

Smell to Spawn: Olfaction and the reproductive axis in homing chum salmon *Oncorhynchus keta*

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Reproductive homing migration of salmonids requires accurate interaction between the reception of external olfactory cues for navigation to the spawning grounds and the regulation of sexual maturation processes. This study has assessed the progression of sexual maturation in homing chum salmon *Oncorhynchus keta* Walbaum along the brain-pituitary-gonadal axis by determining plasma steroid levels by time-resolved fluoroimmunoassays (TR-FIA) and pituitary gonadotropin expression, *sgnrh* expression in the brain and expression of five olfactory genes in the rosettes by quantitative PCR. A clear progression towards final maturation occurred in homing chum salmon from the coastal sea to 75 km upstream the rivers at the pre-spawning ground, mainly characterized by higher plasma 17 α ,20 β -dihydroxy-4-pregnen-3-one (DHP) levels, pituitary *lh β* expression and *sgnrh* expression in the post brain, and lower plasma testosterone (T) and 17 β -estradiol (E2) levels. At the pre-spawning ground the olfactory reception of spawning ground specific cues in the rosettes was activated as evidenced by the up-regulated expression of the *olfactory receptor family D subfamily 400 member 1 pseudogene (or400-1)*. The hypothesized functional link between olfactory reception and final maturation was supported by seven significant correlations between olfaction and maturation parameters and by PCA. Moreover, the specific correlations of olfactory gene expression with final maturation events even allows us to suggest support for the hypothesis that the activation of olfactory gene expression may be ordered along the reproductive axis.