A MODEL FOR ASSESSING THE IMPACT OF FISHING PRESSURE AND STOCK ENHANCEMENT ON GENETIC DIVERSITY

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The multiplicative growth rate, or finite rate, of population increase, resulting from density independent reproduction and survival, is one of the most important parameters of a small population. The total size of exploited populations would change according to its demographic characters, even if they suffered similar fishing pressures. Differences in population dynamics could lead to changes in the rate of loss of genetic diversity. This study was designed to address a major question: how are differences in this demographic parameter reflected in the genetic diversity occurring under fishing and stock-enhancement scenarios? In particular, if the stock size recovers due to limitations on fishing and through implementation of stock-enhancement programs, can the lost genetic diversity be restored? Assuming a linear stock-recruitment relationship and demographic stochasticity with fishing and stock enhancement on a small population, the annual population size was estimated. Based on the calculated population size, the gene frequency shifts by drift on neutral loci were described numerically, and three indexes of genetic diversity (mean heterozygosity, rate of loss of alleles and effective population size) were estimated. I considered the genetic impact of two different multiplicative growth rates (high and low), for three variable recovery strategies (limitation or prohibition of fishing and stock enhancement) and combinations of these strategies. Simulation results indicate the following. *High multiplicative growth rate*: the population that is exhausted by fishing would only recover by reducing the fishing pressure. Stock enhancement will contribute little to the recovery of a population. Genetic diversity would be lost for a small population size caused by high fishing pressure, even though the population size recovered due to a reduction in fishing pressure. *Low multiplicative growth rate*: the population size cannot recover by only reducing fishing pressure. Therefore, it is essential to undertake another recovery strategy, such as stock enhancement. The probabilities of loss of genetic diversity are synchronized with the risk of extinction. Thus, in this case, we might recognize the loss of genetic diversity by monitoring the population size, except for the small broodstock size in a hatchery.