



Modelling the potential inter-connectivity of proposed Marine Protected Areas in the North Sea

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Marine Protected Areas (MPAs) are being defined on the northwest European continental shelf to support conservation of marine habitats. Such MPAs should form a network that offers protection to all the life stages of key species. The various MPAs within a network should be 'connected', i.e. species should be able to travel between them, either by advection through currents or by active swimming behaviour. Here we investigate the potential inter-connectivity of the proposed offshore Natura 2000 sites in the southern North Sea for the egg and larval stages of ten common benthic species. The species include invertebrates, crustaceans and fish species. The work was carried out using a three-dimensional hydrodynamic model and a lagrangean Individual Behaviour particle tracking Model (IBM). The results showed similar trends in potential connectivity between the species, but with considerable variations because of differences in life-history characteristics. The modelled potential connectivity mainly followed the stream lines of the residual circulation, thus separating the proposed Natura 2000 MPAs into three distinct groups that had little connectivity between them. Moreover, some of the proposed MPAs contained substantial numbers of propagules from a large number of species, suggesting that their ecosystems have potential to support themselves, whereas others seemed more reliant on propagules from other proposed MPAs, and some received only few propagules either from themselves or from other proposed MPAs. Based on these results, a procedure to define MPA networks is proposed.