OVERVIEW: In this lesson, students will explore different breeding programs and the success of each in broodfish production. Students will use the Punnett Square method to develop a fish from a list of characteristics that will be both desirable and economical. The lesson also introduces several successful strains of catfish and illustrates a minimum guideline for a successful breeding program.

ALABAMA CONTENT STANDARD(S):
• Identify the genotype and phenotype for specific characteristics in aquatic animals resulting from selective breeding (AS11)

LEARNING OBJECTIVES:
Students will be able to:
• Name two factors essential to successful broodfish management
• Describe some characteristics that should be considered when selecting broodfish (Examples: Age, disease resistance, growth rate, etc.)
• Describe the different types of breeding programs: selection, inbreeding, domestication, hybridization, crossbreeding, mass selection and family selection
• Create a fish using the Punnett Square method from a list of characteristics that will be both desirable and economical
MATERIALS AND EQUIPMENT NEEDED:
- Pen/pencil
- Paper
- Handout
- Quiz

TECHNOLOGY RESOURCES NEEDED:
- Computer
- Microsoft PowerPoint
- LCD Projector
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<th>CONTENT</th>
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| Materials to be covered in this lesson:  
  - Successful management of broodfish  
  - Breeding programs  
  - Selection  
  - Guidelines for a breeding program | R, W, M, S, DM, CT, MS | • Present the PowerPoint on selection and breeding programs.  
• Students will take a quiz on the presentation.  
• Students will develop a “Superfish” from a list of characteristics and then develop a breeding program based on the guidelines given in the presentation. | PowerPoint  
Quiz  
See handout and checklist |
VARIED ASSESSMENT STRATEGIES: Students will take short quiz on the material from the presentation. Students will be evaluated on the "Superfish" project using a checklist.

PROVISIONS FOR INDIVIDUAL DIFFERENCES:
INTEGRATED CONTENT CODES

BASIC SKILLS

R=READING SKILLS
W=WRITING SKILLS
C=COMMUNICATION SKILLS
SS=SOCIAL STUDIES
M=MATH
S=SCIENCE
IR=INTERPERSONAL RELATIONSHIP SKILLS
CL=COMPUTER LITERACY SKILLS

PROCESS SKILLS

DM=DECISION MAKING SKILLS
PS=PROBLEM SOLVING SKILLS
CT=CRTICAL THINKING SKILLS

EMPLOYABILITY

ES=EMPLOYABILITY SKILLS
MS=MANAGEMENT SKILLS
WA=WORK ATTITUDES
TW=TEAMWORK

LEADERSHIP SKILLS

IM=INTEGRATION OF LEADERSHIP
CTSO=CAREER/TECHNICAL STUDENT ORGANIZATION
LD=LEADERSHIP DEVELOPMENT SKILLS

THE MORE INTEGRATION THE BETTER
**Quiz:**

1. Name two factors essential to successful broodfish management.

2. Explain the following types of breeding programs.
   - Inbreeding
   - Mass selection and family selection
   - Crossbreeding
   - Hybridization

3. What is the easiest, most effective breeding program?

4. List three traits that are selected for when choosing broodstock.

5. What are some traits that are useful to produces but not visible? How are they obtained?
“Superfish” Project

Split into groups of four and have each group develop a superfish from some given characteristics. Each group will then make the decision to breed with another group to develop an even more desirable fish. Students will use the Punnett Square method to make the crosses and calculate genotypic and phenotypic percentages. They must then develop a breeding program based on the guidelines from the presentation.

Characteristics:
Feed Conversion ratio
Disease resistance
Growth rate
High Dress-out weight
Color
Age at Reproductive maturity

Guidelines:
Choose broodstock from domesticated strains
Select broodfish from stocks that are known to perform well under commercial culture conditions
Do not mistake large fish for fast growing fish
Prevent inbreeding by obtaining broodfish from as many different spawns as possible
If replacement broodstock comes from fingerlings produced on the farm, they should come from at least 50 random matings
Keep accurate records of spawning output, egg hatchability, fry survival, and growth rates of fingerlings and food-sized fish
Checklist:

1. Groups used assigned characteristics to develop their “superfish”.

2. Groups follow the guidelines for developing their breeding program:
   - Choose broodstock from domesticated strains
   - Select broodfish from stocks that are known to perform well under commercial culture conditions
   - Do not mistake large fish for fast growing fish
   - Prevent inbreeding by obtaining broodfish from as many different spawns as possible
   - If replacement broodstock comes from fingerlings produced on the farm, they should come from at least 50 random matings
   - Keep accurate records of spawning output, egg hatchability, fry survival, and growth rates of fingerlings and food-sized fish

3. Reasons for crossing their “superfish” with another groups “superfish” and the benefits they expect.

4. Groups include in their breeding program:
   - Reasons for choosing the type of breeding program
   - Traits they are selecting for
   - Goals for the breeding program
   - Show the work for three generations of mating in the breeding program using Punnett Squares and genotypic and phenotypic percentages for the traits in each generation.