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Agricultural Development and Diversification (ADD) Program

1994 Grant Final Report

Grant Number P94005

Grant Title The Application of Recirculating System Technology for the
Commercial Production of Yellow Perch

Amount Awarded \$49,551.00

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Wisconsin Department of Agriculture, Trade and Consumer Protection
Division of Marketing, Wisconsin Farm Center
Agricultural Development and Diversification (ADD) Grant #P94005

“The Application of Recirculating System Technology for the Commercial Production of Yellow Perch“

Summary of Final Report
May 15, 1997

Grantee: John Wolf and John Hyink, Alpine Farms
Sheboygen Falls, WI

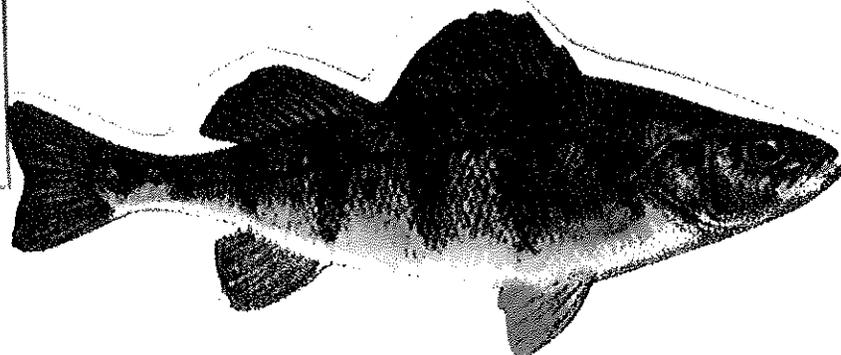
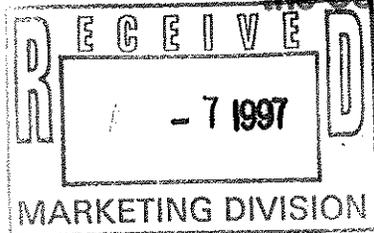
This project addressed two goals: 1) demonstrate the incorporation of recirculation aquaculture system (RAS) technology into a commercial production strategy and 2) find out the feasibility of using the recirculation system to rear pre-fingerling yellow perch. After phase one, the researchers shifted emphasis away from the pre-fingerling study to study the food-conversion, survival, loading and stocking density aspects of the RAS. The new objective was to drastically increase the stocking density of perch fingerlings in the RAS.

The researchers concluded that pond produced fingerling yellow perch that have not been trained to commercial feed or that have been held for a prolonged time at a cold temperatures prior to stocking are likely to perform poorly. With the elevated stocking densities, the initial mortality of smaller fish was high due to predation and lack of conversion to the dry feed. After the initial stocking period, the fish tolerated the higher stocking density with much fewer mortalities. Presentations were given at the perch workshop at Lakeshore Technical College in Cleveland, WI and the Wisconsin State Aquaculture conference held in Wausau.

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Final Report is 8 pages.

The Application of Recirculating Aquaculture System Technology for the Commercial Production of Yellow Perch (*Perca flavescens*)



Sponsored by The Wisconsin Department of Agriculture, Trade & Consumer Protection
Written by Jay Wolf, Alpine Farms

We addressed two goals in this project. The first goal was to provide a practical demonstration of recirculation technology incorporated into a commercial production strategy, which served as a model for other potential yellow perch (*Perca flavescens*) culturists in Wisconsin. The second goal was to find out if the recirculation system could be used for rearing pre-fingerling yellow perch. In the following paragraphs, I will list what we did to achieve these two goals and the successes and failures associated with the processes to produce high quality yellow perch.

The most integral factor to achieve our first goal was to choose a system that best fit our needs. After researching numerous systems from across the United States, we chose the Aqua Manna Style Recirculating Aquaculture System (manufactured by Aqua-Manna INC., R.R. 2, Box 342, Ladoga, IN 47954. The components for this recirculating aquaculture system (RAS) consist of the following:

- **Rearing Tank-** 7000 gallon capacity poly-lined tank with unistrut and PTL 3/4" plywood side walls.
- **Clarifier w/ Rotating Drum Filter-** The screen of the filter is continuously wet vacuumed using the suction created by the intake end of the air blower that also aerates the system. The drum continually rotates by a 1/20 HP electric motor.

- **Sweetwater Blower-** Continuous running aerator supplies both the aeration for the rearing tank and the suction to vacuum the drum filter.
- **Three Biofilter Trickling Towers-** Each tower is supplied with a Peerless

recirculating pump that is operated by a 1 1/2 HP - three phase Baldor INC. Motor. Each tower has rigid corrugated media packed inside it and a water operated rotating arm that distributes incoming water evenly over the biofiltration media. The pump has a 1 1/2" pipe threaded discharge and a pressure gauge on the PVC pipe outflow to monitor pump output. Normal operating pressure from the pump discharge is 12 psi.

- **Foam Fractionator-** These are connected to the biofilters.

In January 30, 1995, the representatives of Aqua-Manna INC. came to our farm and helped us set up the system. Having our yellow perch fingerlings on hand, we stocked the RAS system on February 7, 1995. We put in approximately 9140 yellow perch fingerlings whose sizes ranged from about 50 to 75 mm. We experienced very high mortality rates in the first few weeks. There were several factors that attributed to this problem. Firstly, the yellow perch that we received were not "pellet trained." Secondly, it took the biofilters longer to "kick in" with such a small amount of perch in the system. This caused the unionized ammonia levels in the system to be extremely high and stressed the fish. To counteract this problem, we did some water exchanges usually exchanging about 1000 to 2000 gallons of water. Lastly, some of the perch were getting siphoned into the intake of the rotating drum which we corrected by installing a smaller sized screen so that the perch would not be harmed.

Because of the high number of mortalities, we decided to stock additional yellow perch of the same year class. A total of 7153 perch were added to the RAS system in three separate groups between June 2 and 12, 1995. From this time through Sept. 7, mortality was low (1.26%).

The RAS system water quality parameters are summarized in Table 1 and Figures 3&4.

Table 1. Representative Alpine Farms RAS system water quality parameters.

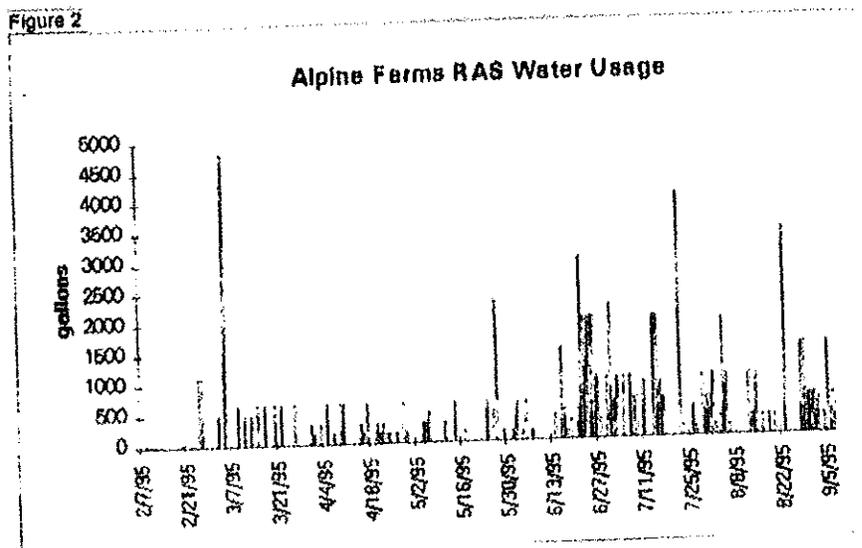
Parameter	n	Mean	Min	Max
Temperature °C	210	22.0	17.8	24.4
DO mg/L	207	6.0	5.2	9.0
pH	197	7.0	6.1	8.1
unionized NH ₃ mg/L	194	0.003	0.000	0.156
Nitrite mg/L	93	0.185	0.000	0.800

Rearing Temperature- Was maintained at room temperature (figure 3) and well within the ideal range for yellow perch. During water replacement, the temperature tended to be lowered slightly.

Dissolved Oxygen- Levels did not drop below 5 mg/L level (figure 3) recommended for fish rearing. This showed us that the RAS system had not reached its maximum carrying capacity.

Unionized Ammonia- If unionized ammonia levels (figure 4) rose above 0.010 mg/L the rearing tank was diluted with additional replacement water.

Nitrite- As the density in the rearing unit increased and the biofilters matured, nitrite levels rose. Replacement water was also used to control increases in nitrite (figure 2&4).



We sampled perch from the RAS system to check for growth and food conversion (table 4). Overall growth in length was between 0.5-0.6 mm per day as would be expected for perch at these rearing temperatures. However, the combination of the smaller originally stocked fish, larger replacement perch, and potential sampling bias may have influenced the apparent growth between specific sampling dates.

Table 4. Descriptive statistics of perch size and mean growth in length. The number of days since the RAS was first stocked = #Days. The number of fish sampled = n. The samples mean and standard deviation(SD) are shown.

Date	#Days	n	Mean Length (mm)	SD Length (mm)	Mean Growth (mm/day)	Mean Weight (gm)	SD Weight (gm)
Apr. 12 1995	64	97	89	11		9.0	3.7
May 23, 1995	105	58	110	15	0.5	15.4	7.7
June 13, 1995	128	53	125	18	0.7	30.1	16.1
Aug. 4, 1995	178	51	133	31	0.15	40.7	32.5
Sep. 11, 1995	217	52	161	15	1.2	90.1	37.5
Overall					0.6		

From the mean weight of the perch on the sampled dates, average weights on each day of rearing were approximated by linear interpolation and with the estimated number of fish in the tank based on stocking minus the mortalities removed. The biomass of perch produced during the rearing period was estimated by subtracting the initial mass of each group stocked from the tank standing crop (figure 10) and this was compared to the accumulated mass of food used to examine the efficiency of food conversion during the rearing period. These calculations do not take into account possible cannibalism in the later part of the rearing cycle when some of the fish were large enough to consume higher biomass than actual. How high can this system go, that will be answered later in this paper.

From the estimated daily tank biomass and the records of daily food usage, the percent daily ration as a proportion of body weight was calculated (figure 11). Feeding was continually adjusted based on acceptance by the perch and variations in water quality. During the early part of the rearing period, ration levels were between 2% and

5.2%. During the later half of the rearing period ration levels on days of normal feeding varied between 1.8% and 0.8%.

Overall food conversion was 0.9 Kg Food (dry): 1 Kg perch (wet). These rearing trial levels suggest that the 3-4% ration level would be excessive for perch over approximately 120 mm and 30 gms when using high quality commercial feeds in the RAS system.

Figure 10

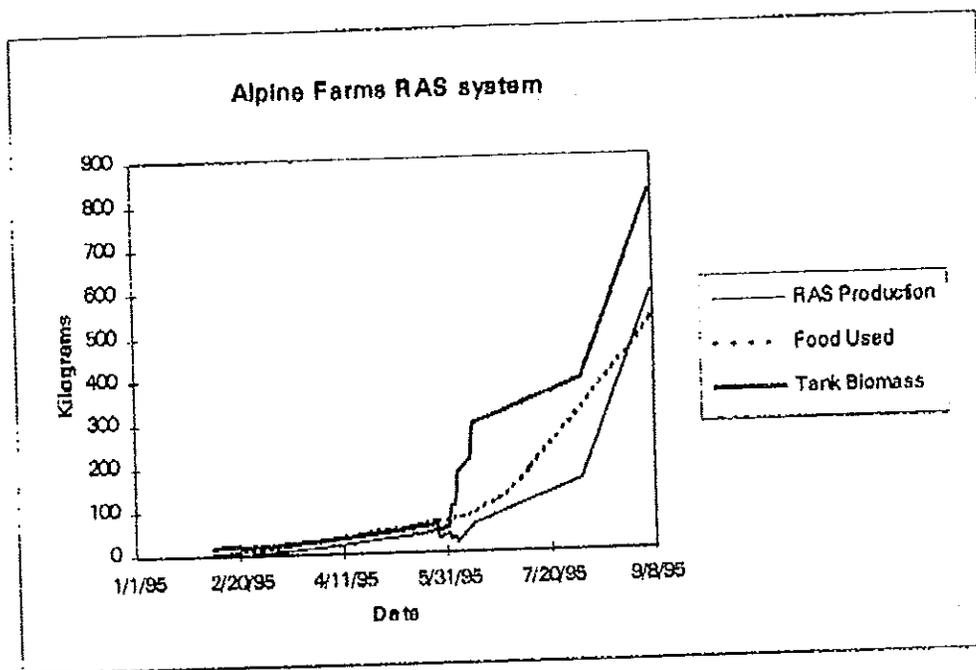
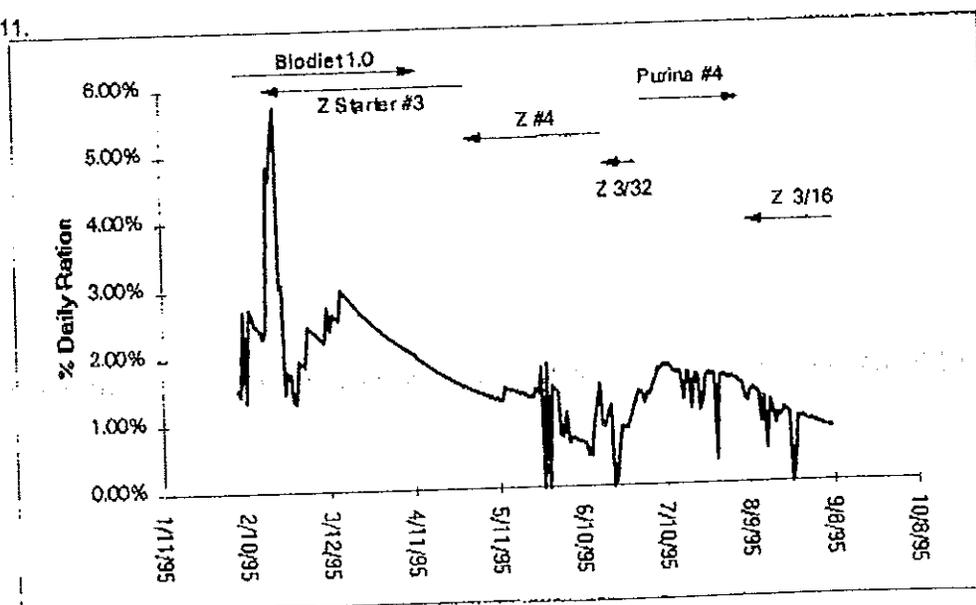


Figure 11.



Conclusions for Goal One

The experiences of this rearing trial suggest that pond produced fingerling yellow perch that have not been well habituated to commercial feed or have been held for a prolonged period at cold temperatures prior to stocking in the RAS system, are likely to perform poorly. Trying to habituate to commercial diet in a newly setup RAS system complicates biofilter conditioning if excessive food is required for training purposes. Gradual stocking of fingerling perch that are well habituated into a completely preconditioned biofiltration system is recommended. Tank reared and habituated perch may offer advantages in this regard.

Second Year

We originally planned on studying pre-fingerling perch productions in a RAS system for the second year of our grant.

After completing the first part of our study, we decided that a shift of emphasis to food conversion, survival, loading density, and stocking density would be more worthwhile for the industry than pre-fingerling production in a RAS system. Our objective was to drastically increase the stocking density of perch fingerlings in the RAS system.

We started the second phase of our study in July, 1996 by stocking the RAS system with 25,787 perch fingerlings with sizes ranging from 2"-4".

The RAS system experienced high ammonia and nitrite levels initially which we handled through the use of numerous water exchanges.

The mortality of smaller fish was high which we attribute to predation by larger fish and small fish not converting to the dry feed. The larger fingerlings that died had broken jaws which we suspect happened from running into the sides of the tanks.

Alkalinity levels dropped extremely low during this period which we corrected by the addition of sodium bicarbonate to the RAS system. Along with low alkalinity, the water became discolored due to the high stocking density. We tried various solutions

for this water clarity problem and resolved it by increasing the speed of our drum filter and increasing our daily water exchange. This solution worked well, with no further problems with water clarity.

The fish tolerated the high stocking density of the RAS system with only minimal mortalities after the initial stocking period. We produced market-sized fish by the end of the last quarter of 1996.

The release of information generated by this project was done through presentations at workshops, conferences, tours of our facility and phone calls.

We presented our findings to the industry at the perch workshop held at Lakeshore Technical College in Cleveland, WI with 75 people in attendance. Findings were also presented at the State Aquaculture Conference held in Wausau, WI with over 400 people present. We conducted several tours of our farm in which over 50 people participated.

The phone calls for information ranged from local fish farmers in Wisconsin to nationwide inquiries including one from NASA.

The demand for perch as a food fish has increased since we originally started this study of perch production using RAS technology.

We have demonstrated that perch can be raised in a RAS system and that a new business of this type can be a viable supplier of product to the aquaculture industry.

Please feel free to contact us if you have any questions regarding yellow perch or this project.

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Alpine Farms
N6250 Alpine Road
Sheboygan Falls, WI 53085

Phone Number: (414) 467-0499 Fax: (414) 467-0220



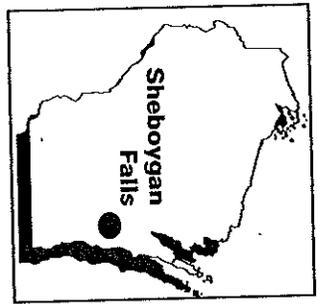
Alpine Farms Testing Aquaculture's Waters

By Ron Johnson
 Assistant Editor

Sheboygan Falls
 What Wisconsinite worth his cheese doesn't like a Friday night fish fry?

John Hynk and John Wolf hope to capitalize on that enthusiasm by putting plenty of fresh perch filets right next to the fries, cole slaw, and buttered rye bread on Friday nights.

The partners in Alpine Farms, a young Sheboygan County aquaculture venture not far from Sheboygan Falls, recently were among three of the state's fish farms approved to receive grants from the Wisconsin Department of Agriculture, Trade and Consumer Protection. Alpine Farms' grant is for \$49,551. Its mission: "To conduct a demonstration study to raise yellow perch in a recirculation system."



Well Drilling, Inc., a business begun in 1949 by Harley Hynk

Says John Wolf, "I guess John and I were looking for an offshoot that pertained to water. We know how to get water, pump it and filter it."

"He's an avid fisherman and I like eating fish, so we considered that we should start raising them."

Trouble was, they knew nothing about raising fish, John admits. They knew plumbing and electricity.

To test the waters of aquaculture, they looked at what fish farmers in the area were doing. John figures there are probably half a dozen other aquaculturists within a several-mile radius, that he knows about.

John credits the people at the University of Wisconsin-Milwaukee's Sea Grant Institute with being "very helpful." For one thing, he says the institute has raised perch for two and three generations in its tanks and gladly shared the information.

Two years ago, Hynk well drilling took up residence in a large metal building. It reserved a 1,200-square-foot room for eight round, fiberglass tanks. These days, six of the thousand-gallon tanks hold feisty brook trout, one holds more sedate perch, and one holds lazy whitefish.

Discussing the whitefish, John explains, "We were looking for a species nobody else had used, and in our area here, in the restaurant trade, it's a recognized and readily accepted species."

"Not without heating the water and recirculating it," is John's reply.

The few whitefish remaining are left from a project Hynk and Wolf started two years ago. The fish don't know it yet, but they are going to be the featured guests at a fish boil, come the middle of August.

Meanwhile, the brook trout are sold to restaurants and individuals in the area. John says, "We were expecting problems" with trying to raise brookies in tanks. Rainbow trout are supposed to be the best adapted to tank farming, but John says they have not had a high death rate with the brook trout.

In tank No. 8, the perch cruise in slow circles. They have been there about 18 months. John says they are "not doing very well" because the water is too cold - about 50 degrees - basically the temperature at which it flows in through a plastic pipe above the tank

Still, Wolf and Hynk have gotten some

See Perch, page 2

Pool of Potential

John Wolf, a partner in Alpine Farms, a Sheboygan County aquaculture venture, is testing the waters in the fish farming business. Alpine Farms was one of three of the state's fish farms approved to receive grants from the state agriculture department's Agricultural Development and Diversification program to further study raising yellow perch in a recirculation system.



AGRI-VIEW

John and John are also partners in Hynk

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Quote
 "Diplomacy is the art of saying nothing when you have something to say."

Alpine Research Hopes to Filet Fish Information

Perch, from page 1

experience with perch – experience that will no doubt prove useful as they undertake their study that the ag department grant is paying for. “We’re learning what

kind of beast we’re dealing with,” John says.

Basically, what they want to do is set up what John calls a “water reuse” system. Their tanks are presently arranged with

a “flow-through system.” Artesian water from a well goes through each tank and is discharged into drains in the concrete floor. From there it flows into ponds where solids settle out, then to a creek, then to a river.

A water reuse system is “not 100%. There is some makeup water that has to be added daily,” John points out.

When they get their demonstration project going, John envisions heating the water for the perch from its in-flow tem-

perature of 50 degrees to 78 to 80 degrees, using propane at first. If all goes well, he says, “We will probably go with a ground-water heat pump.” Hyink Well Drilling’s offices, shop and fish tank room is all heated by way of a heat pump.

Though they are still “pulling in all our loose ends” (the announcement of the grant awards was only made on June 30), John figures they will set up a pair of 2,000-gallon tanks, which would be twice as big as what they have now. “I’m guessing these are going to be 10 feet in diameter and five feet deep,” he describes.

From there they will bring in some fingerling perch – two or three inches long or so, with 10,000 in each tank – and feed them a commercial, pelleted feed (most likely the trout pellets they feed now) and grow the perch to “jumbo” or “large” size. John says the marketable size varies by the time of year, but he would like to sell them after a year or so of feeding, if the fish can provide a nice three- or four-ounce butterfly fillet by then.

He foresees one day shipping fresh perch all over a 60-mile radius of Alpine Farms’ location between Sheboygan and Plymouth. That would take in Green Bay, Milwaukee, and maybe the Fox Valley.

John emphasizes that they do not know whether their attempt to profitably raise perch in tanks using heated and recirculated water will work. “Some of this ‘by guess and by gosh’ because nobody’s done this before,” he reminds. “The can do this under lab conditions, but it has not been proven that it can be done in the field, economically, by lay people.”

What can go wrong?

“Power...can go out...Pump failure. Water quality has a lot to do with it – balancing out all your factors – ammonia, dissolved oxygen. Diseases, overcrowding, stress. You’re putting them in an environment they’re not really raised in,” John explains.

“It’s not like that aquarium (on a credenza in his office). I clean that once every

two months. (In a commercial tank system) there has to be constant monitoring, and backups on backups, to make sure there are no glitches.”

As a condition of receiving the ag department grant, Alpine Farms must write quarterly reports of its findings. Whatever they learn – positive or negative – will be available to other people.

Looking at aquaculture in general, John says, “It’s a new, rapidly expanding industry that’s only going to be more and more in the FDA (Food and Drug Administration) pushes through its testing on products that are brought out of the ocean...And the commercial guys keep getting cut back on the lakes. Somebody’s going to have to fill the void.”

Raising fish in buildings and reusing the water is, “I think, the wave of the future,” John continues. With that method, the fish farmer can tightly control the fishes’ environment, it does not harm the outside environment, it uses minimal water, and no one has to worry about exotic fish (if that’s what are being raised) escaping into the watershed.

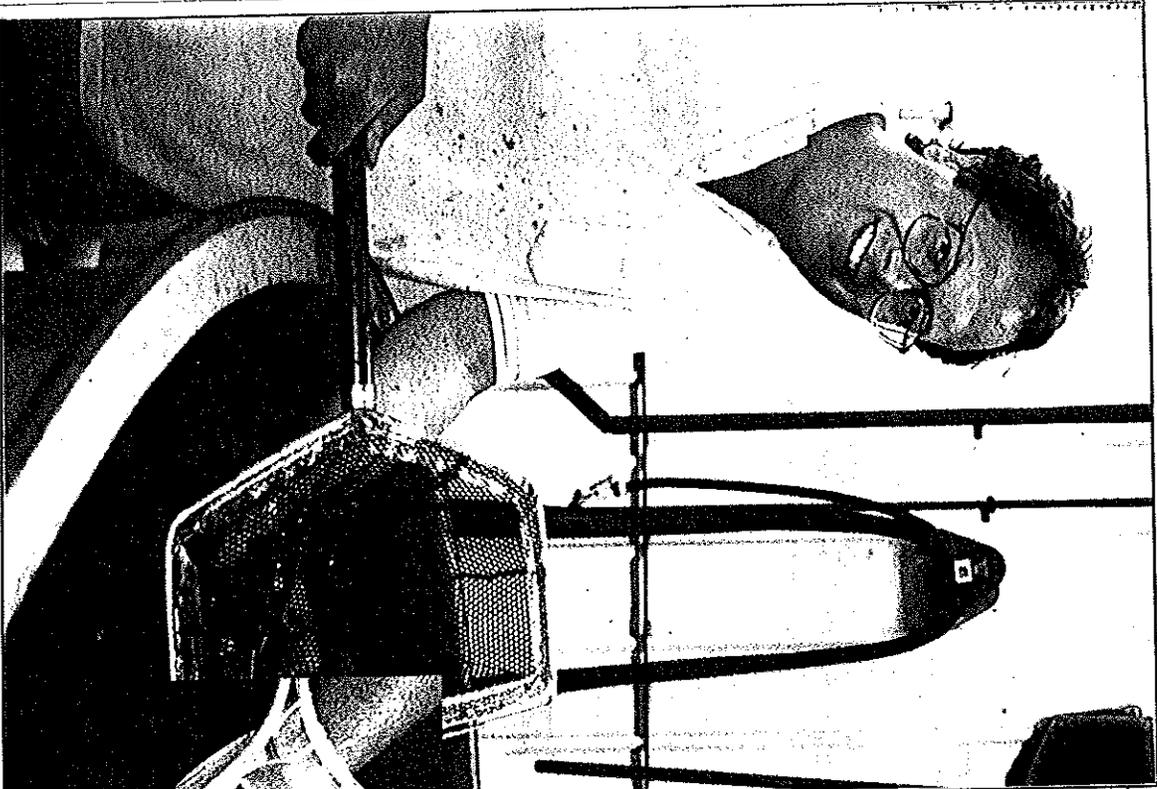
But he warns that fish farming is not a cure-all for any ills of the dairy industry. For example, John says it would probably be difficult to raise fish in a recirculating system in an old dairy barn.

Fish farming then, he says, is not for everyone. Money will not simply flow in like water.

“You’re still raising something,” so where there is life, there is always the possibility of death, he reminds. “You’ve still got to be on top of it. It’s not just a matter of throwing fish in a tank and forgetting about them. We’d wish it was.”

“Perch,” he says, “is the No. 1 fish in this area. The Friday night fish fry is a way of life along this area of Lake Michigan.”

If all goes well with Alpine Farms’ perch study, those Friday night fish fries will not one day be a thing of the past.



Wave of The Future

Partners in a well drilling business, John Hyink and John Wolf (pictured here), were looking for an offshoot that pertained to water. The pair have tried whitefish and trout in the past, and have received a grant to study yellow perch (below) production on their Sheboygan County farm.

achieve its goal.

How are things going to this point? The County Today asked several committee members starting at the top.

"I am surprised things have been going this good," Mr. Knutz said. "I was involved in NR 243 and that was much worse."

"The major change now is farmers realize something needs to be done."

The committee is a diverse group of agricultural and environmental voices. All vital, Mr. Knutz said.

Perch production aim of research project

Sheboygan Falls

Connoisseurs of the Friday night fish fry ultimately may benefit from research being conducted at a Sheboygan County fresh water fish farm.

With a \$49,000 grant from the Wisconsin Department of Agriculture, Trade and Consumer Protection's Development and Diversification program, Alpine Farms is casting to be the first commercial fish farm in the state to success-

Senior outreach course to focus on land issues

River Falls

Rita Kozal, Pierce County board member, will present a non-credit class called "Toward Sensible Land Management" starting Nov. 1 at the University of Wisconsin-River Falls. The course is offered through the Office of Continuing Education in Session 2 of the Technical Services

Mr. Zimmerman says the committee has not provided accurate direction for the technical work group. Advisory committee members are policy makers. The technical work group made up of individuals from numerous environmental agencies provides input about management practices to prevent animal waste pollution.

Mr. Dimmer said the process has been the challenge he expected. "There are diverse opinions, but I don't sense we are as far apart as I thought we would be at this time."

fully raise yellow perch in used water. Yellow perch, which are the centerpiece of Friday fish fries, are harvested commercially in the wild, and only recently have fish farmers attempted to raise perch indoors.

However, efforts have been made to step up especially since the demand outstrips the supply for yellow perch. Hence, retail prices in some shops have gone above \$10 to \$12 per pound for yellow perch.

Pioneering fish production practices has been a way of life for Alpine Farms, owned by John Wolf, and his brother-in-law, John Hynk. Both are in the well-drilling business started by Harley Hynk in 1949, and were looking for an alternative enterprise which fit in with their knowledge of water chemistry.

—Vicky Brown

Farmers want clean water, but need direction. Mr. Bushvelter said.

"Farmers want to do the right thing, but they are getting mixed signals," he said. "They want to know when and how. Water quality is an issue everyone cares about, but it might take a little more time (to develop legislation)."

Pam Porter, director of Wisconsin's Environmental Decade, said the committee

John Wolf, and his brother-in-law, John Hynk.

Both are in the well-drilling business started by Harley Hynk in 1949, and were looking for an alternative enterprise which fit in with their knowledge of water chemistry.

think every farmer needs immediate management plan. I think that's common the pit. We have not anything in 20 years, but signs farmers are do things to solve the problems they are not doing them enough.

Committee members must optimistic, she said. "It will be kind of pulling it all together, but have to hope," Ms. Porter said.

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