Division of Marketing
Agricultural Development and Diversification (ADD) Program

1994 Grant Final Report

Grant Number L94008

Grant Title Health Assessment Index

Amount Awarded $15,134.00

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Final Report

"Health Assessment Index: A Rapid, Simple, Inexpensive Farm-side Technique for Assessing Production and Health Status of Wisconsin Aquaculture Species"

Myron J. Kebus, M.S., DVM
Wisconsin Aquatic Veterinary Service

Funded By
Agricultural Development and Diversification(ADD) Aquaculture Grant Program Round 2, 1994 Contract No. L94008

Intent and Benefit to Wisconsin Aquaculture

The intended benefits of this project included introduction of the Health Assessment Index(HAI) to Wisconsin aquaculture producers, evaluation of the HAI for use on commercial aquaculture farms in Wisconsin, and generation of reference values which could benefit the meaningful application of this technique to commercial aquaculture farms in Wisconsin.

The economic benefits proposed was to provide Wisconsin aquaculturists with a practical and economical farm-side tool for evaluating the production and health of their fish. In addition, on a more advanced level, the HAI would provide a valuable tool for aquaculture veterinarians to assist Wisconsin aquaculture producers to assess and evaluate production and health decisions.

Summary of Achievements

All the participating producers benefited from the introduction to the methodology of the HAI(see enclosed letters, confidential, *WDATCP only*). One of the greatest benefits of the HAI was to introduce a rapid, simple, and inexpensive technique for assessing production and health status of fish.

Its use illustrates tangible proof of the commitment of Wisconsin's aquaculture industry to ensure the health of the fish they produce.

This grant assisted producers in detecting production and health problems during the project. The participating farms now have available a valuable technique for assessing growth and health of their fish.

This project generated real values for growth and health which will provide a more realistic basis for developing business plans for future Wisconsin aquaculture farms.

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Disease problems, previously overlooked, were uncovered during the performance of the HAI on all farms. In addition, Nodular Gill Disease(NGD) which had never previously been reported in production fish in the United States was discovered. This disease would not have been discovered at this time if this grant were not conducted.

This project was viewed by participating and other Wisconsin aquaculture producers as an excellent example of the positive benefit of funding support from the Wisconsin Department of Agriculture Trade & Consumer Protection agency.

Evaluation of Results and Benefits

The results and benefits exceeded the original expectations. This project demonstrated that the HAI is extremely useful in assessing growth and health of fish raised on commercial aquaculture farms in Wisconsin. The application of the HAI provided benefits to the participating producers which were unanticipated by the investigator. They included re-evaluation of long existing concepts of production and health. Certainly, the discovery of a new disease was an unanticipated result. The Wisconsin Aquaculture Industry's image in the eyes of the consumers, legislators, and aquaculture related state government officials has been elevated by this project. This project demonstrated the value of on-site aquaculture veterinary service to Wisconsin aquaculture producers.

Information or Educational Materials Developed(information enclosed)

Fact Sheets:

1) "Growth of Rainbow Trout on Four Commercial Farms in Wisconsin During a Two-Year Period"

2) "Growth and Health Assessment of Yellow Perch Reared in Earthen Ponds in Wisconsin During a Two-Year Period"

3) "Fin Condition of Rainbow Trout on Four Commercial Farms in Wisconsin During a Two-Year Period"

4) "Gill Condition of Rainbow Trout on Four Commercial Farms in Wisconsin During a Two-Year Period"

Reference Data

92 pages of data on HAI parameters.

Article

"Assessing Health in Wisconsin Farm-Raised Fish", Wisconsin Aquaculture Update, Vol. 4, No. 1, Winter 1996

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Lectures

Wisconsin Aquaculture Conference ' 96, Wausau, WI,February 16, 1996

Aquavet 20th Anniversary Conference,Woods Hole, Mass, Marine Biological Laboratory , November 15, 1996

World Aquaculture Conference 97, Seattle, WA, February 23, 1997

Minnesota Aquaculture Conference 97, Brainard, MN, March 7, 1997

Wisconsin Aquaculture Conference 97, Stevens Point, WI, March 14&15, 1997

Future Projections

Based on the success of this grant, aquaculture producers in Wisconsin have requested HAI to be conducted on their farms. Aquaculture veterinary service is in great demand and will continue to contribute to the development of commercial aquaculture in Wisconsin. Wisconsin Aquatic Veterinary Service will seek funding for further evaluation, education, and generation of meaningful information pertaining to the HAI. Proposed future efforts will evaluate aquaculture farms which differ from those evaluated in this grant, such as yellow perch re-circulating systems.

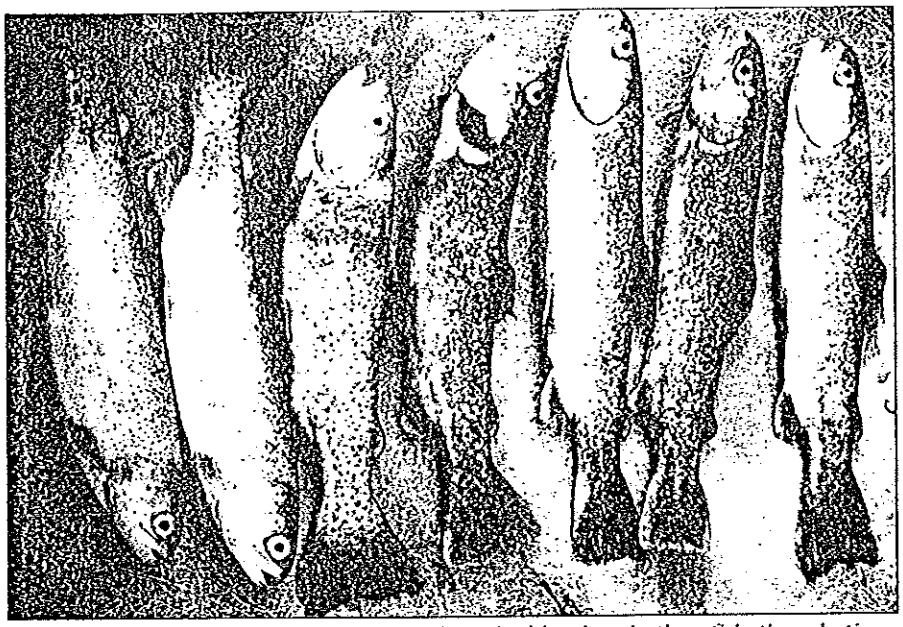
Financial Background

Matching funds were essential in making this effort possible. This effort could not have been accomplished without the funding support of the ADD Aquaculture Grant Program and the Wisconsin Aquatic Veterinary Service.

Assessing Health in Wisconsin Farm-Raised Fish

Myron J. Kebus, M.S., D.V.M.
Wisconsin Aquatic Veterinary Service

In Wisconsin, recent advances in veterinary medicine and stress physiology are now being tested as fish farmers strive to improve production and health of their fish. As part of my work with the Wisconsin Aquatic Veterinary Service (WAVS), I am in the process of evaluating a Health Assessment Index (HAI) for fish. This index was conceived by Dr. Ronald Goede and has already been tested and used by several fish managers. My project, which began in March 1995, represents the first effort to apply the HAI to commercial aquaculture species in Wisconsin. Funding for this work is being provided by a grant from the Wisconsin Department of Agriculture, Trade and Consumer Protection. One objective of the grant is to assist commercial Wisconsin fish farmers to improve the health and production of their fish through the use of the HAI. Five Wisconsin fish farms are currently participating in this project.



The Health Assessment Index can pick up the unhealthy signs in these fish, thus alerting the aquaculturist to a need for corrective measures. Photo by Myron J. Kebus.

The HAI is a rapid, simple and inexpensive farm-side technique. The technique evaluates parameters such as fish length, weight, sex, internal and external condition of several organs (such as the gills, liver or kidney), percent internal body fat, as well as two blood measures. Each of the parameters are ranked on a semi-quantitative scale from normal (healthy) to severely abnormal. In addition to helping the fish farmers currently involved in the grant, the study will eventually help determine which of the measured parameters are the *most* important for assessing the health of commercial aquaculture species in Wisconsin.

Health and stress are closely related. Numerous husbandry procedures and environmental conditions, including feeding practices, handling techniques, and sub-optimal water quality, have the potential to act as stressors and thereby impair fish health. The result may range from reduced growth and feed conversion to disease and associated mortalities. Most fish farmers recognize that maintaining optimum fish health will serve to maximize their farm's production and profitability. The HAI helps identify problem areas in fish farming, thus helping producers take more effective corrective measures.

The farms participating in the HAI grant have already benefited from HAI results. On one farm, for example, interpretation of HAI results suggested that there were problems with feeding practices. Poor growth and a low, but significant level of mortality were occurring. After the findings of the HAI, feeding practices were appropriately altered, and shortly thereafter the mortality levels declined and fish growth greatly improved.

In addition to correcting such problems, the HAI results have provided a means of comparing overall fish health and production between various Wisconsin farms. The HAI also has great potential to evaluate and compare the performance of different groups of fish on the same farm. This information could be useful to the farmer in several ways. For example, recent research studies have shown that genetic differences can account for greater disease resistance observed in some strains of fish. Several research projects, including one now being conducted in Wisconsin, are trying to determine whether the fishes' response to stress can be used to produce disease resistant strains of rainbow trout as well as other species. The HAI is a potential tool for evaluating whether the offspring of particular strains differ in their health.

Interest in the HAI has grown beyond the original grant participants. Several aquaculturists both within and outside of Wisconsin have shown interest in using the HAI for assessing the health of their fish since the grant first began. Hopefully, the HAI will become a very useful tool to increase the production and health of farm-raised Wisconsin fish.

Growth

of Rainbow Trout on Four Commercial Farms in Wisconsin During a Two-Year Period

Myron J. Kebus, M.S., DVM
Wisconsin Aquatic Veterinary Service
Madison, WI

There are many sources for information on growth in rainbow trout. However, until now, little has been published on growth of rainbow trout on commercial farms in Wisconsin. Farms studied varied in production from approximately 5,000 lbs to over 100,000 lbs per year. All fish originated from Troutlodge Inc., Sumner, Washington. Managers of the farms studied had an average of 7 years at their present farm. The farms were located in various regions of the state of Wisconsin, ranging from 120 to 250 miles apart.

The following information is the result of measuring twenty fish per farm from four farms every three months for two years:

Mean (Average)Total Length and Condition Factor($Wx10^5/L^3$ metric)

Age(Month)	Max(Mean)	Min(Mean)	Condition Factors
4	2 1/2" 63.5mm	1 3/8" 35.9mm	NA
8	4 5/16" 110.2mm	2 7/8" 72.8mm	**1.16, 1.01**
12	8 11/16" 220.9mm	4 5/8" 117.1mm	**1.17, 1.18**
16	9 1/2" 242.4mm	5 13/16" 148.2mm	**1.23, 1.20**

NA: not available due to low gram weights

How old is a 12" (Market-Sized) rainbow trout in Wisconsin?

The farm with the fastest growth had fish of mean total length 12" (10 1/2 to 13") at **19** months of age. The farm with the slowest growth did not reach mean total length of 12" by 24 months of age. At 16 months of age no group of fish had reached 12" mean total length, in fact, they were considerably shorter. The maximum mean total length at 16 months was 9 1/2".

Growth varies considerably from farm to farm.

At virtually every point in time the farm with the fastest growth had fish that were at least twice the size of fish of the same age class from the farm with the slowest growth .

Growth varies considerably from year to year on the same farm.

For example, on one farm 5-month old fish in 1995 were 2 3/8"(61.9mm) mean total length, while in the following year 6- month old fish from another lot had only reached 1 13/16" (46.8mm), or 24% shorter. Trout less than 12 months of age demonstrated tremendous capacity to increase growth. In one example Farm B had the smallest fish at 4 months of age. Management changes were instituted based on HAI results. Three months later this farm had the largest 7-month old fish.

Temperature was important, but...

The lowest growth rate occurred on a farm with the lowest average water temperatures of 46^{0}F. Growth rates were as much as double at the remaining three farms, which all had average water temperatures of 50^{0}F. However, growth rates varied as much as 50% between these three farm.

Acknowledgement

The information given was generated during performance of the project **"Health Assessment Index: A Rapid, Simple, Inexpensive Farm-Side Technique for Assessing Production and Health Status of Wisconsin Aquaculture Species"**. This project was funded in part by the Wisconsin Department of Agriculture Trade and Consumer Protection Agency's Agricultural Development and Diversification(ADD) Aquaculture Grant Program Round 2, 1994.
The remaining funds were provided by the Wisconsin Aquatic Veterinary Service(WAVS).
The Health Assessment Index was developed by Ronald W. Goede.

Fin Condition
of Rainbow Trout on Four Commercial Farms in Wisconsin During a Two-Year Period

Myron J. Kebus, M.S., DVM
Wisconsin Aquatic Veterinary Service
Madison, WI

Little has been published on fin condition of rainbow trout on commercial farms in Wisconsin. This project studied commercial rainbow trout farms in Wisconsin which varied in production from approximately 5,000 lbs to over 100,000 lbs per year. All fish originated from Troutlodge Inc., Sumner, Washington. Managers of the farms studied had an average of 7 years at their present farm. The farms were located in various regions of the state of Wisconsin, ranging from 120 to 250 miles apart.

The following information is the result of performing a complete Health Assessment Index(HAI) on twenty fish per farm from four farms every three months for two years:

Fin condition varied from normal(49%), slight erosion(34%), moderate erosion(13%) to severe erosion(3%).

Did the farm with the fastest growth have fish with the best fin condition?

Most often, the farm with the fastest growth rate had the worst fin condition, particularly the dorsal fins. The farm with the slowest growth rate had significant fin abnormalities, and at times this farm had fish with the worst fin condition.

Did size or age of fish affect fin condition?

The largest fish had the most severe erosion, particularly the dorsal fins. On three farms, fish older than 8 months had poorer fin condition than younger fish. On the remaining farm, fish older than 8 months had better fin condition than younger fish.

Which fins had the poorest condition?

Abnormalities were most common in the dorsal fin, followed by the pectoral, pelvic, anal fins, and tail. Fifty-one% (327/640)of the fish examined exhibited some level of fin erosion .

Were earthen ponds better than concrete raceways?

The farm with earthen raceways did not have fish with significantly better fin condition than the fish raised on concrete raceways. In fact, when fish between 12-24 months of age were compared the farm with earthen raceways had the worst fin condition.

Did fish at high density have worse fin condition?

The fish reared at the highest density did not consistently have the worst fin condition. The farm with the lowest rearing density did not have the best fin condition.

If a group of fish had poor fin condition, would that group always have poor fin condition?

Groups of fish demonstrated that the quality of fin condition could fluctuate over time. Groups of fish exhibited the ability for significant improvement of fin condition. In addition, fin condition was seen to deteriorate tremendously within days, and recover within month, on one farm.

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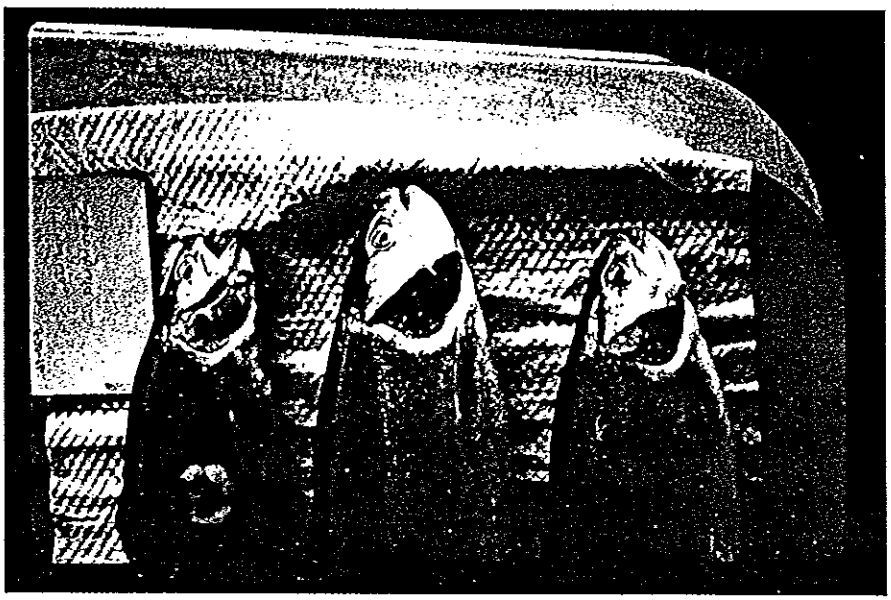
Gill Condition
of Rainbow Trout on Four Commercial Farms In Wisconsin During a Two-Year Period

Myron J. Kebus, M.S., DVM
Wisconsin Aquatic Veterinary Service
Madison, WI

Little has been published on gill condition of rainbow trout on commercial farms in Wisconsin. This project studied commercial rainbow trout farms in Wisconsin which varied in production from approximately 5,000 lbs to over 100,000 lbs per year. All fish originated from Troutlodge Inc., Sumner, Washington. Managers of the farms studied had an average of 7 years at their present farm. The farms were located in various regions of the state of Wisconsin, ranging from 120 to 250 miles apart.

Gills may appear normal, frayed, clubbed, marginate, or pale depending on the health of the fish. Abnormalities of the opercules(gill plates), such as shortening, may accompany gill abnormalities.

The following information is the result of performing a complete Health Assessment Index(HAI) on twenty fish per farm from four farms every three months for two years:



In a number of cases observed during this project significant gill lesions did not accompany abnormalities of the opercules. Therefore, evidence of abnormalities of the opercules was not a sufficient indicator of gill erosion.

How common are gill abnormalities?

Gill abnormalities were common on all farms, all sizes of fish, and all age-classes in this study. Gill abnormalities were found in 26%(166/640) of the all fish examined. All farms had fish with gill abnormalities: Farm A(26%), Farm B(29%), Farm C(20%), and Farm D(30%). Time of year or water temperature was not a significant factor affecting gill condition.

Does size or age of fish influence gill abnormalities?

Size of fish, or age were not significant factors affecting gill condition. Gill abnormalities were as common in young fish as they were in older fish. Assessment of fish eight months of age or less showed that 27%(92/340) had gill abnormalities. Within an age-class, size was not a significant factor affecting gill condition.

Which diseases are most commonly observed on gills with abnormalities?

Bacterial Gill disease, Environmental gill disease, Costiasis, Monogenean Disease, and Nodular Gill Diseases were all detected during the two-year health assessment period. Mortality and morbidity were seen with all of the above conditions.

If a group of fish show gill abnormalities will they appear worse, better, or the same on the next three-month visit?

The condition of the gills was not a significant indicator that gill abnormalities would be present on the subsequent assessments. Detection of gill abnormalities resulted in management recommendations. The validity, and proper performance of the recommendations frequently improved gill condition. In numerous cases no permanent abnormalities were evident.

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The Health Assessment Index was developed by Ronald W. Goede.

Growth and Health Assessment of
Yellow Perch
Reared in Earthen Ponds in Wisconsin During a Two-Year Period

Myron J. Kebus, M.S., DVM
Wisconsin Aquatic Veterinary Service
Madison, WI

This is the first report of growth and health parameter of yellow perch reared in earthen ponds on a Wisconsin farm. During this project 255 yellow perch were weighed, measured, and examined using the Health Assessment Index(HAI). All fish had been reared in outdoor earthen ponds for their entire life. Age of fish ranged from 4 to 24 months. No significant mortalities or morbidity were observed among the fish studied.

The following information is the result of measuring twenty fish from each of two groups of yellow perch every three months for two years:

Growth

Mean(Average) and Individual Total Lengths

Age(MONTH)	Max(mean)	Min(mean)	Max(indiv)	Min(indiv)
4	1 1/2" (38.5mm)	1 1/2" (37.4mm)	2 1/16" (52mm)	1 3/16" (30mm)
12	6 1/16" (154mm)	3 3/8" (86mm)	7 1/16" (179mm)	2 9/16" (65mm)
15	7 1/8" (180.1mm)	4 11/16" (120.6mm)	8 3/8" (214mm)	3 15/16" (101mm)
24	7 7/8" (200mm)	6 1/2" (165.9mm)	9 1/4" (234mm)	5 7/16" (138mm)

Gill Condition

Gills are believed to be the best indicator of health. Gill abnormalities were relatively uncommon (8.0%), compared to commercial rainbow trout from Wisconsin(26%).

Fin Condition

Fin abnormalities were relatively uncommon(6.5%), compared to commercial rainbow trout from Wisconsin(51%).

Internal Organs

Abnormalities were very uncommon(<1%), as they were in commercial rainbow trout from Wisconsin. Organs examined included: spleen, liver, kidney, and intestine.

Internal (Visceral)Body Fat

It is believed that the level of fat reflects the intensity of feeding and energy deposition. Fish of all ages examined demonstrated the ability to achieve the maximum fat level(4). Females, 24 months of age, acheived scores of 4 even in the April spawning season. One group of 12-month old fish demonstrated very low scores the previous April.

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