

## Significance of Fish Size-At-Release on Enhancement of Striped Mullet Fisheries in Hawaii

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### Abstract

A tag-release-recapture study was conducted to evaluate size-at-release impacts upon recruitment of cultured, juvenile striped mullet, *Mugil cephalus* released in inshore habitats of Oahu, Hawaii, USA. In June and July 1990, 85,848 juvenile mullet were graded into five size groups (ranging from 45 to 120 mm in length), identified with binary-coded wire tags, and released into two estuaries ( $2 \times 5$  factorial design). Of the tagged fish, 42,822 were released into Kaneohe Bay on the east (windward) coast of Oahu; 43,026 were released into Maunalua Bay on Oahu's dryer south shore. The fish were released into both bays simultaneously. Releases were blocked in time across 5 release lots. To evaluate growth and survival rates of released mullet, both bay systems were sampled monthly with cast nets over a ten-month period after release. Overall, 733 tagged *M. cephalus* were recaptured, 277 from Kaneohe Bay and 456 from Maunalua Bay. Overall proportions of tagged fish in samples declined from 33.4% ( $\pm 25.2\%$ ) of the total *M. cephalus* catch at week 5 to 1.88% ( $\pm 0.95\%$ ) by week 23. From week 23 on, tagged fish averaged 2.09% ( $\pm 0.23\%$ ) of the striped mullet in monthly samples. Within 9 wk after releases, recapture frequencies were clearly skewed in favor of fish that were larger at the time of release. Fish smaller than 70 mm when released were rare or absent in collections within 18 wk after release. This confirms results of a smaller-scale pilot study in Maunalua Bay and shows that fish size-at-release can have a major impact on the success of hatchery releases in marine habitats. Pilot studies to identify minimum fish size-at-release should be conducted at all sites targeted for full-scale marine hatchery releases.

The potential of hatchery releases to help replenish depleted marine fish stocks is being evaluated in Hawaii, where inshore and nearshore fish populations appear to have suffered major declines in abundance during this century. A series of pilot hatchery releases of native striped mullet *Mugil cephalus* are being conducted to examine the impacts of release protocols on growth and survival of cultured and released fingerlings (The Oceanic Institute 1990, 1991). These pilot experiments are identifying release parameters for a larger-scale test of the marine stock-enhancement concept in Hawaii.

Although full-scale hatchery releases are conducted in open marine habitats (e.g., Rutledge and Matlock 1986; Honma 1993), little direct information exists for evaluating the impacts of releases in marine systems on fish population size and on fishery yields. To design an effective test of the marine hatchery release concept, there are several key issues regarding release strategy that

need to be resolved. The importance of conserving genetic diversity among released fingerlings is a primary concern (Shaklee et al. 1993a, 1993b; Blankenship and Leber 1995). This study addresses a key question about the logistical success of releases: to what extent is post-release survival directly impacted by fish size at the time of release?

A pilot tag-release-recapture study in Maunalua Bay, on Oahu, Hawaii, revealed that cultured *M. cephalus* could survive and grow in a back-reef marine environment, but that fish size-at-release appeared to have a major impact upon recapture rates (and presumably survival) of tagged, juvenile striped mullet in their nursery habitats (The Oceanic Institute 1990). The smallest fish released were underrepresented in field collections made in Maunalua Bay; individuals less than 70 mm total length (TL) when released dropped completely out of field samples within 11 wk after release (The Oceanic Institute 1990).