The neuroendocrinology of fish sexual behaviour: mechanisms and implications for endocrine disruption studies

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Teleost fish are the most diverse vertebrate taxa with over 24,000 living species. Teleosts exhibit the widest range of modes of reproduction among vertebrates. The diversity in reproductive patterns includes gonochoristic species, male-to-female sex changing species, female-to-male sex changing species, serial (i.e. male-to-female-to-male) sex-changing species, simultaneous hermaphrodites, and asexual reproduction in some parthenogenic species. The fertilization mode also varies among teleosts: while most species are external fertilizers, live-bearers also occur in phylogenetic independent lines. Mating systems can vary from monogamous, to polygamous to promiscuous species. Also the patterns of parental care are the most diverse among vertebrates, with most species showing no care, to species with bi-parental, paternal or maternal care. The high variability in reproductive modes is also present within species, ranging from inter-population differences in mating systems, to the occurrence of alternative sexual phenotypes within the same sex. This wide variation in their modes of reproduction makes teleosts a group of election for the study of the proximate causes of reproductive behaviour in vertebrates. However, it also raises problems when one needs to extrapolate results across different taxonomic units (e.g. fish families/ vertebrate classes). The basic neuroendocrine mechanisms underlying teleost reproduction will be described and briefly compared to those of other vertebrates. The role of sex steroids and forebrain neuropeptides on the differentiation of reproductive phenotypes and on the expression of sexual behaviour will then be addressed. Finally, a brief review of studies on endocrine disruptors that have used fish reproductive behaviour as an indicator will be presented.

From this brief review I should stress the following points: (1) due to the great diversity among fish and to between species variations in reproductive physiology and how it responds to environmental stressors, it is advisable to use more than one species as a bioindicator; (2) most EDS studies have concentrated on few freshwater species (mainly poecilids); there is a need for the development of studies in costal and estuarine species, which are potential areas of contamination by EDS. A potential model for the use of toadfish vocalizations as a tool for the evaluation of contamination of such areas will be presented; (3) Most studies have concentrated on male sexual behaviour, since females usually do not exhibit conspicuous behavioural patterns. It will also be proposed to direct future studies to species with sex-role reversal, in which females are the active courting sex (e.g. peacock blenny). These new approaches may open new avenues of research for a more efficient use of fish behaviour as an indicator of endocrine pollution.