

POST-RELEASE MORTALITY DUE TO PREDATION: A CASE STUDY OF WINTER FLOUNDER AND GREEN CRABS

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Developing release strategies that reduce post-release mortality is essential to any enhancement effort. These may include semi-natural rearing techniques, predator training, and the use of acclimation cages. For the winter flounder *Pseudopleuronectes americanus* enhancement project in the Hampton-Seabrook Estuary, New Hampshire, USA, acclimation cages are used at the release site to reduce immediate post release mortality. Cultured flounder are stocked into the cages so that the fish can adjust to their new environment, hone their burial skills, begin pigment change, and recover from the stress of transport to the release site, all in the absence of predation. After 48 hours, the fish are released into the wild and post-release surveys commence. In 2004, we noticed that green crab *Carcinus maenas* density increased from 0.6 crabs/50 m² to 4.3 crabs/50 m² within 4 days after the flounder were released from the acclimation cages. Crab density returned to pre-release densities quickly thereafter, but cultured winter flounder density also decreased quickly. This led us to hypothesize that crabs may be attracted to, and aggregate around, the acclimation cages containing the fish, and that crab predation may have been responsible for the decrease in the cultured flounder density.

To determine if green crabs are attracted to the acclimation cages, a study was conducted in 2005 at the release site. Crab densities were determined by trawl surveys for 2 days. Following this, four acclimation cages were placed on the bottom at the release site. Two replicates contained flounder while two were empty (control). Surveys of crab density (#crabs/m²) within 5m of each cage were conducted daily for 3 days by SCUBA. Results showed that after one day, crab abundance was significantly (t-test, $p < 0.01$) higher on cages containing fish than on empty cages, proving that acclimation cages containing flounder do attract green crabs (Figure 1).

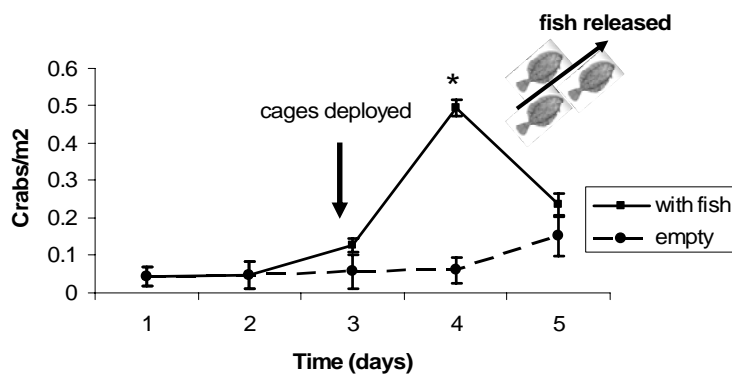


Figure 1. *Carcinus maenas* density before and after acclimation cage deployment. Two cages contained *Pseudopleuronectes americanus* and two were empty. Fish were released after day 4.

To determine if acclimation cages, even in the absence of fish within them, attract crabs because they provide structural relief in an otherwise relatively featureless environment, a second field study was conducted. In this, a second site (control) was established 250 m downriver from the release site. At both sites, crab densities were determined by trawl surveys for 2 days. Four empty acclimation cages were deployed at the release site while no cages were deployed at the control site. At the release site, surveys of crab density (#crabs/m²) within 5 m of each cage were conducted daily for 3 days by SCUBA, while at the control site, trawl surveys were continued. Results showed that within 30 minutes of cage deployment, crab densities significantly increased in the release area (t-test, $p < 0.01$) and continued to increase each day indicating that green crabs are attracted to the empty acclimation cages.

Although cages are necessary for acclimating cultured flounder, they also are detrimental by attracting predators to the release site. Modification of the release strategy is necessary to offset this problem and an alternate release strategy is being investigated in 2006. A synopsis of this new technique and its outcome will be presented.