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Genomic and phenotypic analyses of polychaete sibling species *Platynereis dumerilii* and *Platynereis massiliensis* in relation to Ocean Acidification

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Thesis submitted for the degree of Doctor of Philosophy

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September, 2017

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Abstract

The increase of anthropogenic carbon dioxide emissions and the subsequent uptake of CO_2 by the sea, is leading to a decrease in the pH of the oceans, a process known as Ocean Acidification. One of the main challenges of the current research on climate change is to determine how marine species respond to low pH/elevated pCO_2 conditions.

This thesis has investigated the effects of natural OA on the polychaete species *Platynereis dumerilii* and its sibling *P. massiliensis* (Annelida, Nereididae) as driver of genetic differentiation and phenotype/genotype selection. *Platynereis* spp. populations were sampled in five geographical areas situated along a thermo-latitudinal gradient along the Italian coasts, characterized by different pH conditions (acid *vs* normal). A multidisciplinary approach, focused on different aspects of the target species biology, was chosen and the following analyses were performed: (a) morphological and morphometric analyses of different populations/genotypes; (b) laboratory rearing of different populations to study the reproductive biology and gamete morphology; (c) population genetics by the amplification of a mitochondrial DNA marker (COI); (d) population genomics by a next-generation sequencing approach (RAD-seq); (e) background analyses and a long term laboratory experiment on selected genotypes/populations to study physiological responses to different pH conditions.

This work has confirmed that *Platynereis dumerilii* and *P. massiliensis* represent two complexes of sibling species characterized by contrasting life history traits, reproductive biology and gamete morphology. The overall *Platynereis massiliensis* predominance in the CO_2 vent systems is not a direct consequence of elevated pCO_2, but it seems to derive from a winning reproductive strategy (brooding habit) in low pH conditions. Unlike *Platynereis dumerilii*, *P. massiliensis* is potentially able to thrive in the CO_2 vents thanks to the higher stability of its antioxidant defence systems over temporal scale and its greater responsiveness to extreme hypercapnia conditions.