

Inbreeding and its consequences

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INBREEDING

- Inbreeding is simply the mating of related individuals; nothing more, nothing less.
- Inbreeding does not imply anything about viability, growth, or productivity.
- Inbreeding increases homozygosity in the offspring.
- This increase in homozygosity is called “inbreeding”, and the coefficient of inbreeding (F) is a measure of how much more homozygous a fish is than the population average.

ESTIMATION OF INBREEDING

- Inbreeding is estimated from the following equations

$$\Delta F = \frac{1}{2 N_e}$$

ΔF = rate of inbreeding per generation

$$N_e = \frac{4 (\text{♂}) (\text{♀})}{(\text{♂}) + (\text{♀})}$$

N_e = effective breeding number

♂ = number of males contributing offspring to the next generation

♀ = number of females contributing offspring to the next generation

USE OF INBREEDING

- It is extremely useful in fish selection.
- This usefulness stems primarily from the stabilization of selection traits due to increased homozygosity and the augmented expression of several of them.
- It is used to produce superior animal and plant brood stock, to produce genetically improved animals and plants for grow-out, to create new breeds or varieties that breed true for “type”; i.e., a particular body conformation or set of qualitative phenotypes.

LINE BREEDING

- Line breeding occurs when an outstanding individual (usually male) is brought back into the line to mate with a descendant.
- Done because the animal is so outstanding that his contribution to each descendant is increased in the gene pool.
- Line breeding is the way of developing breeding lines from outstanding female and male parents.

INBREEDING DEPRESSION

- As inbreeding increases, it causes a decrease in productivity which is termed “inbreeding depression”.
- Inbreeding depression is a decrease in growth rate, fecundity, etc. that is observed in the inbred group when it is compared to a control population where there is no inbreeding.
- The severity of inbreeding depression depends on the level of inbreeding, the phenotype in question, and the population

- Inbreeding depression occurs because of the pairing and expression of detrimental recessive alleles.
- By decreasing heterozygosity, inbreeding reduces what is called “over dominance”.
- Over dominance occurs when the heterozygous genotype produces a phenotype that is superior to the two homozygous loci.
- Inbreeding increases homozygosity, decreases heterozygosity.

INBREEDING STUDIES IN FISH

- Few inbreeding studies in fish have been done in rainbow trout, Atlantic salmon, brook trout, brown trout, common carp, *T. mossambica*, channel catfish, zebra danio.
- Inbreeding depressed production phenotypes such as growth, viability and survival, and increased the number of abnormalities

- Kincaid (1977) estimated that the critical level of inbreeding in rainbow trout is about 18%;
- below 18%, inbreeding produced few problems, but above 18%, productivity was depressed significantly.
- One generation of brother-sister mating in rainbow trout resulted in increased fry deformity (37.6%), decreased FCE (15.6%) and fry survival (19%).

MEASURES TO AVOID INBREEDING

- i) The brood stocks in a hatchery should be particularly replaced periodically. Exchange of brood stocks between the local hatcheries can be done.
- ii) Brood stocks of different age groups should be bred together. This helps in reducing the chance of loss of some valuable alleles due to genetic drift.

- iii) Natural stocks may be inducted in to the hatchery periodically to increase the heterozygosity.
- iv) The pedigree record of brood stock should be maintained to avoid the mating of close relatives.
- v) Cultured populations should be identified using a proper marking system. Females and males have to be originated from two different lines.

THANKU...😊