

Berntsson, Kent M 2001. Larval behaviour of the barnacle *Balanus improvisus* with implications for recruitment and biofouling control

Abstract: Invertebrate larvae are the prime agents of marine biofouling and the sequence of fouling can best be understood from a larval ecology perspective. This thesis investigates processes involved in the fouling sequence of the barnacle *Balanus improvisus* the most notorious fouler on man-made surfaces on the Swedish west coast.

The barnacle was identified as a major fouler in a study of fouling development on static, artificial panels in the Tjörnö archipelago on the northwest coast of Sweden and on boat hulls sailing the Kattegat and Skagerrak Seas. The dominant sessile species on static panels were the barnacle *B. improvisus* (July through September), the mussel *Mytilus edulis* (June through August) and the hydroid *Obelia geniculata* (June through November). Succession of foulers on panels led to a dominance of *M. edulis*. This was in contrast to the fouling on boat hulls where *B. improvisus* was the dominant species. Assessment of *B. improvisus* recruitment during 4 years (1997-2000) showed that recruitment was abundant and predictable on artificial substrates from July until September each year although the intensity of recruitment varied by orders of magnitude within the examined area. Variation in recruitment was mainly driven by the number of larvae arriving at settlement sites, local water motion and behavioural responses. On the coastal scale larval supply varied 10-fold due to Ekman-transport of surface water towards and out from the coast. Within the archipelago scale larval supply differed more than 10-fold among the studied stations. Recruitment was positively correlated with larval supply and negatively correlated with local water motion. Approximately half of the cyprids that encountered settlement panels accepted the substrate and recruited although this proportion varied among sites. Differences in the proportion of recruitment between sites were presumably a consequence of behavioural responses to local flow. This was supported in flume experiments demonstrating that cyprids leave surfaces after exploration at higher flow velocities.

Barnacle cyprids have the capacity to reject or accept settlement sites based on a broad range of cues. *Balanus improvisus* settlement, recruitment and behaviour was examined on surfaces that differed in attractiveness for settlement. Settlement and recruitment was heavily reduced on surfaces with certain topographies compared to smooth surfaces and almost unaffected by conspecific extracts. Cyprid exploratory behaviour was inhibited on topographic surfaces and stimulated by conspecific settlement factor. Inhibition involved that cyprids rejected topographic surfaces after exploration and swam off more often than on smooth surfaces. These studies indicate that surface topography is a stronger cue for settlement than conspecific attraction in *B. improvisus*.

It is concluded that cyprids' choice of settlement sites is an important factor in the settlement process of *B. improvisus*. Furthermore, knowledge of the stimuli affecting larval settlement behaviour can be exploited to create surfaces unattractive for settlement. This may form an interesting basis for future, less-toxic methods to control marine biofouling. Finally, assays based on larval behaviour may be a rapid method to find and develop new antifouling products.

Key words: *Balanus improvisus*, Biofouling, Recruitment, Settlement, Habitat selection, Larval behaviour, Exploratory behaviour, Conspecific attraction, Rejection behaviour Contact rate, Hydrodynamics, Larval supply, Micro-topography, Micro-texture, Antifouling

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