



## **Jim's Notes on Feed Training**

Feed training is one of the most critical steps in the production of yellow perch, and has shown promising results for the production of advanced (6-8") fingerling walleye, northern pike and muskie. In general, the fish are harvested from the ponds at 1-2" total length, stocked into tanks so that they are isolated from their natural prey, and introduced to formulated feeds. The choices for the fish are limited: eat the formulated feed, eat one of your cohorts, or starve to death. Of course, it is to the producer's advantage to maximize the number of fish habituated to formulated feed and minimize losses to starvation and cannibalism. The tips and techniques described here have been developed over the past 20 years and are proven effective for yellow perch, walleye, sauger and northern pike. I have not had personal experience with muskie but feel confident these methods will provide a good starting point for muskie culture.

### Pond Harvest

Several methods can be used to harvest fingerlings from production ponds. The individual pond usually dictates the preferred method of harvest. I think the important things to keep in mind are minimizing stress and mechanical injury during harvest. If possible, drain harvest is the best method. In-pond or out-of-pond harvest basins or net pens can hold the fish in a relatively low-stress environment as long as water temperature, dissolved oxygen and protection from predators can be maintained. My next choice would be the use of a seine. Fingerlings can be corralled or cradled and quickly dip-netted into hauling tanks for transfer to training tanks with relatively low mechanical losses. For small perch (e.g. 1") seines can be used in combination with lights for harvesting at night with excellent results using the following technique: Lights are placed along a shoreline of a pond at night to attract the small perch and a seine is slipped behind the fish and brought to shore. This technique eliminates the need for dragging a seine through a weedy or large pond but becomes less effective as the fish grow past 2 inches and become less photopositive. Light traps (using light to lure small perch into a drop-side net pen) can also be effective with small fish but is less so with larger fingerlings or fish like walleye that exhibit photo negativity.

### The Fish

I have successfully trained perch as small as 12mm (0.5"), but I wouldn't recommend it. The losses incurred during harvest and subsequent tank cleaning can be significant. These small fish are very fragile and have very low protein reserves. If they do not accept the feed within the first 5 or 6 days they are probably doomed to die. My preferred size to start feed training is 25-35mm (1-1.5"). Perch at this size are fairly resistant to harvest and mechanical stress and have adequate protein reserves to last 10-14 days before they starve to death. As fish size increases, the training period becomes longer. In one study

completed over a decade ago we found that 17 mm perch took about 14 days to complete the training interval, 33 mm perch took 35 days and mortalities in 43 mm perch did not end until about day 47 (more on this when we talk about how to tell when the fish are trained). Keep in mind that this study was conducted in the days when we considered 60% habituation a roaring success. As a comparison, this year's 31 mm fish completed the training interval in about 17 days and resulted in over 95% successful habituation. Another important consideration in choosing when to begin the habituation process is body condition. *Plump healthy fish will train much more successfully than starving emaciated fish.* Given a choice, I would much rather harvest the fingerlings a little early than to wait until the pond runs out of food and the fish begin to lose body condition. This is especially true of walleyes where the starving weak fish quickly become victims of cannibalism.

### Culture Conditions

I've been most successful in circular, center-drain tanks but that's not to say that other designs will not work. The advantage to these types of tanks is that you can establish a circular current to sweep excess food and feces to the middle of the tank for easy cleaning as well as keep the fish swimming in the same direction (which reduces cannibalism). Rectangular tanks can be modified with a center panel to make a long oval where directional flow can be induced. Directional flow can be set-up using the water input as well as small airlift pumps.

Tank size and depth are more of a consideration for cleaning rather than the actual training process. *Scrupulous cleanliness is a must!* Dead fish, feces and uneaten food should be removed on a daily basis. If left in the tank they will become sources for fungal infection with catastrophic results. External standpipes, venturi drains and correctly sized drain screens can also be a huge benefit when it comes to keeping the tanks clean.

Stocking density is dependant on fish species and size. I usually stock 1" perch at about 20 fish/gal, 2" perch at about 15 fish/gal, and cannibalistic fish like walleyes, sauger and pike at 10 fish/gal. Size uniformity within the cohort is important. Remember, *big fish eat small fish!*

I habituate the fish at a water temperature of 18°C (65°F), slightly cooler than what I would consider optimal culture temperature. In small (30 gal) tanks I try to provide one water change every 1-2hr. In larger tanks lower flow rates may be possible depending on water quality and D.O. levels. Continuous, subdued overhead lighting seems to work well for the species I train. Shadows and movement near the tanks can frighten the fish and should be avoided as much as possible especially when training walleye or sauger.

### Feed and Feeders

We are currently conducting studies on several feeds and combinations of feed to optimize habituation success. To date the data do not support any conclusions so I will describe my feeding protocol for the past several years with the caveat that my opinion may change when the results of this study are analyzed.

I start the feed training with 3 days of crumbled freeze-dried krill. Krill products are available from numerous sources. What I look for is whole freeze-dried *Euphausia pacifica*. Some suppliers will refer to this species as freeze-dried plankton. The other type of krill *E. superba* is larger in size and usually more expensive. I have purchased krill from Argent (who had a shortage of product this year) and Jehmco.com (this year it cost \$125 for a 4kg bag). I crumble or rub the krill by hand to break up the big pieces. For large amounts a food processor works well but don't over-process and turn it into powder

(it's kind of fun to watch the fish fight over the big pieces). After three days of krill I start mixing in formulated feed. The feed I use is either Epac CW (Inve Aquaculture Nutrition) or Salmon Starter (Silver Cup). Both diets have worked well for me. I prefer the Inve because it seems to stay cleaner in the tank and doesn't breakdown or fungus like the Silver Cup (although if you are cleaning your tanks like you should be this shouldn't be a problem). For perch I use the Inve 0.6/0.8mm size or Silver Cup #2, for walleye Inve 0.8/1.2mm or Silver Cup #2, for pike Inve 0.8/1.2mm or Silver Cup #3. The transition from all-krill to all-feed lasts for about 7 days. By this time most of the fish should exhibit a strong feeding response. Walleye and pike will begin to accept a larger pellet sooner than the perch. I transition to a 1.0mm Silver Cup steelhead diet as soon as they will take it. Perch will probably need 2 weeks of the crumble before they will accept the pelletized feed (just about the time they are ready to go back into the pond). I would like to remind the reader at this point that I do not necessarily endorse the feeds described here, it's just what I happen to use. Other feeds may perform as well as those mentioned and for reasons of cost or availability may be preferred.

During the training period automatic sweep-type feeders continuously supply feed. Additionally the fish are hand-fed several times daily. This hand feeding provides a "blizzard of feed" so smaller less aggressive fish get an opportunity to eat. If hand feeding is not provided the bigger fish in the tank will congregate by the feeder and keep the little ones away from the food. I have not found any commercially available feeders that satisfy my needs. The feeders I use were modified from Lifeguard brand automatic fish feeders. I added bigger food plates, a sweep-arm structure and adjusted the feeders to complete 1 rotation every 24 hours. Similar feeders could be built using rotary light timers. For bigger tank applications (like at Coolwater Farms) the impeller feeders I designed for use on the ponds seem to work well. Other vibrating type feeders (e.g. Sweeney SF7) can also be used but they tend to be expensive. Fingerlings get conditioned to the vibration set-up by the feeders as an indicator that food is coming, this can be very useful when transitioning the fish back to the grow-out pond where impeller or vibrating feeders are used.

### Cannibalism and Disease

*If the first rule of fish is big fish eat little fish, the second rule is if you can fit it in your mouth you get to eat it.* Perch have a relatively small mouth gape and a compressed body form. This means that perch of similar size cannot eat each other. Unless there is a large discrepancy in size, perch will not cannibalize. In contrast, walleye, sauger, pike and muskie have a large mouth gape and a fusiform body shape. In these species, fish of similar size can eat each other. Successful cannibalism comes from face-to-face confrontation. One way to help control cannibalism is to get the fish to all swim in the same direction. Regardless of the control, cannibalism will occur while training game fish. On a large scale, fish may need to be size graded to remove the cannibals. Cannibals should be removed when observed. These fish *can* be trained to accept feed but the process is long. It seems that once these fish go piscivorous it is hard to get them back on feed.

Most diseases that I have encountered during feed training have been the result of either harvest stress (white tail) or water quality issues (gill fungus). It has been my experience that once fish are stressed (by high temperature or low D.O.) during the harvest and exhibit "white tail syndrome" they will never perform up to expectations. We currently have studies underway to characterize this syndrome (which seems to be a closing down of the tail vasculature) but to date no definitive pathology has been confirmed. Fish

exhibiting white tail at harvest will grow at a reduced rate and be hypersensitive to handling stress throughout their lives. They may survive but they will never thrive. Gill fungus usually comes from piles of dead fish or feed in the tanks. It is probably exacerbated by “high stress” confined culture conditions, and little can be done for the fish once the disease displays. A flow through bath of 0.7% NaCl will ease the stress levels and may help the healthy fish to fight off the infection. In my way of thinking, it is better to remove the sick fish rather than try to save them.

### Are They Done Yet?

It's a surprisingly easy task to determine if the fish have completed the feed training interval. I keep daily records of the number of mortalities in each tank. When graphed, this data will usually show a sharp increase and decline over a 4 or 5-day period. Assuming the fish started the training at a uniform size and body condition, the fish that did not accept the formulated feed will all starve to death within a few days of each other. If for no other reason this demonstrates the importance of size grading prior to stocking fish into tanks for feed training. There may be a few lingering deaths after the peak mortality has passed, but for the most part the fish are now trained and can be returned to the production pond for grow out.

Returning the fish to the pond should be done in a step-wise fashion or they may revert to natural prey. One way is to section off a corner of the pond with a seine keeping the newly trained fish confined and well fed for a few days. Another successful method is the use of microponds (as seen at Coolwater Farms) to provide the fish with a transitional phase of limited freedom and acclimation to impeller or vibrating feeders. Either way the fish should be frequently fed small amounts to accustom them to seeking formulated feed in the pond.

### In-Pond Training

Feed training can be accomplished in the pond using automatic feeders with or without lights. I will start feeding perch when they reach 0.75", this is just after they change from transparent to striped. I use a mix of 10% crumbled krill with the appropriately sized Inve or Silver Cup. Feeders are activated in short bursts during 15 min intervals between dusk and midnight and then again for 2 hours at dawn. Lights are used to attract the small photopositive fingerlings to the area below the feeders. The idea is provide many opportunities for feeding while limiting the total amount of feed going into the pond. At most I would feed about 10 lbs of feed per acre per day. If no lights are available I feed at dawn and dusk relying on the vibration of the feeders to attract the fish. Within a week or two the fish will respond to the vibration of the feeders. This can be observed by running an empty feeder and watching the fish gather for their meal. After a few weeks feeders can be set to feed for several hours in the morning and evening. A strong feeding response should be observed. In-pond training has a tendency to set-up social hierarchies where the bigger, earlier trained fish will keep the smaller fish away from the feeders. To avoid this, fingerlings should be removed from the pond about 6 weeks after training has started and the big fish should be size graded off and placed in a separate pond. Over the course of the next 6 weeks a new group of big fish will arise and those fish should be graded off. If the grading protocol is not followed the big can grow large enough to cannibalize the small and the producer will end up with some big fish and a few small fish when harvesting the pond in fall. The In-pond technique is also an excellent way to pre-train fish headed for tank training and to supplement pond food levels while fingerlings are waiting for training space to become available.

## Summary

- Feed training is one of the most critical stages in fish production
- Use methods of pond harvest that reduce stress and injury
- Start training with uniform size fish
- Choose fish with good body condition for training
- The larger the fish, the longer the training period will last
- Scrupulous cleanliness is a must
- Krill works like magic
- Supplement auto feeders with hand feeding several times daily
- Control cannibalism, especially in “game fish”
- Use transitional techniques to return fish to grow out ponds
- In-pond training can work but size grading is important