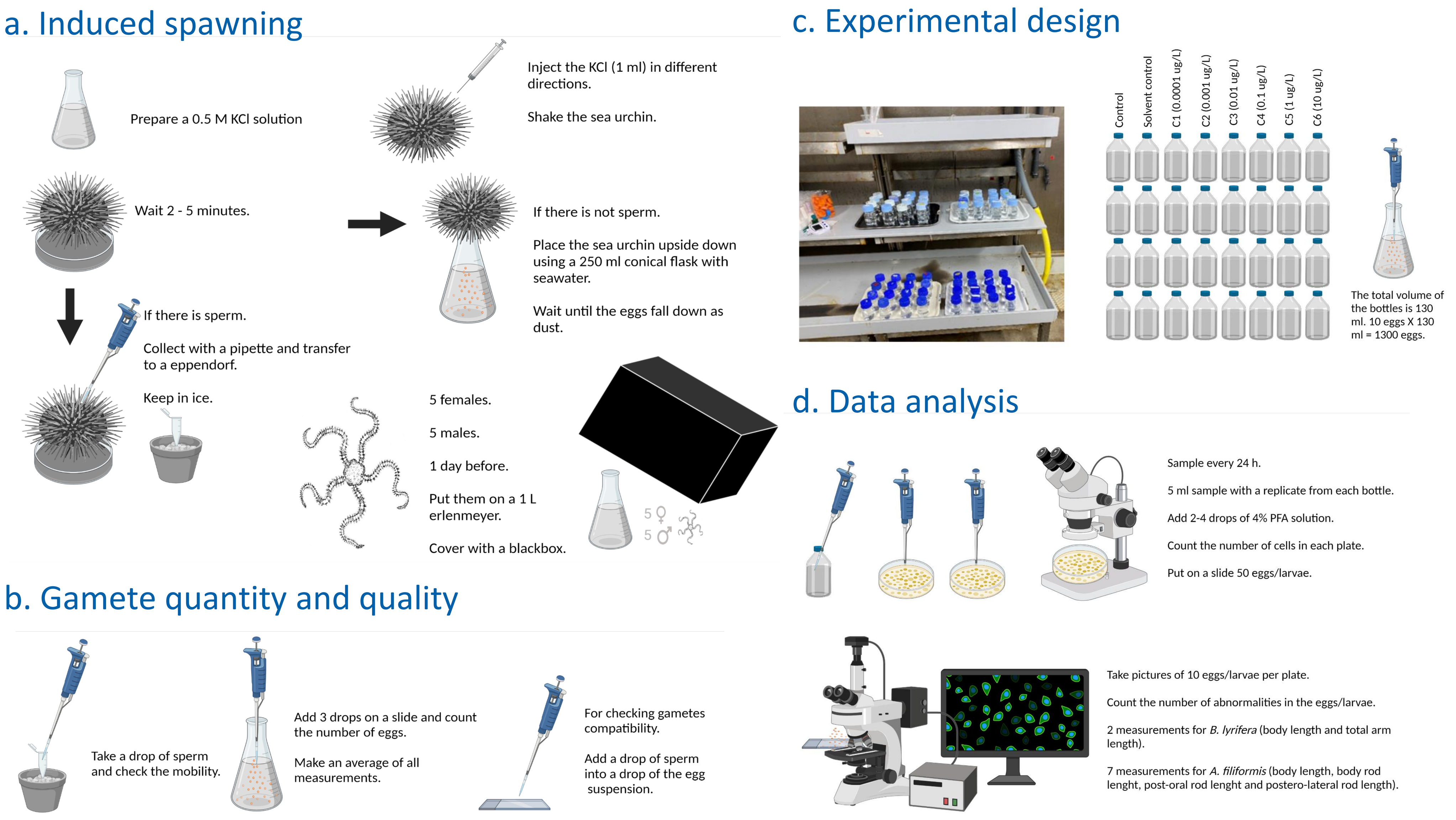


Fig 2. *B. lyrifera* and *A. filiformis* embryo development approach. (a) induced spawning, (b) gamete quality and quantity, (c) experimental design and (d) data analysis.

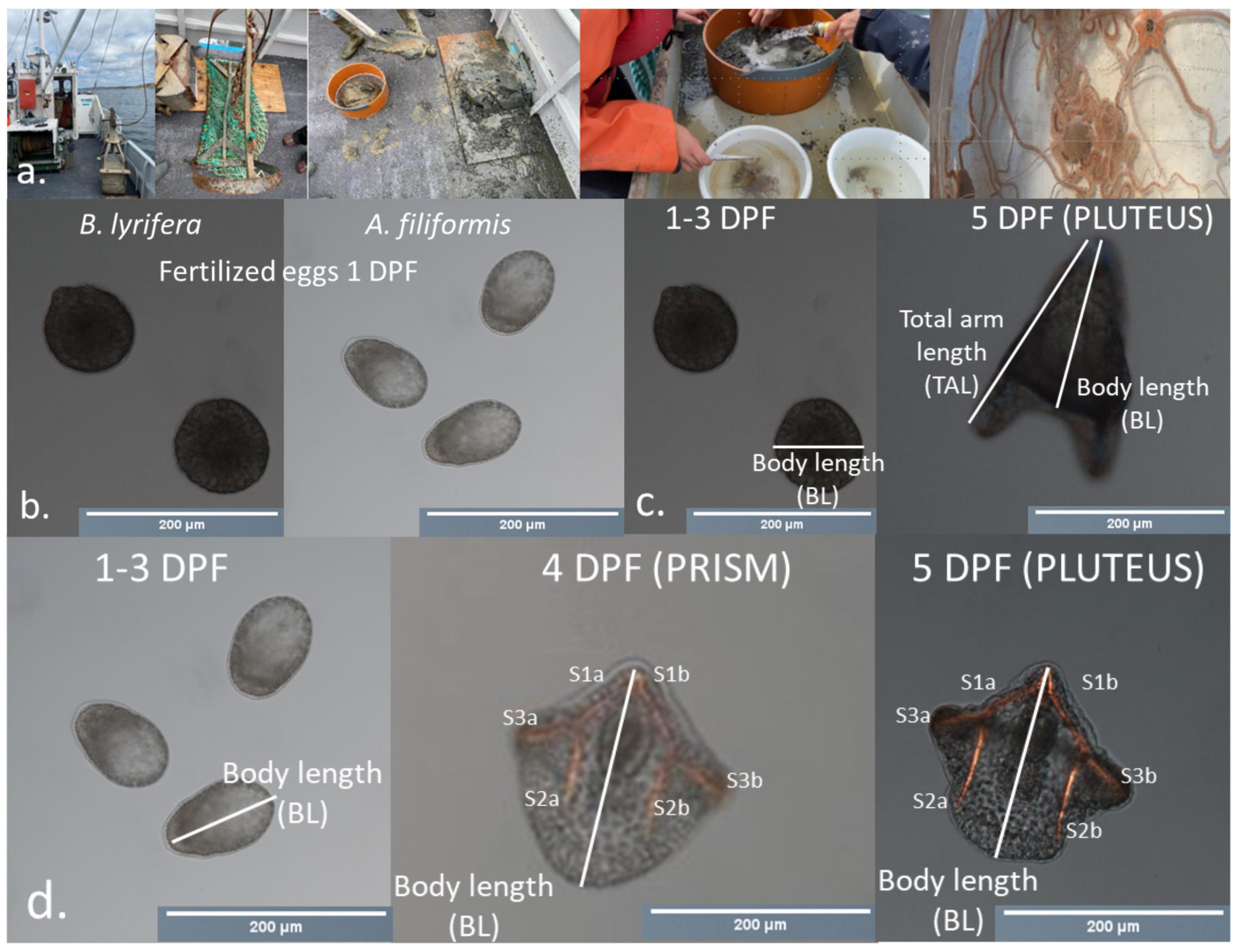


Fig 3. Sampling and morphometric analysis. (a) sampling campaign, (b) fetilized eggs for both species, (c) *B. lyrifera* and (d) *A. filiformis*. * S1a,b: body rod length (right and left), S2a,b: post-oral rod length (right and left) and S3a,b: postero-lateral rod length (right and left).

Results

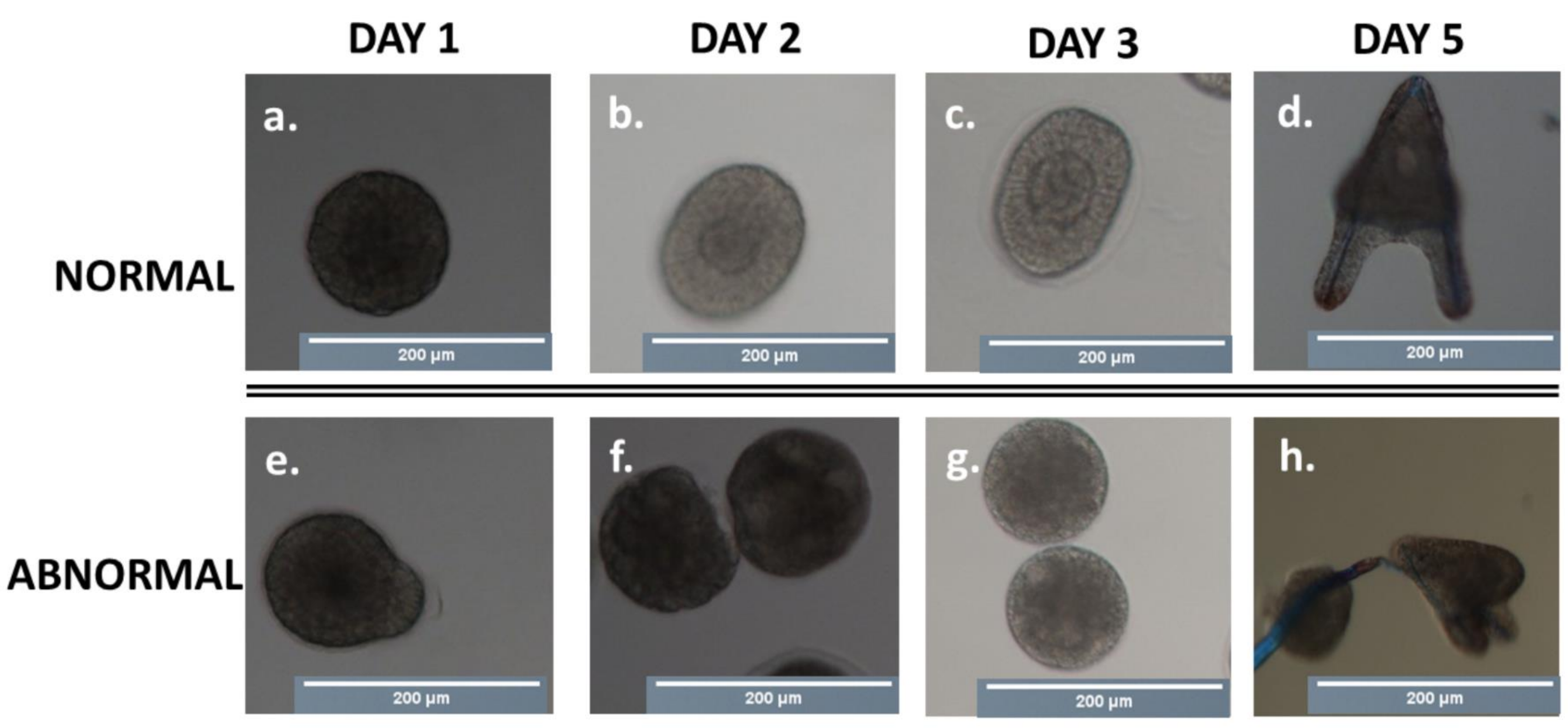


Fig 4. Normal and abnormal embryo development of the sea urchin *B. lyrifera*. (a):(c) blastula, (d) pluteus, (e) unstable fertilization membrane with a polyspermic egg, (f):(g) zygotes with dense material and (h) malformed pluteus.

- 1123 eggs/larvae analyzed for body length.
- 264 pluteus larvae measured for symmetry analysis (day five).
- No statistical differences for mortality, growth rate and total arm length symmetry.

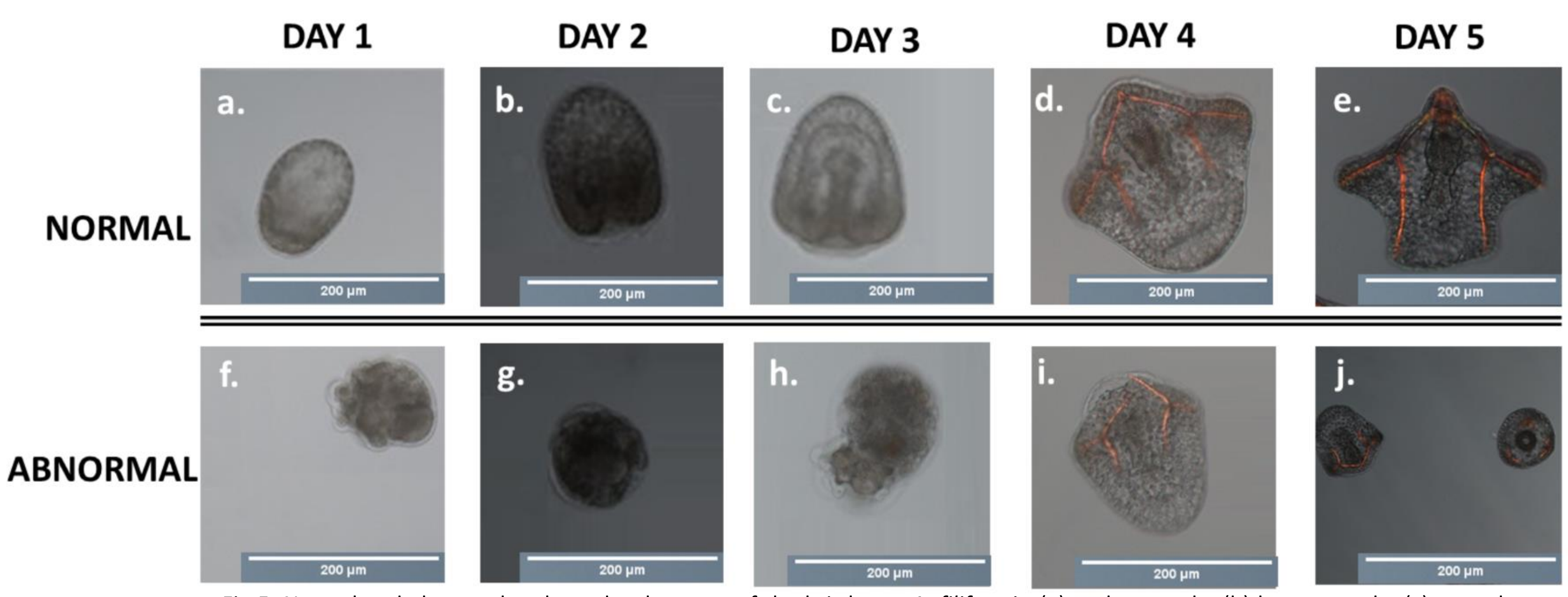


Fig 5. Normal and abnormal embryo development of the brittlestar *A. filiformis*. (a) early gastrula, (b) later gastrula, (c) grastula, (d) prism, (e) pluteus, (f) unhatched gastrula, (g):(h) exogastrulae and (i):(j) rod malformation.

- 1538 eggs/larvae analyzed for body length.
- 601 pluteus larvae measured for symmetry analysis (days four and five).
- No statistical differences for mortality, growth rate and body rod length and postero-lateral length.
- Differences only found for abnormality percentage and post-oral rod length symmetry.

Conclusions

Toxicity studies using pesticides and sea urchins often observe developmental anomalies in the early stages from gamete to zygote (Gambardella *et al.*, 2021). In this study there were no significant effects in *B. lyrifera* exposed to TEF for any endpoint. The only significant effect of TEF was for abnormality percentage and post-oral rod length symmetry in *A. filiformis,* but this was not a dose dependent response. In conclusion, the echinoderms species used in this study were not as susceptible to the effects of TEF compared to other classes of organisms such as crustaceans (Mendez, 2005; Samuelsen *et al.*, 2014; Macken *et al.*, 2015), which is not surprising based on the mode of action of TEF and the way it effects chitin producing organisms.

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