

Covering behaviour of echinoids in an Arctic fjord

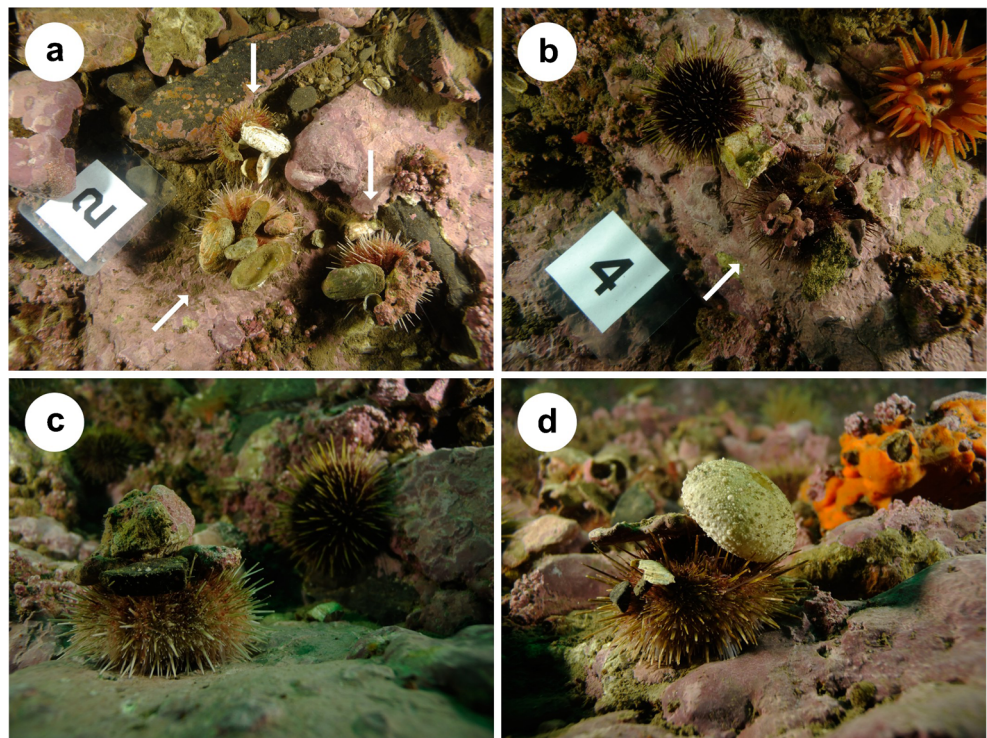
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Several reports suggest that piling debris on the surface of echinoid skeletons, so-called ‘masking’ or ‘covering’ behaviour, provides camouflage or physical protection against predators. Others have ascribed masking in shallow water echinoids to a response to light incidence or UV radiation (e.g.

Adams 2001; Verling et al. 2002). Further studies have argued that covers are used due to multiple factors (Dumont et al. 2007), including protection from desiccation or as ballast in turbulent waters. Observations from the bathyal zone (Pawson and Pawson 2013) showed that light or most factors

Fig. 1 Covering behaviour of *Strongylocentrotus droebachiensis* (O.F. Müller). Arrows indicate covered individuals. Badge number (a, b) is 5 cm long



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hypothesised to cause covering in shallow water echinoids are insufficient to explain such behaviour in the deep sea and hence reinvestigations are needed.

We report a new finding from Isfjorden (Spitsbergen), where abundant sea urchins, *Strongylocentrotus droebachiensis* (O.F. Müller), frequently (25.7 % among 498 echinoids captured by 99 photographs) cover their bodies with the shells of bivalves (Fig. 1a), gastropods, calcareous algae (Fig. 1b), stones (Fig. 1c), seaweed and dead conspecifics (Fig. 1d), without notable selectivity. At the surveyed depths (5–30 m), benthic light intensity is high (up to 14 466 lx), as recorded by multi-year data from multiple loggers. Simultaneously, predation is rather low, as evidenced by high echinoid density, their non-bimodal size distribution and the lack of repair scars or regenerated echinoid spines. Low predator diversity, abundance, metabolism, and rarely observed attacks on echinoids during hundreds of SCUBA hours support the argument of low predation intensity.

Covered and uncovered individuals co-occur (Fig. 1b, c), while all are exposed to the same dose of light and have the same probability of being eaten. Thus, the covering behaviour adopted by a number of shallow water species worldwide accounts for non-functional interpretation, e.g. tactile reflex action, which is similar

to echinoids living in bathyal settings (Pawson and Pawson 2013).

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References

- Adams NL (2001) UV radiation evokes negative phototaxis and covering behaviour in the sea urchin *Strongylocentrotus droebachiensis*. *Mar Ecol Prog Ser* 213:87–95
- Dumont CP, Drolet D, Deschênes I, Himmelman JH (2007) Multiple factors explain the covering behaviour in the green sea-urchin, *Strongylocentrotus droebachiensis*. *Anim Behav* 73:979–986
- Pawson DL, Pawson DJ (2013) Bathyal sea urchins of the Bahamas, with notes on covering behavior in deep sea echinoids (Echinodermata: Echinoidea). *Deep Sea Res II* 92:207–213
- Verling E, Crook AC, Barnes DKA (2002) Covering behaviour in *Paracentrotus lividus*: is light important? *Mar Biol* 140:391–396