
Fish Culture Technical Bulletin

Best Management Practices

FISH INVENTORIES, INTERNAL TRANSFERS, AND GRADING PROCEDURES ^{1.}

INVENTORIES

The importance of carrying out accurate and regular inventories of fish cannot be over-emphasized. The data are used both for the management of production in individual rearing units and for the overall management of the facility. Production decisions depend on an accurate estimate of the total weight (biomass) of fish on hand, as well as an accurate estimate of the average fish weight and distribution of individual fish weights.

Accurate, regular inventories are required for:

- calculation of feed rations (quantity and size)
- calculation of basic production management indicators
 - rearing density
 - gain and growth coefficient
 - feed:gain ratio or feed efficiency
 - percent mortality
- forecasting future activities (transfer, grading, stocking, etc.)
- calculating treatments
- calculating the production capacity of the station
- preparation of monthly and annual production reports, annual feed orders, and work program planning and budgeting

Two types of inventories are done in OMNR Fish Culture Stations. The **total inventory** refers to a complete inventory of a particular lot. Estimates are made of the total number of fish, total weight of fish, and the average weight of individual fish in the lot. Total inventories are normally done four or five times for each lot; as green egg, eyed egg, once or twice as fingerlings, and once as yearling (at stocking). **Monthly inventories** are done more frequently (not necessarily monthly) and are aimed at estimating the average weight of fish in the lot.

Inventories

- Total Inventories
 - Number of fish
 - Total biomass (weight) in kilograms (kg)
 - Average weight in grams (g)

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- “Monthly” Inventories
 - Sample counts
 - Average weight (g)

For total inventories, two of the three numbers required have to be estimated, the third number is calculated. For very small lots, all of the fish can be weighed and counted and the average weight calculated. For larger lots, this is not feasible, and the usual method is to weigh all of the fish and perform sample counts to estimate the average weight. The total number of fish can then be calculated. For monthly inventories, the average weight of the fish is estimated from sample counts, the number of fish on hand is taken from the production records, and the total biomass is calculated.

The key to having accurate inventories is the sample count. Any population or lot of fish has a certain amount of variability in length and weight. The method used to sample the population will produce estimates that vary in accuracy when compared with the total population. Therefore, it is important that sample counts be done carefully and that sources of error are controlled as much as possible.

In a production facility the physical difficulty, unit sizes and configurations, personnel and time available, weather conditions, and the stress induced in the fish all have an effect on the extent and frequency with which inventories are performed and the accuracy of the inventories. The sampling techniques and sample sizes must be determined by what is practical for each situation as well as by the desired degree of accuracy. After determining what technique is acceptable, it is important to apply it consistently.

Sampling Technique

The following technique is generally considered to be acceptable within the OMNR Fish Culture system given the range of conditions in those facilities. Other methods are discussed in Piper et al. (1982) and Klontz et al. (1978).

The fish being inventoried should not be fed from the afternoon of the preceding day. The units should be cleaned and the water level returned to the normal operating depth prior to sampling. Every effort must be made to minimize the stress caused by the handling required in the sampling process.

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Equipment required: Kilogram balance or scale and supports
Seine nets or crowding screens of the appropriate size for the unit being sampled
Basins or tubs
Dip nets and counting nets
Cup or scoop
Record forms

Comments on inventories

- Crowding is best done with a screen rather than a seine net as seine nets introduce a higher size selection bias.
 - Electronic digital scales are convenient, as they have a tare feature, but may not provide accurate weights if exposed to adverse weather conditions, and rough handling. Beam scales are more accurate than spring scales, but are susceptible to icing in winter conditions.
 - Make sure the electronic or beam scale is level and the accuracy checked before use.
1. Crowd the fish to the inflow end of the unit. It is less stressful to crowd the fish at the fresh water inflow than at the effluent where the highest concentration of metabolites and wastes prevails.
 2. Pre-weigh or tare (zero) the tub containing water on the scale. The water volume should be adequate to support the chosen sample weight of fish for the time required to count them.
 3. Fish are sampled with a dip net from the crowded section by sweeping widely through the moving fish. Once a sample of fish is taken into the net, the entire netful should be weighed. Care must be exercised not to over fill dip nets as the fish may be easily injured or smothered.
 4. Before a dip net of fish is added to the tub on the scales, excess water should be carefully drained from the netful. Quickly wiping the outside of the net helps remove excess water.
 5. The total number of fish in each sample should be in the order of 150 to 250 fish. If this number of fish cannot be safely held in the tub, increase the number

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of samples taken.

6. The sample weight is recorded and then the fish are counted back into the open section of the unit. Fish smaller than 5 g should be weighed to the nearest 0.5 g; 5-50 g fish to the nearest gram; and larger than 50 g to the nearest 10 g.
7. A minimum of five samples per lot should be taken. The average weight should be calculated for each individual sample to allow for comparison between samples (see the averages in brackets in Table 1). If one or more of the average weights vary greatly from the rest, this suggests that an error was made at some point during the sampling. Make sure the fish are sufficiently crowded, dip nets are taken randomly through the fish, and the scale is properly set up and balanced. If all of these are adequate then an error could have been made in recording the data or counting fish, in which case consider redoing that sample.
8. Calculate the average fish size by summing the total weight of all the samples and dividing that by the total number of fish counted (see Table 1).

Table 1: Example of the calculation of the average weight of fish in a lot.

Count No.	Weight (g)	No. Fish	Average Weight (g/fish)
1	1735	167	(10.39)
2	1853	173	(10.71)
3	1979	220	(9.00)
4	2894	315	(9.19)
5	2513	253	(9.93)
Total	10974	1128	9.73

The frequency of “monthly” inventories depends on the situation. For routine production, samples should be done once a month if possible. For a new stock or species, or where production conditions have changed significantly from previous years, more frequent sample counts may be beneficial in establishing benchmark information and predicting future performance.

Ideally, every unit should be sampled each time an inventory is done. If this is not practical, sample a portion of the units depending on the circumstances. For small lots all units should be sampled. For larger lots, a representative number of units of each unit type in use and for each size grouping of fish, (if the fish have been graded) should be done. To provide the best tracking of production indicators such as feed:gain ratio, or growth coefficients, it is advisable to have a set of “benchmark” units that are sampled each time an inventory is done. Other units

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should be sampled on a rotating basis to provide assurance that some units are not falling behind.

INTERNAL TRANSFERS

Fish are transferred among units within a facility when the unit loadings become excessive. Preparation of empty units receiving fish involves cleaning, disinfecting and rinsing the units. The water supply lines should be flushed if they have not been used for some time. The water flow rate and water depth are adjusted to the desired level. Make sure that the screens are in good condition, correctly sized for the fish to be kept in the unit, and installed so that fish cannot escape. Screens should be small enough to prevent fish escaping through the screen, but as large as possible to allow feces and waste feed to pass through the screen easily.

The equipment required is the same as for completing inventories with the addition of a means to move the fish from unit to unit. Fish can be actively moved with a transfer tank, or passively through piping. If piping is used, be sure to provide a flow of water along the bottom of the pipe to ease the movement of fish.

The fish being moved should not be fed from the afternoon of the preceding day. The units should be cleaned and the water level returned to the normal operating depth prior to sampling. Every effort must be made to minimize the stress caused by the handling.

The process of moving fish is essentially the same as for completing an inventory. The fish are crowded into a small section of the unit, preferably the inflow end. Sample counts are done to provide an accurate estimate of average fish weight. All of the fish to be moved are weighed. Avoid the addition of water to the weighing tubs with the fish and do not overload the tubs. It is better to add less fish to each tub and weigh more tubs than stress fish. The tubs are poured into the transportation tank, passive transfer piping or carried to the receiving unit.

GRADING

Fish are graded to maintain uniform-sized fish in discrete rearing units. Grading should only be done when necessary for reasons of enabling small fish to feed better or to reduce cannibalism. Note that proper feeding techniques throughout the early rearing and advanced rearing will minimize size variation in the population and reduce cannibalism.

If fish that are stocked for rehabilitation purposes are graded, the various sizes should be re-mixed prior to stocking so that each water body or stocking site receives a representative sample of the population.

Graders are often made of a series of parallel bars (glass, PVC/ABS, metal) which allow smaller fish to pass through while retaining larger fish. Most graders are adjustable and may be used to

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separate fish at various stages throughout their life cycle. “Passive” graders may also be used to separate fish. These graders are placed in a raceway and fish may be crowded towards the grader – smaller fish will pass through the openings.

The fish being graded should not be fed from the afternoon of the preceding day. The units should be cleaned and the water level returned to the normal operating depth prior to sampling. Every effort must be made to minimize the stress caused by the handling.

The equipment is similar to that required for inventories but with the addition of a grading or sorting device. The width of the openings in the grader should first be adjusted or chosen on the basis of a sample that separates the fish into two or three suitable groups. When the appropriate openings have been set, the fish are confined in a small section of the unit, preferably at the inflow. Light net loads of fish are dipped from the unit and gently passed through the grader and delivered into separate sections or units. Lengths of water or irrigation pipe can reduce the effort required to redistribute the fish and the stress on the fish. After grading, all the fish must be inventoried (total inventory) and the unit loadings adjusted as required.

¹. Adapted from: OMNR Fish Culture Course Manual. 2000.