The steroidogenic enzyme aromatase catalyzes the conversion of androgens (androstenedione and testosterone) to estrogens (estrone and estradiol) and therefore plays a central role in reproduction. In contrast to most vertebrates, teleost fish have two distinct forms of aromatase. Because of this, and because brain aromatase activity in fish is up to 1000 times that in mammals, fish may be especially susceptible to negative effects from environmetal endocrine-disrupting chemicals (EDCs) that impact aromatase activity. In this study, we investigate the effects of four EDCs on reproduction and aromatase activity in brains and gonads from the marine fish cunner (Tautogolabrus adspersus) treated in vivo in the laboratory. The EDCs tested were estradiol, ethynylestradiol, octylphenol, and androstatrienedione. We address three hypotheses: (1) the activity of the two major aromatase isozymes in fish brain and gonad are differentially affected by exposures to different EDCs, (2) modulation of aromatase activity in fish brains or gonads can be used as an indicator of exposure to EDCs, and (3) significant changes in aromatase activity in brains or gonads of spawning fish are linked with reproductive dysfunction. Our results indicate that aromatase activity in brain and ovary are affected differently by exposure to the four tested EDCs. Significant modulation of brain aromatase activity occurred in spawning males, but not females, with exposure to all the tested EDCs, except octylphenol, which did not significantly affect any reproductive endpoint either. Changes in male brain aromatase activity were associated with decreased reproductive success in these fish, while female brain aromatase activity was not. Overall, results suggest EDC exposures that impact aromatase activity also affect reproductive output in spawning cunner.