The Fish Propagation System Action Plan for Meeting Wisconsin's Fish Stocking Needs

by

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NOTES

Report Summary

I. BACKGROUND

Sport fishing is an extremely popular recreational activity and a major economic industry in Wisconsin. Each year over 1.5 million anglers spend 17 million days fishing. They spend $1.1 billion directly on fishing related expenses which results in over $2.1 billion in economic activity in the state supporting over 30,000 jobs and generating over $75 million in tax revenues for the state (Maharaj and Carpenter 1997).

While the vast majority of Wisconsin's sport and commercial fisheries are supported by naturally reproducing populations, stocking is an important fisheries management tool that creates and maintains sport fisheries in waters. The Wisconsin Department of Natural Resources (WDNR) Bureau of Fisheries Management and Habitat Protection currently stocks 50-60 million fish each year in public waters across the state.

In 1997 the Wisconsin Department of Natural Resources (WDNR) began a comprehensive review of their public fish propagation and stocking program at the request of the state legislature (WLAB 1997). First, an analysis and summary of existing WDNR fish production capacity was completed (WDNR 1998). Second, a review and revision of WDNR statewide stocking strategies was completed to determine the current and future statewide needs for stocking fish in Wisconsin's public waters (WDNR 1999). Finally, this report compares statewide fish stocking needs with existing WDNR fish production capacity and develops strategies for meeting those needs.

A comparison of long-term stocking needs with the current production capacity shows that existing WDNR facilities are unable to accommodate the long-term demand. If WDNR is to fulfill their public trust responsibilities and meet the needs of anglers and the many others that depend on healthy fisheries in Wisconsin, additional capacity to meet these needs must be created.

II. STOCKING NEEDS ASSESSMENT

A. Coldwater Fish Production Capacity.

Total projected long-term stocking needs are nearly 6.4 million (7.8 ***million domestic equivalent****) brook, brown, rainbow, and lake trout, chinook and coho salmon, and splake. Additional rearing space will be needed for small fingerlings, large fingerlings, and adult feral trout, and Great Lakes trout and Salmon. The "critical" needs project at the Nevin State Fish Hatchery will optimize feral (wild) trout production, including retrofitting smaller tanks needed for small fingerling production. "High priority" needs projects at the Lakewood Rearing Station would optimize and develop water supplies and rearing space to meet feral trout needs for Northern Wisconsin. Large fingerling rearing needs will come from redirected and reconfigured yearling production facilities to meet needs.

*Note: ***domestic equivalent,*** refers to the number of fish, equivalent to domestic fish, that can reared in a given amount of space with a given amount of water. A typical example is that the rearing of 10,000 feral trout has a ***domestic equivalent*** of 20,000 fish that can be reared in the same sized tank with the same water flow.

New yearling trout needs include 30,000 lake trout (60,000 domestic equivalent) for restoration needs and space to develop and rear feral trout broodstocks were not included in the WDNR report *A Evaluation of Stocking Strategies in Wisconsin with an Analysis of Projected Stocking Needs* (WDNR 1999). The Wild Rose State Fish Hatchery renovation will optimize the available water supply and Great Lakes trout and salmon production at all sizes. Additional space is needed for the development and maintenance of two captive feral broodstocks. Space for these needs will come from the redirected and reconfigured the remaining yearling production capacity. Ground water compliance issues at the Osceola State Fish Hatchery will require a groundwater study and an engineering study to develop solutions and budgets.

B. Warmwater Fish Production Capacity.

The WDNR projects major production shortfalls for muskellunge, northern, lake sturgeon and walleye. The only surplus production capacity currently existing is for bass production.

Muskellunge production shortfalls of 26,205 large fingerlings can be met by shifting the production of muskellunge to surplus bass rearing facilities in the West Central Region (WCR) Operations ponds (11,205 large fingerlings) and the earthen pond lining project at the Oehmke hatchery (15,000 large fingerlings).

Walleye production shortfalls of 1,593,000 small fingerlings can be partially met by the "compliance" hatchery renovation at the Wild Rose SFH (460,000 small fingerlings), the "high priority" hatchery renovation project at the Lake Mills SFH (250,000 small fingerlings) and the earthen pond lining project at the Oehmke hatchery (50,000 small fingerlings). The Department has the space to rear 100,000 of the 1,000,000 large fingerling walleye needed with forage availability and funding as the primary issues. An internal team has been formed to look at issues that are limiting to large fingerling walleye production and formulate strategies that will include the private fish farming industry as a part of the solution to meet the remaining 900,000 large fingerlings needed.

Northern production shortfalls of 37,980 small fingerlings and 42,100 large fingerlings can be met by the "compliance" hatchery renovation at the Wild Rose SFH (17,980 small fingerlings and 22,100 large fingerlings) and the high priority hatchery building project at the Lake Mills SFH (20,000 small fingerlings and 20,000 large fingerlings).

Bass production capacity will be scaled back to meet projected needs. Remaining rearing capacity will be converted to other warmwater needs.

Lake sturgeon production shortfalls of 5,000 small fingerlings and 65,000 large fingerlings will be met by the "compliance" hatchery renovation at the Wild Rose SFH.

III. STRATEGIES FOR FULLY MEETING THE STATE'S STOCKING NEEDS

To meet its public trust responsibilities, additional funding must be found to maintain facilities, protect current production capabilities and expand production. The Fisheries Program does not have sufficient funding or bonding authority to rebuild our system of hatcheries, many of which are 50 to 100 years old.

Strategy A - Rehabilitate Existing WDNR Facilities

An estimated one-time capital development investment of $32,028,950 would increase the fingerling production capacity of the WDNR system by 200,000 feral trout, 760,000 walleye, 26,205 muskellunge, 80,000 northern pike and 70,000 sturgeon. This expenditure also addresses "compliance" needs, "critical" needs, "high priority" needs, "enhancements" and "maintenance" needs at nearly all of the Departments major rearing facilities as well as most of its smaller facilities. These

project estimates are based on the current Six-Year Capitol Facilities Plan and projects pending inclusion in the plan submitted by facility managers.

Strategy B - Fully Staff and Fund Existing WDNR Facilities

Funding and staffing for all WDNR fisheries management programs has, at best, remained constant relative to inflation for at least the past 30 years. During that time the demands on the program have increased, including the addition of more and larger fish propagation facilities, the need to manage a new treaty fishery and increasing needs for fish assessment information. An additional 5.75 FTE's (full time employees), $287,500 would be required to fully staff the hatcheries. Together, these additions would bring existing facilities and operational budgets to a level that would allow for full facility utilization, a reduction in facility-related mortality, expansion of the walleye fall fingerling program, and expanded operation of outlying ponds. This would result in an increase in the total annual propagation operating costs of approximately 12% to 6.4 million.

Strategy C - Increase Efficiency within the WDNR Fish Propagation System

The most likely improvement would come from maximizing production at facilities that are capable of making the efficient use of new technologies and have the potential for expansion. Detailed economic and rearing analyses need to be completed to determine whether or not this would, in long term, lower annual personnel and acceptable operational overhead costs while still producing the quality of fish needed to meet management specific goals.

Strategy D - Expand Use of Cooperative Agreements

Cooperative agreements with not-for-profit groups and commercial businesses annually account for nearly 300,000 warmwater fingerlings and over 42,000 coldwater fingerlings and about 88,000 coldwater yearlings produced toward stocking quotas each year. We believe there is some potential to expand production through cooperative agreements, but only with an investment of additional staff and financial resources.

Strategy E - Private Contracting

There are a number of significant questions that need to be addressed to make sure contracting can provide a consistent source of fish each year, and that the fish obtained meet specifications for health, genetic strain, and size and weight. Assuming that these issues can be addressed, we estimate an annual cost of $706,600 to purchase the 833,000 walleye fingerlings needed to meet management stocking goals at $0.20 each and 900,000 large fingerling walleye at $0.60 each. Distribution costs could add 30% or more to this cost.

IV. RECOMMENDATION

Operate all existing WDNR facilities at full capacity and in compliance with environmental regulations and expand private contracting to fully meet projected stocking needs.

Total one-time capital development costs	**$32,028,950**
Total additional annual costs (includes)	**$1,394,100**
Fully fund existing facilities	$400,000
Private contracting cost to purchase fish	$706,600
5.75 New FTE's	$287,500

This is the Department's preferred recommendation. This recommendation provides the funding needed to increase statewide fish production to fully meet all projected stocking needs as outlined in *A Evaluation of Stocking Strategies in Wisconsin with an Analysis of Projected Stocking Needs* (WDNR 1999). This recommendation provides the funding and staffing needed to fully implement all of the strategies outlined. These strategies are what the Department feels to be the optimal choices for meeting the public trust to provide angling opportunities. This includes provisions for purchasing products from the private aquaculture industry, provided that annual funding can be secured from new sources. There are also opportunities for expanding public education and outreach, and ecosystem restoration at some facilities such as restoration of wetlands, spring areas, and stream channels, as facilities are renovated.

Issues: Additional staffing and funding must be found for capitol development and hatchery operations budgets. Bonding could offset development costs and hatchery operational costs could be recovered from SEG funding sources.

Alternatives Considered:
Minimal Funding, Alternative Recommendation: Address only Compliance and Critical needs. Total One-time Capital Development Costs = $24,947,300.

This alternative recommendation would allow the Department to meet compliance needs at the Wild Rose State Fish Hatchery and to proceed with implementing the critical needs for feral (wild) trout production at the Nevin State Fish Hatchery. This alternative includes strategy A at a reduced level. Strategy C, D, and E -provisions for purchasing products from the private aquaculture industry could not be implemented unless new funding for annual expenditures can be secured.

Issues: Additional funding must be found to meet development needs. Long term bonding is a likely source. This recommendation does not provide what the Department feels to be the optimal choice for meeting the public trust to provide angling opportunities, but would allow the Department to move forward at two of its most important coldwater facilities. Strategy B – "Fully staff and fund existing WDNR facilities" would not be possible under this alternative. This would limit the Department's ability to solve production problems. Over time there will be a loss of fish production as other rearing units are taken off-line due to continued physical plant deterioration.

The Consequences of No Action.

Over time, production levels will decline from their current level. Noncompliance at the Wild Rose SFH could end fish production at the hatchery. As an example, closure of the Wild Rose SFH would result in dramatic reductions in the number of fish produced for stocking. This would result in a statewide reduction of trout and salmon production by 27%, a reduction of northern pike production by 64%, a reduction of Great Lakes spotted muskellunge production by 100%, and a reduction of lake sturgeon by 100%.

A large portion of the propagation system's infrastructure is past its "useful lifetime". The result would be a rapid decline in the Department's fish production capacity over the next 10 years as production units and facilities fall out of use. The Department's ability to provide fishing opportunities would be severely compromised. Budgets would have to be re-prioritized which would result in the closure of one or more facilities and the relocation or loss of key experienced and trained personnel to provide enough operation money to perform critical maintenance at the remaining facilities.

The Department's primary recourse would be the full implementation of Strategy C, Increasing Efficiency within the WDNR Fish Production System. Expanded use of Strategy D, Cooperative Fish Rearing Agreements, would also be used to meet demand. However, money available to purchase products from the private aquaculture industry would decline over time as budget dollars are redirected toward maintaining existing WDNR facilities.

I. Introduction.

Sport fishing is an extremely popular recreational activity and a major economic industry in Wisconsin. Each year over 1.5 million anglers spend 17 million days fishing. They spend $1.1 billion directly on fishing related expenses which results in over $2.1 billion in economic activity in the state supporting over 30,000 jobs and generating over $75 million in tax revenues for the state (Maharaj and Carpenter 1997). Best available estimates show that Wisconsin anglers annually take home almost 66 million fish (Joint Committee on Legislative Organization, Wisconsin Legislature, 1995). Panfish are the most popular, but other species are heavily utilized as well. Walleye, muskellunge, bass and various trout species comprise our premier inland fishing opportunities. On the Great Lakes, continued stocking of coho and chinook salmon, lake trout and steelhead trout have all helped to create a world class fishery.

Stocking is an important fisheries management tool that creates and maintains sport fisheries in waters that cannot support them through natural reproduction. The Wisconsin Department of Natural Resources (WDNR) Bureau of Fisheries Management and Habitat Protection currently stocks 50-60 million fish each year in public waters across the state. Stocked fisheries can be extremely important in some waters. The Lake Michigan trout and salmon sport fishery annually harvests 300,000 to 600,000 fish and generates an estimated $50 to $100 million in direct angler expenditures. This fishery is primarily dependent on stocking. Stocking also supports approximately 25% of muskellunge fishing opportunities. These are both welcome and highly valued additions to Wisconsin's fishery.

A majority of Wisconsin's sport and commercial fisheries are supported by naturally reproducing populations - not stocking. The Department relies heavily on other fisheries management tools such as habitat protection and restoration, harvest regulation, access development, and educational programs to manage the state's fisheries. It is a major challenge to wisely invest limited personnel and fiscal resources among different management activities, including operation of propagation programs, to most cost-effectively manage the state's diverse fisheries. Wisconsin also has a number of viable private and tribal commercial fisheries including whitefish, chub, and lake trout on the Great Lakes, and catfish, carp, and other rough and bait fish on the Mississippi River and some inland waters. On the Great Lakes, estimates suggest that 5-10 million fish were commercially harvested annually from these fisheries with a landed value of $5-$10 million.

The WDNR Bureau of Fisheries Management and Habitat Protection operates a statewide fish propagation and stocking program that creates important sport fishing opportunities on many of Wisconsin's public waters. The ***coldwater*** *(species of fish that prefer water temperatures between 45°F and 65°F)* propagation program produces trout and salmon for stocking in the Great Lakes and domestic and wild strain trout for stocking in inland waters. The ***warmwater*** *(species that prefer water temperature between 60°F and 80°F)* propagation program produces walleyes, muskellunge, northern pike, largemouth and smallmouth bass, and lake sturgeon for stocking in waters across the state, and minnows and suckers for use as forage in raising of some of the stocked species. All facilities offer opportunities for public education and outreach of the fisheries program. As facilities are renovated, full consideration will be given to expanding this important education and outreach role to include all Department activities.

In 1997 the WDNR began a comprehensive review of their public fish propagation and stocking program at the request of the state legislature (WLAB 1997). This review involved three parts. First, an analysis and summary of WDNR fish production capacity was completed in July 1998. This initial report contained information on existing WDNR fish propagation facilities, historical production numbers, estimates of the current production capacity to meet existing stocking needs, and procedures to determine future production capacity in response to changed statewide stocking needs (WDNR 1998).

Second, a review and revision of WDNR statewide stocking strategies was completed in February 1999. A major objective of this evaluation was to determine the current and future statewide needs for stocking fish in Wisconsin's public waters. Existing stocking policies were revised to maximize both cost-effectiveness and fishery potential of the stocked water using the most recent scientific and customer preference information. Revised stocking guidelines were applied statewide to determine projected fish stocking needs (WDNR 1999).

Third, this report compares statewide fish stocking needs with current WDNR fish production capacity and develops strategies for meeting those needs. Detailed production statistics and strategies were analyzed for WDNR facilities. A more qualitative analysis of strategies involving other sources of fish for stocking such as private businesses, cooperating volunteer groups, and other governmental agencies was not conducted since detailed and accurate production information from these sources is not readily available.

II. WDNR Fish Propagation Capacity

The Department operates an array of facilities and coordinates several activities to meet fisheries management goals. **Spawn** (*the eggs and sperm collected to produce fertilized eggs*) collection is the initial step. The Department operates 3 facilities on tributaries of Lake Michigan where eggs are collected and fertilized from seasonally migrating mature trout and salmon. Fish produced from these fertilized eggs are stocked back into the Great Lakes. WDNR maintains rainbow, brook, and brown trout **broodstocks** *(captive adults used to provide spawn for production needs*) at 4 fish hatcheries across the state to annually collect eggs at these facilities. Fish produced from these eggs are stocked in both Great Lakes and inland waters.

Maintaining **domestic** (*refers to fish that have been raised in an artificial situation such as a hatchery for several generations*) broodstock in the hatcheries provides for a reliable and inexpensive source of eggs. These domesticated fish can and often significantly differ genetically from **feral** (*of wild origin or originating from fish populations with "wild" characteristics that have demonstrated survival for several generations and adaptation to local conditions)* reproducing populations. Domestic trout can provide an excellent short-term fishery, but generally do not survive for long periods or successfully reproduce in the wild. To address this problem, WDNR also produces eggs from feral populations of brook, brown, lake and rainbow (steelhead) trout. Mature fish are initially collected from streams with excellent trout populations and either spawned on site or transferred to a hatchery for holding until the fish are ready to spawn. To minimize the cost of annually collecting mature feral fish and the impacts of fish removals on the streams, **first generation** (*the first offspring, in this case of feral parents*) feral broodstocks of brown trout fish have been developed at the Nevin hatchery. This broodstock is created from new feral eggs collected each year. The offspring of this broodstock provide the production numbers needed as well as the desired genetic and performance characteristics. The production requests for feral brook trout are small enough for each of the identified basin stocks that the development of a captive feral broodstock is not warranted. The eggs are taken directly from feral spawning runs to the hatchery where the eggs are collected and fertilized in sufficient numbers to produce the fish needed with the desired genetic and performance characteristics.

In the warmwater propagation program all eggs are collected from feral fish. Mature walleyes, muskellunge, northern pike, lake sturgeon and suckers are collected each spring by netting from waters known to have good populations of each species.

After collection, eggs are transported to **hatcheries** (*facilities where eggs can be incubated and hatched and fish are reared*). WDNR operates five coldwater hatcheries, one warmwater hatchery and 4 dual coldwater and warmwater hatcheries. Eggs for fertilization are stripped from mature adult fish; the adults are then returned to the water. Eggs cannot be removed from largemouth or smallmouth

bass, or minnows. Instead, a few mature fish are transported to hatchery ponds and allowed to spawn naturally. The ponds are harvested to collect the fingerlings for stocking.

Newly hatched **fry** (*the life stage that begins at hatch and continues until feeding begins*) are then reared to suitable size for stocking depending on the species and management need. Some fish are immediately stocked as fry, while many are raised to a larger size for an additional 1-11 months and then stocked as **fingerlings** (*the life stage that begins at initial feeding and continues until the fish is one year old*). Some are raised overwinter to an even larger size and stocked as **yearlings** (*the life stage that begins at one year of age and continues until age 2 or adulthood*). The Department's four (4) **rearing stations** (*facilities that do not have the ability to incubate and hatch eggs because of extremely cold winter water temperatures*) utilize indoor tanks, outdoor raceways and ponds to rear fish. In addition, the Department rears fish in **outlying ponds** (*ponds and/or impoundments that are not located at one of the Departments 14 hatcheries and rearing stations*) at other locations throughout the state. These outlying ponds generally have some level of site improvements and have small fixed operational costs. Fish demand and budget determine whether or not outlying ponds are used. WDNR has recently operated up to 10 outlying ponds for coldwater production, and up to 20 outlying ponds for warmwater and forage production.

The Department produces fish for stocking through active participation in **cooperative fish rearing agreements** (an agreement with either volunteer organizations or private businesses). The Department provides a suitable life stage to the cooperator, who then raises the fish to the target stocking size in their own facilities. All or a portion of the fish are then stocked back into public waters. The motivation for the cooperator is the satisfaction of producing fish or sizes of fish to meet stocking quotas set by the fisheries managers that result in more fish to the creel or commercial profit from a share of the fish raised. The numbers of fish or sizes of fish are typically ones that the Department might otherwise not have been able to rear because of facility or financial bottlenecks. The State benefits by receiving the fish produced at a size that results in better return to the creel and often at a low cost. Currently the Department participates in over 40 cooperative agreements each year. The availability of successful cooperators and the availability of some Department resources limit further expansion of this program.

The Department's fish propagation system clearly produces a significant proportion of the fish needed for statewide stocking of Wisconsin's public waters. As detailed in "Production Capacities of the Wisconsin Department of Natural Resources' Fish Propagation Facilities" report (WDNR 1998) there is also considerable flexibility to produce different mixes of species and sizes either with short- or long-term adjustments to hatchery operational plans. Given this flexibility, it is impractical to develop a single statement of hatchery capacity, but tables 1 (page 13) and 2 (page 14) summarizes the optimal production at each WDNR facility which is driven by past fisheries biologists' annual needs.

III. Summary of WDNR Fish Production Capacity

The WDNR has an extensive and flexible fish production system. In any given year, production can be shifted to a great extent among warmwater species, among coldwater species, and between Great Lakes and inland coldwater species. Our current annual quota system also provides necessary flexibility to regional fisheries biologists to vary stocking among waters and species each year to meet their current management objectives. Given this flexibility in both annual need and production capacity, it is difficult to provide a single definitive analysis of need versus capacity. However, such an analysis is possible if it is assumed that the projected stocking needs based on the recently revised stocking guidelines (WDNR 1999) represent a stable annual stocking need and thus a stable production goal. Production among species and facilities can then be optimized relative to that goal and existing available staff and fiscal resources and any shortfalls or excess capacity can be identified.

The Department's production capacity also can be described as a "web". Fish are often spawned, incubated, hatched and reared at a broodstock facility for transfer to other hatcheries, rearing stations and cooperators that are closer to their ultimate stocking location. An example of this is production of domestic brown trout. The St. Croix Falls SFH has a disease free water supply where domestic brook and brown trout brood stock are reared and maintained to supply the Departments egg needs. The brood fish are spawned and the eggs and **milt** (sperm) are collected. The eggs are fertilized, incubated and hatched. When large amounts of fish are to be stocked in other parts of the state, eyed eggs are economically and efficiently transferred. In southern Wisconsin, the Nevin SFH would receive these eggs for final incubation, hatching and rearing to the desired life stage and size. The St. Croix Falls hatchery also rears newly hatched fry to the fingerling stage for transfer to hatcheries that don't have incubation and hatching facilities. These include the Brule River SFH, the Langlade Rearing station and 9 different cooperators (12 ponds). These facilities continue to rear the fish for stocking when they have reached the desired life stage and size. Brown trout beginning at the St. Croix Falls SFH are ultimately stocked in 49 of Wisconsin's 72 counties, as well as Lake Superior and Lake Michigan (Figure 1).

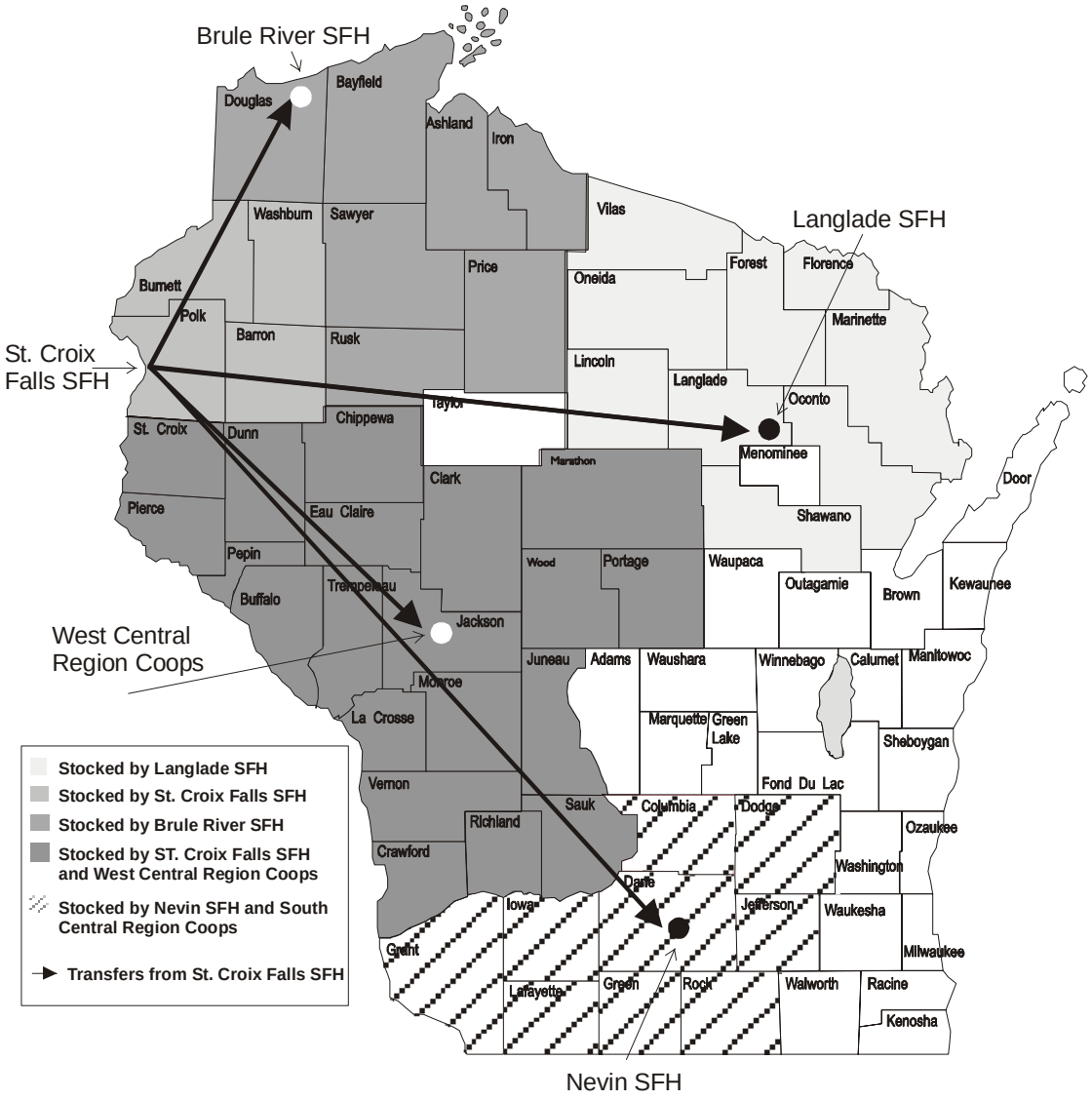

Figure 1. The production and distribution of St. Croix domestic brown trout in Wisconsin.

A Review of the Department's Current Production Capacity.

The coldwater fish production capacity of the Department's hatcheries based on **professional judgement** (*an opinion of fish rearing capacity based on a combination of facility experiences and an intimate working knowledge of each species and strain's unique rearing requirements*) is summarized in Table 1. Capacity is described in terms of **domestic equivalents** (*the number of fish, equivalent to domestic fish, that can be reared in a given amount of space with a given amount of water flow*) to highlight differences between domesticated and feral fish.

Table 1. Summary of current optimal coldwater fish production capacity based on Professional Judgement (modified from WDNR 1998).

Fish type	Age Class	Number	*Domestic Equivalent:
Trout (Domestic)	Small fingerling	179,200	179,200
Trout (Domestic)	Large fingerling	1,269,385	1,269,385
Trout (Domestic)	Yearling	2,014,342	2,014,342
Trout (Domestic)	Adult	10,200	10,200
	Totals:	**3,473,127**	**3,473,127**
Trout (Feral)	Small fingerling	223,400	446,800
Trout (Feral)	Large fingerling	266,550	533,100
Trout (Feral)	Yearling	461,235	922,470
Trout (Feral)	Adult	0	0
	Totals:	**951,185**	**1,902,370**
Salmon	Small fingerling	1,456,415	1,456,415
Salmon	Large fingerling	100,000	100,000
Salmon	Yearling	714,550	714,550
	Totals:	2,270,965	2,270,965
Combined	Small fingerling	1,859,015	2,082,415
Combined	Large fingerling	1,635,935	1,902,485
Combined	Yearling	3,190,127	3,651,362
Combined	Adult	10,200	10,200
	Totals:	**6,695,277**	**7,646,462**

* **Note: Domestic Equivalent** refers to the number of fish, equivalent to domestic fish, that can reared in a given amount of space with a given amount of water. A typical example is that the rearing of 10,000 feral trout has a ***domestic equivalent*** of 20,000 fish that can be reared in the same sized tank with the same water flow.

The warmwater fish production capacity of the Department's hatcheries based on past long-term production averages is summarized in Table 2. These are more meaningful numbers for planning and comparison purposes than calculated capacity estimates based on pond surface area because it eliminates the exceptionally poor and good years that are almost always due to natural factors (weather) over which we have no control.

Table 2. Warmwater fish production capacity in the Department of Natural Resources' hatcheries based on long-term production averages.

Fish type	Age Class	Number
Muskellunge	Small fingerling	10,085
Muskellunge	Large fingerling	101,595
Muskellunge	Yearling	200
	Totals:	**111,880**
Walleye	Small fingerling	4,007,000
Walleye	Large fingerling	63,700
	Totals:	**4,070,700**

Table 2. Warmwater fish production capacity in the Department of Natural Resources' hatcheries based on long-term production averages (continued).

Fish type	Age Class	Number
Northern	Small fingerling	42,020
Northern	Large fingerling	27,900
	Totals:	**69,920**
Bass (LM + SM)	Small fingerling	732,355
Bass (LM + SM)	Large fingerling	9,075
	Totals:	**741,430**
Lake Sturgeon	Small fingerling	5,000
Lake Sturgeon	Large fingerling	15,000
	Totals:	**20,000**
Combined	Small fingerling	4,796,460
Combined	Large fingerling	217,270
Combined	Yearling	200
	Totals:	**5,013,930**

Key:
LM = Largemouth bass; SM = Smallmouth bass

These production capacity values result from the development of a production plan that maximizes production of each species up to the projected management need (WDNR 1999). The hatchery system's production capacity is also influenced by current fish health and genetic policies, facility condition, available budget and staffing levels and the weather.

Projected Statewide Stocking Needs for Public Waters

In a recently completed analysis, the Department developed projected statewide stocking needs with the objective of using cost-effective stocking practices to optimize the fisheries in public waters across the state (WDNR 1999). The analysis considered what fish, if any, needed to be stocked in a particular water to develop the best possible fishery given the natural constraints imposed by available habitat, water quality, and existing fisheries, and the management objectives or plans that had been developed for the water.

A majority of waters in the state have good water quality and physical habitat, and already have good fisheries. These waters do not benefit from stocking. Other waters may naturally lack specific types of habitat, have suffered from past over harvest or habitat degradation, or have management objectives that call for modification or enhancement of the existing fishery. These waters may benefit from selective stockings. Some waters have suffered major environmental degradation, winterkill, or have other factors that preclude establishment of a naturally reproducing fishery. In such waters stocking may actually be able to recreate or sustain a successful fishery.

The analysis also considered the most cost-effective stocking practice for each water type. Stocking of large numbers of newly hatched fry may be appropriate for waters with few predators and/or turbid water conditions, which make it hard for predators to find prey. Stocking of fewer numbers of larger fingerlings or yearlings that are too large to be eaten by common predators may be better in waters with many predators or clear water conditions. The relative survival of various sizes of fish stocked must be compared to the relative cost of raising fish to each size. In many cases survival cannot be accurately predicted and must be determined by actual evaluations in the stocked water.

Finally, the analysis developed a recommended stocking rate for the specific management objectives for each water. Contrary to popular belief, stocking more fish does not always result in more adult fish for anglers to catch. Each water has a biological limit or "carrying capacity" of fish that can be sustained. That carrying capacity is determined by factors such as the fertility, size and depth of

the water, average annual water temperature, water quality, available habitat and forage, and other species already present. Studies show that there is a point of diminishing returns beyond which stocking additional small fish results in much higher costs with only a marginal, no increase, or even a decrease in adult populations (Kerr et al., 1996). Studies conducted on specific waters stocked are often needed to determine the optimum stocking number for that water.

The projected stocking numbers for each species represent a cost-effective optimum number for Wisconsin public waters. It is in the State's public interest to develop sufficient internal or external capacity to meet these stocking needs on a consistent long-term basis.

1. Coldwater Fish Production Capacity and Needs

Stocking of trout and salmon in the Great Lakes is the direct basis for an extremely valuable sport fishery and also indirectly enhances other native sport and commercial fisheries by maintaining predator control on detrimental exotic species such as the alewife. Annual direct angler expenditures have been estimated at between $50 and $100 million! Since this fishery is almost entirely sustained by annual stocking in Lake Michigan and greatly enhanced by annual stocking in Lake Superior, it is crucial to have an extremely reliable long-term capacity for production of trout and salmon.

Total projected long-term stocking needs are nearly 6.4 million (7.8 million domestic equivalent) brook, brown, rainbow, and lake trout, chinook and coho salmon, and **splake** (lake trout-brook trout hybrid). These projections are based on fish raised under "**optimum sustained production**" conditions (*the optimum number and pounds of high quality fish that can be produced on a consistent basis under the given set of conditions at a particular hatchery*) **(**WDNR 1998). Capacity is needed to accommodate production of yearlings of all species, and large fingerlings for all species except brook and lake trout, and splake. In addition, capacity is needed to separately produce 3 feral brown trout and 5 feral rainbow trout strains. It is expected that this demand for Great Lakes trout and salmon will remain relatively constant over the next 10 years with the exception of new strain evaluations. New strain evaluations increase the demand placed on the hatchery system for a period of 3 to 6 years while the strains are being evaluated and compared against existing strains.

To date, a combination of existing WDNR egg collection, hatchery, and rearing facilities and cooperative agreements with volunteer sports groups have been sufficient to meet these projected numbers. Great Lakes anglers must purchase a Great Lakes trout and salmon stamp which has historically generated a portion of the production expenses and some limited maintenance and development costs. However, WDNR hatchery and rearing facilities suitable for Great Lakes production are also typically suitable for production of inland trout so allotting capacity for one precludes production of the other. The production of Great Lakes and inland trout and salmon must sometimes be operationally isolated because of the presence of diseases such as bacterial kidney disease (BKD), which has a direct bearing on over-all system capacity. The Great Lakes program relies heavily on production of eggs from feral broodstocks that may limit options for procuring these fish from external vendors or cooperators. These factors must be considered when determining whether the Department's total coldwater propagation capacity is sufficient to meet both Great Lakes and inland needs, and in developing long-term plans for capacity development.

Current WDNR production is about 1.5 million trout for inland stocking of which approximately 500,000 are from wild brood sources. Funding for inland trout stocking comes from fisheries program revenues with some important local help from volunteer cooperative projects. A shift to wild trout stocking will require additional rearing space to hold captive feral broodstocks and annual production capacity and additional small fingerling rearing capacity. It is likely that existing WDNR facilities can be modified to accommodate the inland trout stocking long-term demand.

a) Domestic Trout

The projected long-term annual demand will total 2,657,000 (including Great Lakes stocking). Although there are many outstanding naturally reproducing Class 1 trout waters (3,540 miles) in Wisconsin, stocking is an important tool to maintain fisheries in many Class 2 and 3 waters (6,030 miles) where natural reproduction is limited. Stocking has also been used to develop popular seasonal put-and-take trout fisheries in some urban areas. The presence of significant self-sustaining trout fisheries and short-term nature of some trout stocking allows for considerable flexibility in considering and developing long-term capacity strategies.

Table 3. Projected Trout (domestic) stocking needs (modified from WDNR 1999).

Fish type	Age Class	Number	Domestic Equivalent
Trout (Domestic)	Small fingerling	19,200	19,200
Trout (Domestic)	Large fingerling	1,067,450	1,067,450
Trout (Domestic)	Yearling	1,560,680	1,560,680
Trout (Domestic)	Adult	10,200	10,200
	Totals:	**2,657,530**	**2,657,530**

b) Feral Trout

The projected long-term demand will total 1,386,080 (2,772,160 as domestic equivalent production). Feral trout for inland trout stocking reflects a major shift from the use of domesticated to feral broodstocks. Fish biologists have found two to three times better survival and increased chances to develop natural reproduction with offspring from feral broodstock. Overall projected annual demand is summarized in Table 3. These projections are based on fish raised under "Optimum Sustained Production - Professional Judgment" conditions (WDNR 1998). Additional capacity is needed to produce all life stages of feral trout. Production of wild fish will require capacity to maintain brood stocks for at least 1 feral brown trout strain, one feral lake trout strain for important, long-term restoration efforts, and space to seasonally hold and spawn up to 3 different feral brook trout strains. Through experience in the Department's hatcheries, it was found that feral trout production requires about twice the rearing space as is required for domestic trout production. Inland lake trout restoration efforts will require the development of 2 new feral captive broodstocks.

Table 4. Projected Trout (feral) stocking needs (modified from WDNR 1999).

Fish type	Age Class	Number	Domestic Equivalent
Trout (feral)	Small fingerling	378,580	**757,160**
Trout (feral)	Large fingerling	461,860	**923,720**
Trout (feral)	Yearling	506,640	**1,013,280**
Trout (feral)^	Yearling	30,000	**60,000**
Trout (feral)^	Adult	9,000	**18,000**
	Totals:	**1,386,080**	**2,772,160**

Notes: ^ Includes additions to projected needs for lake trout restoration efforts and the development and rearing of 2 additional feral brood stocks.

c) Salmon

Salmon projected needs are expected to remain relatively stable. Wisconsin currently stocks chinook and coho salmon in the Great Lakes.

Table 5. Projected salmon stocking needs (modified from WDNR 1999).

Fish type:	Age Class:	Number:	Domestic Equivalent:
Salmon	Small fingerling	1,867,000	1,867,000
Salmon	Large fingerling	100,000	100,000
Salmon	Yearling	398,000	398,000
	Totals:	**2,365,000**	**2,365,000**

Table 6. Projected summary of coldwater fish stocking needs (modified from WDNR 1999).

Fish type	Age Class	Number	Domestic Equivalent
Combined	Small fingerling	2,264,780	2,643,360
Combined	Large fingerling	1,629,310	2,091,170
Combined ^	Yearling	2,495,320	3,031,960
Combined ^	Adult	19,200	28,200
	Totals:	**6,408,610**	**7,794,690**

Key:
Dom = Domestic; fgl = fingerling

Notes:
^ Additions to projected needs for lake trout restoration efforts and the development and rearing of 2 additional feral brood stocks.

2. Warmwater Fish Production Capacity and Needs

a) Muskellunge

The projected annual long-term demand for muskellunge will total 138,000 fish. Muskellunge is the state fish, and has traditionally been a major focus of both Wisconsin sport anglers and fisheries management programs. Past stocking has greatly expanded the number of waters in which muskellunge are found. Currently, 27% of the state's muskellunge waters are regularly stocked (216 of 804 waters) therefore stocking may be responsible for up to a third of muskellunge caught and harvested by Wisconsin anglers.

Despite a long history of muskellunge propagation in Wisconsin there are still significant questions concerning the cost-effectiveness of this practice, such as deciding when to stock, stocking frequencies, and stocking densities needed to provide a successful muskellunge fishery. Many waters have good natural reproduction, but other waters have experienced poor or declining natural reproduction. It is thought that degradation of spawning habitat is one cause of poor natural reproduction. Competition with expanding northern pike populations is also thought to be responsible for declines in natural reproduction of muskellunge in some waters. Angling over-harvest was thought to have greatly reduced stocks in many waters to the point where natural reproduction could not keep pace. It is also difficult to measure the level of natural reproduction of muskellunge in a particular year due to the naturally low number of young produced. This has led to a stocking strategy based largely on projected harvest, habitat, and competition concerns rather than annual field measurements of natural reproduction.

Recently, higher minimum length limits and increased practice of catch-and-release by anglers have increased adult stocks in many waters and may have reduced the need for stocking. Limited measurements of natural reproduction indicate that current stocking rates may be higher than needed to maintain stocked populations. The impacts of increased muskellunge populations on other valuable fisheries such as walleyes, bass, and panfish continue to be assessed.

Given these uncertainties and the relatively high cost of muskellunge propagation (about $1.36/ 1,000 fry (WLAB 1997) to about $5.20/ small yearling (Margenau 1992)), the WDNR has recommended a long-term (10 year) muskellunge stocking evaluation project (WDNR 1999). This evaluation will be based on consistent application of existing stocking practices (i.e., the stocking rates and frequencies) and a new production capacity reflecting the optimal production capacity of 101,595 large fingerlings. This should stabilize the projected over-all long-term demand for muskellunge stocking during the evaluation period. The result will be a long-term production plan that meets fisheries management stocking requests and the stocking evaluation study design. Management of the 5 genetically different strains of muskellunge (Field, et al 1997) will be incorporated into the study design.

Another management objective is to improve muskellunge fishing opportunities in **Class B** (An intermediate class consisting of waters providing good fishing. In general, angler success and catch rates may be less than in prime waters) and **Class C** (These waters have fishable muskellunge populations, but they are not of major importance in the total fishery) muskellunge waters. Many fisheries biologists believe that the Class B or Class C status of many waters may be due to the inability of the hatchery system to supply sufficient number of fish for stocking, particularly for larger waters. Past requests for fish were truncated by a per-water maximum. As a result, the projected demand may be underestimated.

Current WDNR production of muskellunge fingerlings has averaged less than 100,000 large fingerlings annually. This number, though, probably does not reflect existing long-term system capacity since both major muskellunge hatcheries have been retooling from major renovations in the mid-90s. Additional capacity is available from outlying rearing ponds, though production in these is historically far more variable than from onsite rearing ponds. WDNR facilities have capacity to handle a substantial number of different strains if necessary. A major recent limitation to hatchery production has been the availability of adequate forage. Muskellunge propagation requires the availability of various sizes of sucker and minnow fry at crucial life stages of the muskellunge fingerlings. It has been increasingly difficult to find wild sucker eggs for raising onsite, or reliable contract suppliers. Funding for this program is from base fisheries program revenues, with limited assistance through volunteer and private cooperative agreements. Projected muskellunge stocking needs are summarized in Table 7.

Table 7. Projected muskellunge stocking needs (modified from WDNR 1999).

Fish type	Age Class	Number
Muskellunge	Small fingerling	10,000
Muskellunge	Large fingerling	127,800
Muskellunge	Yearling	200
	Totals:	**138,000**

b) Walleye

The projected annual long-term demand for walleye will total 6,600,000 fish. Walleye are the most popular gamefish in the state. Targeted fishing for walleye accounts for almost 33% of all sport fishing days (U.S. Department of the Interior et al. 1996). They are also the primary species of a tribal subsistence fishery in the ceded territory accounting for an annual harvest of around 30,000 fish (U.S. Department of the Interior 1995). Wisconsin has a long history of propagating and stocking walleyes that dates back to the 1870's. Walleyes have been stocked at one time or another into many lakes in the state. Currently about 170 of the state's approximately 1000 walleye waters are stocked each year. Despite this long history of walleye propagation and stocking, the factors affecting the success of this stocking program are not well understood.

Some stockings are known to be successful. It is clear that past introductions have expanded the presence of walleyes from the historical range of major rivers systems and connected drainage lakes to also include many smaller landlocked lakes (Becker 1983). Escanaba Lake in Vilas County is a well-documented example. Walleyes were first introduced into this small (293-acre) lake in the early 1940's and it now has an excellent naturally reproducing walleye population (Kempinger and Carline 1977). Although introductions have often been successful, it is not known what percentages of such stockings were successful or what factors result in successful introductions.

It is also well known that stocking is typically successful when used to restore populations in waters where walleyes and other fishes have been eliminated through winterkill or chemical treatments. Delevan Lake in Walworth County was chemically treated in 1989 and restocked with walleye fry. That one stocking has resulted in one of the highest walleye population densities in southern Wisconsin. It is believed that reintroduction stockings are usually successful because there are no predators or competitors at the time fish are stocked.

Stocking to maintain walleye populations in waters where they do not naturally reproduce has been successful in some waters but the factors that affect success are not well understood (Kampa and Jennings 1998). Also populations maintained by stocking are generally less than half those found in lakes maintained by natural reproduction (WDNR April 1999). Lake Mendota in Dane County, for example, is a well-studied lake in which walleye populations have been successfully maintained by stocking (WDNR 1992). In contrast, an evaluation of walleye fingerling stockings in 20 small lakes in northern Wisconsin showed almost no survival in any of the lakes (Jennings 1996). We have concluded that walleye stocking must be individually evaluated in each waterbody stocked.

Stocking to enhance naturally reproducing populations is now generally thought to be ineffective. Extensive studies in Minnesota (Li et al. 1996) and at Escanaba Lake (Kempinger and Carline 1977) clearly show that any survival from stocked fish merely replaces a commensurate amount of natural reproduction resulting in no net increase in adult populations. Further, there could be impacts to the genetics of natural populations resulting from the introduction of non-native walleye strains through stocking (Philipp 1991).

Stocking of walleye can have detrimental impacts on other naturally occurring species. Escanaba Lake, for example, had an excellent smallmouth bass population before walleyes were stocked. Today, smallmouth bass are rare in that lake. The impacts of walleye stockings are also difficult to predict. Again, we have concluded that these impacts must be evaluated for each waterbody stocked.

Despite the uncertainties, statewide demand for stocked walleyes is considerable (WDNR 1999). Fry stocking requests vary each year, depending on the number of winterkill or chemically rehabilitated lakes that require restocking, but have not exceeded 100 million in recent years. Recent changes in stocking guidelines for fingerling walleye include eliminating per-water maximum numbers and increasing allowable stocking rates for all walleyes. These changes have increased our projected demand to 5.6 million small fingerlings and 1 million large (extended growth) fingerling. Based on genetic concerns (Fields et al. 1997), we must also have the capacity to separately produce up to five different strains each year. The relative number of each strain will vary somewhat each year depending on stocking demand.

Currently, production of walleye fry has been sufficient to meet demand. Existing warmwater facilities have sufficient capacity to hatch enough eggs to produce requested fingerlings, plus up to 100 million fry for stocking. Existing facilities can also be re-configured to separately hatch up to five different strains. Existing wild brood stock sources are adequate to produce sufficient numbers of eggs for only the Mississippi headwater strain. Additional reliable feral broodstock sources must be identified and developed for the Lake Superior basin, Lake Michigan basin, Mississippi mainstem basin, and Rock-Fox basin strains.

Current walleye fingerling production averages about 4 million small fingerlings, although in peak production years as many as 5 million have been produced. Few large fingerlings are now produced, though in past years up to 200,000 large fingerlings were produced during exceptional production years, largely from outlying pond operations that have had smaller fingerlings cropped off and stocked, allowing the remaining fish to grow larger. The current production system has a relatively fixed capacity of around 3.5 million fingerlings from on-site ponds at the four major warmwater facilities (Governor Thompson, Art Oehmcke, Lake Mills, and Wild Rose) and two developed outlying rearing ponds (Winding Creek and Presque Isle). The production system has a variable capacity of up to 1 million fingerlings in undeveloped outlying ponds that are used on an as-needed basis. Typically, production success is considerably more variable in outlying rearing ponds. Most production is based on Mississippi River headwater strain eggs taken by the crews at Gov. Thompson and Art Oehmke hatcheries and on Rock-Fox basin stain eggs taken by crews for Lake Mills and Wild Rose. There is capacity to separately raise the five strains of walleyes with minor renovation in incubation and fry handling facilities and in the various on- and off-site ponds, but this will entail additional distribution costs. Projected walleye stocking needs are summarized in table 8.

Table 8. Projected walleye stocking needs (modified from WDNR 1999).

Fish type	Age Class	Number
Walleye	Small fingerling	5,600,000
Walleye	Large fingerling	1,000,000
	Totals:	**6,600,000**

c) Northern Pike

The projected annual long-term demand for northern pike will total 150,000 fish. Northern pike are a widely distributed and popular game fish in Wisconsin. They grow and mature quickly, are relatively easy to catch particularly through the ice, and provide a variety of fishing opportunities. Naturally reproducing populations are found in a variety of waters including some waters in which other game species do not do well. Nonetheless, biologists have observed declines in the abundance of northern pike and their average size throughout southern Wisconsin. These declines are attributed to a combination of greater fishing pressure and the loss of critical spawning habitat. Historically northern pike stocking has not been a big part of the WDNR propagation program. Much of the stocking has been in winterkill or chemically rehabilitated lakes to quickly reestablish a fishery. Maintenance or recreational stockings are also popular to diversify opportunities or provide basic fisheries in heavily fished waters or waters with severely degraded habitat. It is likely that these stockings would have been more popular had additional fish been available from the hatchery system. Another major use has been for biomanipulation projects where stocking of predators may alter the aquatic community and improves water quality. These projects typically require stocking of large numbers of fish.

Long-term projected demand for northern pike is 80,000 small fingerlings and 70,000 large fingerlings. In addition, capacity is needed for periodic production of large numbers of fry - an average of 8 million but in years of severe winterkill or large numbers of lake rehabilitation projects up to 25 million. These numbers reflect a need to fully restock winterkill and chemically treated lakes, to stock adequate numbers in lakes undergoing biomanipulation, to remediate the loss of northern pike spawning habitat and to provide additional recreational fishing opportunities.

Production of northern pike from WDNR facilities (1995 to 1999) has averaged 8 million fry, 40,000 small fingerlings and 30,000 large fingerlings. Production space for these fish is typically allotted only after accounting for other warm water production needs. Aside from basic rearing space, production has been limited in some years by availability of eggs from wild brood sources. North-

ern pike are the first to spawn in spring. In some years this happens before the ice is fully off the water, limiting access to the adults. Since all eggs are collected from the wild, netting crews have only a short window of time to spawn adults to get eggs needed for production. Adult spawning stocks are also low in many waters - particularly in the southern part of the state. Funding is from base fisheries program revenues. Projected northern pike stocking needs are summarized in table 9.

Table 9. Projected northern pike stocking needs (modified from WDNR 1999).

Fish type	Age Class	Number
Northern pike	Small fingerling	80,000
Northern pike	Large fingerling	70,000
	Totals:	**150,000**

d) Largemouth and Smallmouth Bass

The projected annual long-term demand for bass will total 210,000 fish. Stocking is currently a minor component of the largemouth and smallmouth bass management program in Wisconsin. During the 1980s and 1990s an average of only about 500,000 fish, including fry, were stocked each year. Most stocking is used to re-establish either intentionally or naturally severely depressed populations. Stocking generally occurs on lakes that have had a winterkill or have been rehabilitated using chemical fish toxicants. Restocking of these waters can often be accomplished through transfer of adults from other neighboring lakes within the watershed.

Projected long-term demand for largemouth and smallmouth bass is 210,000 fingerlings per year. These projections are based on fish raised under "Optimum Sustained Production" conditions (WDNR 1998). A major recommended change is a reduced emphasis of maintenance, remedial, and recreational stocking for bass. These stockings have not been demonstrated to be cost-effective, particularly when compared to management actions that restore natural reproduction of bass or other species appropriate to the managed water. Also, there is good scientific evidence that mixing of bass strains can result in degradation in survival, growth and eventual reproduction capability of the resident bass population (Philip 1991). Widespread stocking of bass would require increases in hatchery capacity sufficient to maintain a large number of separate strains, which would be difficult because bass can only be propagated by "natural" spawning in ponds.

Recent production in WDNR facilities has ranged from 200,000-450,000 total bass. However this production is typically a single strain of fish which would be inadequate to meet stocking demands for a number of separate waters. Although the recommended numbers of bass to be stocked appear to be within the existing capacity of WDNR facilities, consideration must be given to the unique requirements of bass propagation, the demonstrated negative impacts of mixing bass genetic stocks, and tradeoffs with pond capacity demands from other species. Funding for this program is from base fisheries program revenues, with limited assistance through volunteer and private cooperative agreements. There are opportunities for additional development of cooperative agreements to rear small, discrete lots of bass for specific stocking needs. Projected large- and smallmouth bass stocking needs are summarized in table 10.

Table 10. Projected Bass (large- and smallmouth) stocking needs (modified from WDNR 1999).

Fish type	Age Class	Number
Bass (LM + SM)	Small fingerling	200,000
Bass (LM + SM)	Large fingerling	10,000
	Totals:	**210,000**

Key:LM = Largemouth bass; SM = Smallmouth bass

e) Lake Sturgeon

The projected annual long-term demand for lake sturgeon will total 90,000 fish. Wisconsin has one of the oldest active sturgeon management programs in the world and is currently looked to by many states and countries as a model for sturgeon management. Despite a history of dam construction, habitat loss, water quality declines, and overfishing over the last 100 years, the sturgeon management program has allowed Wisconsin to maintain waters with good lake sturgeon fisheries supported by natural reproduction. There is also a tremendous potential for restoring lake sturgeon fisheries as dams are removed or fitted with adequate fish passage facilities, water quality improves, and habitat is restored. The recently completed Wisconsin Lake Sturgeon Management Plan outlines a program for restoring many of the state's original lake sturgeon populations over the next 50 to 100 years (WDNR 2000).

Lake sturgeon is an extremely long-lived fish – males do not mature until age 12-15 years and females until age 20-25 years. Sturgeon can live to be more than a century old! Stocking programs will be an important part of the lake sturgeon restoration program, but will have to be a very long-term commitment (a minimum of 25 years on any restoration water) because the fish mature at such an advanced age. Lake sturgeon population rehabilitation is a relatively new endeavor in North America as well as in Wisconsin and fisheries managers are in the early stages of assessing the effectiveness of stocking versus adult transfer as rehabilitation techniques. Therefore, we recommend development of sufficient long-term lake sturgeon propagation capacity to assist with critical restoration efforts as outlined in the Lake Sturgeon Management Plan.

Additional capacity will be needed to collect eggs and separately produce up to 5 different strains. Current annual WDNR production has ranged from 20,000-50,000 fingerlings of up to 5 different strains. Funding is provided out of base fisheries program revenues, though private donations have been very important in supporting this program. The program should have adequate support through the base fisheries program however, and not be dependent upon private donations. All propagation activities have been at the Wild Rose Hatchery but consideration could be given to utilizing the sturgeon rearing expertise and facilities at the University of Wisconsin Great Lakes Water Institute in Milwaukee for special projects and/or additional needed production. Projected lake sturgeon stocking needs are summarized in table 11.

Table 11. Projected Lake Sturgeon stocking needs (modified from WDNR 1999).

Fish type	Age Class	Number
Lake Sturgeon	Small fingerling	10,000
Lake Sturgeon	Large fingerling	80,000
	Totals:	**90,000**

Table 12. Projected warmwater (combined) fish stocking needs (modified from WDNR 1999).

Fish type	Age Class	Number
Combined	Small fingerling	5,900,000
Combined	Large fingerling	1,287,800
Combined	Yearling	200
	Totals:	**7,188,000**

IV. Meeting Production Demand

If WDNR is to fulfill their public trust responsibilities and meet the needs of anglers and the many others that depend on healthy fisheries in Wisconsin, additional capacity to meet these stocking needs must be created. The difference between fish production capacity and projected needs are summarized in tables 13 and 14.

Table 13. Comparison of coldwater fish stocking production capacity versus projected need.

Fish type	Age Class	Capacity	Projected need	*Difference
Trout (Dom)	Small fingerling	179,200	19,200	+160,000
Trout (Dom)	Large fingerling	1,269,385	1,067,450	+201,935
Trout (Dom)	Yearling	2,014,342	1,560,680	+453,662
Trout (Dom)	Adult	10,200	10,200	0
Trout (Feral)	Small fingerling	*446,800*	*757,160*	*-310,360*
Trout (Feral)	Large fingerling	*533,100*	*923,720*	*-390,620*
Trout (Feral)	Yearling	*922,470*	*1,013,280*	*-90,810*
Trout (Feral)^	Yearling	*0*	*60,000*	*-60,000*
Trout (Feral)^	Adult	*0*	*18,000*	*-18,000*
Salmon	Small fingerling	1,456,415	1,867,000	-410,585
Salmon	Large fingerling	100,000	100,000	0
Salmon	Yearling	714,550	398,000	+316,550
Combined	Small fingerling	2,082,415	2,643,360	-560,945
Combined	Large fingerling	1,902,485	2,091,170	-188,685
Combined ^	Yearling	3,651,362	3,031,960	+619,402
Combined ^	Adult	10,200	28,200	-18,000

Key:
Dom = Domestic

Notes:
Numbers in *Italics* (feral trout) denotes a numbers expressed as domestic equivalents.
* These numbers can not be directly added or subtracted because each coldwater age class and fish type has its own rearing requirements. Also:
- A negative number indicates needed production capacity for the listed age class and coldwater fish type.
+ A positive number indicates available production capacity for the listed age class and coldwater fish type.

^ Includes additions to projected needs for lake trout needed for Trout L. Restoration (30,000 yearlings; 60,000 domestic equivalents) and additional space needed for development and maintenance of 2 feral trout brood stocks.

Coldwater Fish Production Analysis

The data summarized in table 13 show that the Department will have to develop rearing space for small (560,945) and large (188,685) fingerling stocking needs. Small (spring) fingerling rearing requires smaller tanks with a high quality water supply and location in a building to protect the fish from predation. The "critical" needs project at Nevin will be optimized for feral trout production including retrofitting smaller tanks needed for small fingerling production. The "Critical needs" Lake Water Disinfection System project at the Bayfield SFH, a major coldwater fish production facility, will reduce fish losses due to pathogens brought in from Lake Superior in the lake water supply. The "Critical needs" Nevin SFH Renovation project will insure that production is maintained from a major coldwater fish production facility. "High priority" needs projects at the Lakewood Rearing Station will optimize and develop water supplies and rearing space to meet feral trout needs for Northern Wisconsin.

Large fingerling rearing needs will come from redirecting and reconfiguring yearling production facilities to meet these needs. A major fish health goal would be to rear large fingerlings at a reduced density. This would have a significant positive impact of overall fish health and would result in increased survival to the creel.

Not included in the WDNR report *An Evaluation of Stocking Strategies in Wisconsin with an Analysis of Projected Stocking Needs* is the addition of 30,000 lake trout (60,000 domestic equivalent) for restoration projects and space to develop and rear feral trout broodstocks. The Wild Rose "compliance" needs project will be optimized for the available water supply and Great Lakes trout and salmon production at all life stages. Consideration will be given for reducing the rearing densities for all life stages because of the significant positive impact on the overall health and survival potential, especially with feral stocking. Also, space to allow for the evaluation of different strains of coldwater fish is vital to optimizing the products that are provided for fisheries management purposes. Space for these needs will come from redirected and reconfigured yearling production facilities as well as renovations at the Wild Rose SFH. Ground water compliance issues at the Osceola State Fish Hatchery will require a groundwater study and an engineering study to develop solutions and budgets

Additional space is needed for the development and rearing of 2 feral trout brood stocks. Space for these needs will come from redirected and reconfigured yearling production facilities. This would use the remaining available yearling production capacity.

As major facilities are renovated, improved and/or maintained and as the "state-of-the-art" advances, the Department will re-evaluate its capacity and facility needs to minimize overhead and costs while still meeting the public's trust for providing a recreational fishery.

Table 14. Comparison of warmwater fish stocking production capacity versus projected need.

Fish type	Age Class	Capacity	Projected need	*Difference
Muskellunge	Small fingerling	10,085	10,000	+85
Muskellunge	Large fingerling	101,595	127,800	-26,205
Muskellunge	Yearling	200	200	0
Walleye	Small fingerling	4,007,000	5,600,000	-1,593,000
Walleye	Large fingerling	63,700	1,000,000	-936,300
Northern	Small fingerling	42,020	80,000	-37,980
Northern	Large fingerling	27,900	70,000	-42,100
Bass (LM + SM)	Small fingerling	732,355	200,000	+532,355
Bass (LM + SM)	Large fingerling	9,075	10,000	-925
Lake Sturgeon	Small fingerling	5,000	10,000	-5,000
Lake Sturgeon	Large fingerling	15,000	80,000	-65,000
Combined	Small fingerling	4,796,460	5,900,000	-1,103,540
Combined	Large fingerling	217,270	1,287,800	-1,070,530
Combined	Yearling	200	200	0

Key: LM = Largemouth bass; SM = Smallmouth bass;

* These numbers can not be directly added or subtracted because each warmwater age class and fish type has its own rearing requirements. Also: A negative number indicates needed production capacity for the listed age class and warmwater fish type; A positive number indicates available production capacity for the listed age class and warmwater fish type.

Warmwater Fish Production Analysis

The data summarized in table 14 show major production shortfalls for muskellunge, northern, lake sturgeon and walleye. The only surplus production capacity currently existing is for bass production.

Muskellunge production shortfalls of 26,205 can be met by shifting the production of muskellunge to surplus bass rearing facilities in the WCR (11,205 large fingerlings) and the earthen pond lining project at the Oehmke hatchery (15,000 large fingerlings). This will require funding of an "enhancement" and several "maintenance" projects listed for WCR facilities and at the Oehmke SFH (pond lining maintenance project).

Walleye production shortfalls of 1,593,000 can be partially met by the "compliance" hatchery renovation at the Wild Rose SFH (460,000 small fingerlings), the "high priority" hatchery renovation project at the Lake Mills SFH (250,000 small fingerlings) and the earthen pond lining project at the Oehmke hatchery (50,000 small fingerlings). An economic analysis of strategies that will include fish purchased from the private aquaculture industry, increased production efficiencies, the expanded use of cooperative rearing agreements and the development of additional rearing pond space by the Department will determine how the remaining approximately 833,000 small fingerlings will be obtained. The Department has the space to rear 100,000 of the projected 1,000,000 large fingerling walleye needed in ponds that are refilled after the small fingerling harvest. The limitations to walleye large fingerling production are the small sized forage needed for the fingerling walleye to transition from a **zooplankton** (*microscopic animals found in water*) food base to a fish diet, additional forage to rear the fish to stocking time in sufficient quantity and the money to pay for either raising or purchasing forage and pay for increased distribution costs. An internal team has been formed to look at these issues and formulate strategies that will include the private fish farming industry as a part of the solution. The propagation system is ramping up production as budget and staffing allow while developing lower cost strategies to produce the large fingerling walleyes. A need exists to provide 900,000 large fingerling walleye.

Northern production shortfalls of 37,980 small fingerling and 42,100 large fingerling can be met by the "compliance" hatchery renovation at the Wild Rose SFH (17,980 small fingerlings and 22,100 large fingerlings) and the "high priority" hatchery building project at the Lake Mills SFH (20,000 small fingerlings and 20,000 large fingerlings).

Bass production capacity will be scaled back to meet projected needs. Rearing capacity will be diverted to other warmwater needs.

Lake sturgeon production shortfalls of 5,000 small fingerlings and 65,000 large fingerlings will be met by the "compliance" hatchery renovation at the Wild Rose SFH where the staff has the experience in spawning and rearing.

V. Strategies for Meeting the State's Stocking Needs

There are a number of different steps that could be taken to increase fish production capacity to meet the Department's projected needs. An analysis of the strategies is presented below. The most cost efficient solution for meeting the state's stocking needs will involve elements from all of these strategies.

Strategy A - Rehabilitate Existing WDNR Facilities

Recent major renovations at the Governor Tommy G. Thompson State Fish Hatchery and the Art Oehmcke State Fish Hatchery have provided excellent facilities to produce warmwater fish for stocking in Wisconsin waters. These hatcheries lead Wisconsin's efforts to maximize production efficiently and cost effectively. Under this strategy remaining renovation and major maintenance needs would be addressed.

Capacity estimates presented in this report reflect the current state of repair for Wisconsin's propagation facilities. Some of these facilities are operating below capacity due to major maintenance needs. Many of these facilities are older and in need of critical compliance driven renovation or

significant maintenance (WDNR 1998) which if completed would result in increased fish production. A recent example is the compliance driven renovation projct at the Wild Rose SFH. During the summer of 2001, hatchery crews noticed a significant reduction in flow from a four-inch artesian well supplying water for coldwater fish production. The reduced flows have resulted in a production reallocation of 200,000 chinook salmon to two other state facilities and one cooperating neighboring state agency hatchery. The well is currently not in compliance with existing well codes and can not be repaired in such a way as to meet code and still maintain artesian flow.

An estimated one-time capital development investment of $32,058,950 would increase the fingerling production capacity of the WDNR system by 200,000 feral trout, 760,000 walleye, 26,205 muskellunge, 80,000 northern pike and 70,000 sturgeon. This expenditure also addresses compliance needs (Table 15), critical needs (Table 16) high priority needs (Table 17), enhancements (Table 18) and maintenance needs (Table 19) at nearly all of the Department's major rearing facilities as well as most of its smaller facilities. These project estimates are based on the curent Six-Year Capitol Facilities Plan. The Six-Year Capitol Facilities Plan is updated by the Department every two years and may be amended as emergencies, new projects, and changing priorities arise. Annual budget adjustments would have to be made to feed, rear and transport these additional fish.

Table 15. Projects needed to meet state or federal environmental law compliance requirements.

Property	County	Need/Project	Nature of need *	Amount	Benefits
Wild Rose SFH	Waushara	Hatchery feasibility /design/cost estimate	CP, CN	$155,000	Develop renovation options and cost estimates
Wild Rose SFH	Waushara	Hatchery renovation	CP, CN, CW, WW, EE, EH&S, EP, MT, PE, R&R, GL, ON, R/M, PM	$21,200,000	+200,000 CW fgl +500,000 WW fgl +70,000 sturgeon fgl
[1]Osceola SFH	Polk	Groundwater study	CP, CN, CW, PM, R/M	$100,000	Develop ground water model that will be used to determine option for continued production
[1]Osceola SFH	Polk	Hatchery feasibilty design/cost estimate	CN, CW, PM, R/M	$200,000	Engineering study to develop options and cost estimates
[1]Osceola SFH	Polk	Hatchery renovation	CN, CW, PM, R/M	$1,000,000	Reconstruct water supply to meet compliance renovate existing outdoor rearing to maintain existing prod. capacity
			Compliance needs subtotal =	**$22,655,000**	

*Key:
CP = Compliance (State/Fed. env. law)
CN = Critical need
CW = Coldwater fish production
EE = Energy efficiency
EH&S = Employee health and safety
EP = Enhanced production
fgl = fingerling
GL = Great Lakes trout and salmon
PE = Public education
PM = Primary production maintenance
R/M = Renovation/maintenance
R&R = Remove and replace
MT = Maintenance
ON = Operational need

[1]Groundwater compliance needs at the Osceola SFH.

Table 16. Projects that meet critical fish production needs.

Property	County	Need/Project	Nature of need*	Amount	Benefits
Nevin SFH	Dane	Spiral building tank refit	CN, WT, EP, R&R	$90,000	+200,000 WT fgl
Bayfield SFH	Bayfield	Lake water disinfection system	CN, CW, EP, WT	$150,000	Kill pathogens entering the facility via the lake water fish rearing supply
Nevin SFH	Dane	Nevin hatchery renovation	CN, FT, CW R/M, WT	$2,052,300	Maintain prod. capacity, meet groundwater compliance, pre-treat water for max. use of fish health benefits treat wastewater prior to discharge to a trout stream
			Critical needs subtotal = $2,292,300		

*Key:
CN = Critical need
CW = Coldwater fish prod.
EP = Enhanced production
fgl = fingerling
FT = Feral Trout
R/M = Renovation/maintenance
R&R = Remove and replace
WT = Wild Trout

Table 17. Projects that meet high priority fish production needs.

Property	County	Need/Project	Nature of need	*Amount	Benefits
Lakewood SFH	Oconto	Incubation water supply	FT	$125,000	Allow for incubation of FT eggs
Lakewood SFH	Oconto	Renovate rearing facilities	CW, FT	$47,400	Maintain prod. capacity
Lakewood SFH	Oconto	Dredge waste settling ponds	CW, MT possible compliance	$40,000	Meet conditions of wastewater discharge permit
Lake Mills SFH	Jefferson	Engineering for phase II	GL, WW	$100,000	Develop renovation options and cost estimates
Lake Mills SFH	Jefferson	Hatchery building	GL, WW	$3,591,700	Centralize the production of 200,000 CW ygl, +25 million CW/WW fry
Lake Mills SFH	Jefferson	Renovate ponds/ ground water supply, raceway construction	GL, WW	$1,700,000	+40,000 northern fgl, +250,000 walleye fgl
Kettle Moraine Springs SFH	Sheboygan	Isolate egg incubation building	GL	$118,300	GL disease control, brood stock dvlpmnt
Oehmke SFH	Oneida	Install hatchery building subsurface drainage	FM, WW PM, WW	$6,000 $5,000	Protection of hatchery bldg. from excess surface water, frost damage
			High priority needs subtotal $5,733,400		

*Key:
CW = Coldwater fish production
fgl = fingerling
FM = Facilities Maintenance
GL = GL trout and salmon
MT = Maintenance
PM = Primary prod. maintenance
FT = Feral trout
R&R = Remove and replace
ygl = Yearling
WW = Warmwater fish prod.
R/M = Renovation/maintenance

Table 18. Projects needed to enhance fish production facilities.

Property	County	Need/Project	Nature of need	*Amount	Benefits
WCR – Northfield Lake RS	Jackson	Divide pond	EP, ON, WW	$25,000	Easier to manage for coolwater species + 11,205 muskellunge
Kettle Moraine Springs SFH	Sheboygan	Install aquatic education	PE, CW, WW	$15,000	Public education at a high visibility hatchery
Lake Mills SFH	Jefferson	Construct a heated shop/ cold storage building	CW, WW, ON, EH&S	$141,000	Provide an area separate from the crew offices and lunch room to perform maintenance and storage functions
Lake Mills SFH	Jefferson	Pave roads within the hatchery	CW, WW, ON	$200,000	Access to CW and WW rearing areas and buildings, reduction of dust in the community
Lima Rearing Station	Walworth	Install raceways	EP	$118,500	Maximize production capacity based on available water supply
Nevin SFH	Dane	Remodel office	ON, PE	$52,500	Provide adequate office visitor publication area
Oehmke SFH-Presque Isle rearing Station	Vilas	Construct a storage building	ON	$8,000	Provide on site storage of propagation equipment used at Presque Isle
Westfield SFH	Marquette	Electrify storage building	ON, EH&S	$12,000	Provide an area for maintenance and storage of propagation equipment
Oehmke SFH	Oneida	Construct a boat storage building	ON	$26,500	Provide an area for storage of propagation equipment
Oehmke SFH	Oneida	Install additional communication	ON	$6,000	Provide additional comm. lines for controls/security
			Enhancements subtotal = $604,500		

*Key:
CW = Coldwater fish production
EH&S = Employee health and safety
EP = Enhanced production
R&R = Remove and replace
ON = Operational need
PE = Public education
WW = Warmwater fish prod.

Table 19. Projects needed to meet major fish production facility maintenance needs.

Property	County	Need/Project	Nature of need *	Amount	Benefits
WCR-Albion Pond	Jackson	Replace 3 water control structures	WW, R&R	$21,000	Maintain production capacity at Albion Pond
WCR-Northfield Rearing Station	Jackson	Replace Bill's pond outlet	WW, R&R	$14,000	Maintain production capacity at Northfield Rearing Station
WCR-Northfield	Jackson	Reline water control culverts	WW, R&R	$20,000	Maintain production capacity at Northfield Rearing Station

Table 19. Projects needed to meet major fish production facility maintenance needs (continued).

Property	County	Need/Project	Nature of need *	Amount	Benefits
WCR-Trump Lake	Jackson	Reline water control culverts	WW, R&R	$34,000	Maintain production capacity at Trump Lake
Langlade Rearing Station	Langlade	Replace raceways	CW, R&R	$200,000	Maintain production capacity at Langlade
Brule River Rearing Station	Douglas	Dredge and rip-rap rearing ponds	CW	$29,500	Maintain fish production capacity at Brule River Rearing Station
Brule River Rearing Station	Douglas	Renovation of building	EE, R/M, EH & S	$19,000	Replace siding (asbestos
Oehmke SFH	Oneida	Restore ponds 8-11	EP, MT, WW	$160,000	Enhance production capacity for: + 15,000 large fgl musky, +50,000 walleye
Lakewood SFH	Oconto	Install new siding on hatchery bldg.	CW, PM	$14,000	Maintain Building for CW rearing
Lakewood SFH	Oconto	Install new siding, doors and windows on storage bldg.	CW, SM	$8,500	Maintain Building for fish production equipment
Lakewood SFH	Oconto residence	Reroof hatch.	CW, SM	$4,500	Building maintenance
Langlade Rearing Station	Langlade	Replace siding and windows	CW, PM	$50,000	Building maintenance
Osceola SFH	Polk	Reroof 2 buildings	CW, MT	$4,850	Maintains critical buildings used in the prop. of CW fish
Osceola SFH	Polk	Replace floor residence	MT, EH&S	$2,000	Maintain required residence
St. Croix Falls SFH	St. Croix	Replace office windows, insul. building	CW, PM, EE	$24,500	Building maintenance
St. Croix Falls SFH	St. Croix	Pave public paths	ADA	$8,000	ADA accessibility
St. Croix Falls SFH	St. Croix	Sealcoat	CW, MT	$4,500	Extend the life of hatchery asphalt and access roads
Thunder River Rearing Station	Oconto	Reroof upper warehouse	CW, MT, SM	$35,000	Maintains critical buildings used in the prop. of CW fish
Thunder River Rearing Station	Oconto	Reroof office. residence	CW, MT, SM	$15,000	Maintains critical buildings used in the prop. of CW fish
Oehmke SFH	Oneida	Reroof net house	WW, SM	$9,200	Maintains a critical building used in the propagation of WW fish
Oehmke SFH	Oneida	Reroof boat house	WW, SM	$8,200	Maintains a critical building used in the propagation of WW fish
Oehmke SFH	Oneida	Insulate hatch. building	CW, WW, EE	$5,000	Maintains and improves energy efficiency of a critical building used in the propa gation of WW fish
			Maintenance needs subtotal = $743,750		

*Key :
ADA = Americans with Disabilities Act
CW = Coldwater fish production
EE = Energy efficiency
MT = Maintenance
EH&S = Employee health and safety
EP = Enhanced production
PM = Primary prod. maintenance
R&R = Remove and replace
SM = Supp./Storage Bldg. Maint.
fgl = fingerling
R/M = Renovation/maintenance
R&R = Remove and replace
WW = Warmwater Fish Production

Strategy B - Fully Fund and Staff Existing WDNR Facilities

Funding and staffing for all WDNR fisheries management programs has, at best, remained constant relative to inflation for at least the past 30 years. During that time the demands on the program have increased, including the addition of more and larger fish propagation facilities, the need to manage a new treaty fishery, increasing needs for fish assessment information, and increased demand for critical habitat restoration and enhancement projects. The net result has been an actual decline in number of staff assigned to fish propagation facilities and the operation budgets of these facilities. An additional 5.75 FTE's would be required to fully staff the existing facilities. An additional $400,000 for direct costs (see note below) is needed to fully fund propagation operations. Together, these additions would bring existing facilities and operational budgets to a level that would allow for full facility utilization, a reduction in facility-related mortality, expansion of the walleye fall fingerling program, and expanded operation of outlying ponds. This would result in an increase in the total annual propagation operating costs of approximately 12% to $6.4 million. We estimate an increased production of 500,000 warmwater fingerlings from outlying ponds and the development of alternative feeding and forage strategies.

Note: Every activity created by a subprogram is classified as either direct or allocable. A direct activity identifies a specific work effort. An allocable activity does not relate to a specific work activity but benefits the work of the whole subprogram. There are three main types of allocable activities. Two of these allocables are easy to understand; one is leave time and the other is comp time. The third is general administration time. Examples of this are time spent receiving technical skills or developing personal skills at formal courses or conferences or to improve one's general knowledge of the Department's goals. Another example is general supervision. The bureau director's often use an allocable code because their work provides general program supervision.

Table 20. Additional staffing needed to bring facilities to full production.

Facility	FTE Required	Need
Wild Rose SFH	0.25	Increase existing 9 month seasonal position to 12 months to support cold- and warmwater fish rearing and spawning activities
Nevin SFH	0.25	Restore existing 9 month seasonal position to 12 months now that Lima and Token Creek rearing ponds are back in operation
Central office	1.00	Add a full time propagation scientist position to work on solving critical propagation related problems
WCR Operations	0.25	Increase an existing 9 month position to 12 months to assist in fish production, distribution and rearing facility maintenance
WCR Operations	0.50	Increase an existing 6 month position to 12 months to assist in fish production, distribution and rearing facility maintenance
Root River Steelhead Facility	1.00	Add a full time permanent position to operate and maintain the facility
Lake Mills SFH	0.50	Add new 6 month seasonal position for critical warmwater spawning and rearing activities
Kettle Moraine Springs SFH	1.00	Add a full time permanent position to assist with steelhead fish production
Besadny Anadromous Fisheries Facility	1.00	Support single existing permanent position with maintenance, spawning activities, public education and tours
Total FTE's required:	**5.75**	**To bring facilities to full production**

Fully fund existing DNR facilities	$400,000
Fully staff existing DNR facilities 5.75 FTE,	$287,500
Fully fund and staff existing WDNR facilities	**$687,500**

Strategy C - Increase Efficiency within the WDNR Fish Propagation System

Some increases in production can be obtained through increasing efficiency in the existing system. Depending of the condition of the facility and maintenance needs, the most likely improvement would come from maximizing production at facilities that are capable of making the best use of new technologies efficiently and cost effectively. An example of this would be the use of oxygen injection to maximize the production potential for hatcheries that have limited water supplies. Use of oxygen injection technology, with appropriate water exchange patterns and waste treatment has the potential of increasing coldwater production capacity by up to 15%. Detailed economic and rearing analyses need to be completed to determine whether or not this would result in long-term lower annual personnel and acceptable operational overhead costs while still producing the quality of fish needed to meet management specific goals. However, since this strategy depends on first providing capital development funding, depreciation of these costs would initially offset any savings, which would then be reinvested in expanding production options. Distribution costs would increase and partially offset gains from improvements in efficiency. Individual hatchery needs would need to be assessed before a capital cost can be developed.

Strategy D - Expand Use of Cooperative Agreements

Cooperative agreements with not-for-profit groups and commercial businesses annually account for nearly 300,000 warmwater fingerlings and over 42,000 coldwater fingerlings and about 88,000 coldwater yearlings produced toward stocking quotas each year. It is assumed that the cost to the Department is low. The use of cooperative agreements can be one way to increase production at a lower cost. These cooperative agreements do however require an investment of the Departments resources. These are typically fish, technical expertise and equipment for harvest and distribution. Cooperators are typically supplied with fry or fingerlings, and provided with ongoing technical assistance from hatchery staff. Also, WDNR typically distributes (stocks) these fish. We have had very good success with trout cooperative agreements in the West Central Region, but less consistent success with walleye and muskellunge cooperative agreements. We believe there is some limited potential to expand production through cooperative agreements, but only with an investment of additional staff and financial resources. A thorough analysis of current agreements needs to be conducted to document the extent of cost savings. Also, we do not recommend relying on these agreements for production needs requiring special handling due to disease, genetics or difficult to raise species, given the variability of success of these efforts. We believe that a 10% gain (30,000) in the number of warmwater fingerlings produced by cooperative agreements can be realized by clarifying the role and scope of cooperative agreements and redirecting minimal internal resources before reaching a point of diminishing returns.

Strategy E - Private Contracting

It may be possible to simply purchase fish from private contractors to meet stocking shortfalls. There are a number of significant questions that need to be addressed to make sure contracting can provide a consistent source of fish each year, and that the fish obtained meet specifications for health, genetic strain, and size and weight. However assuming that these issues could be addressed, we estimate an annual cost of $706,600 to purchase the 833,000 walleye fingerlings needed to meet management stocking goals at $0.20 each and 900,000 large fingerling walleye at $0.60 each. Typical stocking patterns with multiple stops and small numbers of fish stocked at each site may drive these cost estimates up 30% or more, or require that DNR pick up the fish at the private farm and distributes them. The resulting annual cost could approach $918,580.

WDNR may be able to augment its production of lake sturgeon for restoration purposes as outlined in the Wisconsin Lake Sturgeon Management Plan (WDNR 2000) by developing cooperative agreements with private fish farms.

Some activities currently being done by Department staff may be contracted more economically from private sector hatcheries. Purchase of forage minnows on a large scale with long-term contracts, for example, might reduce the need for Department staff to collect or raise forage, allowing the Department to invest staff and funding in expanded production options. Discussions of these alternative strategies involving the private aquaculture industry will depend on their willingness to address volume, availability and timing issues. This may result in additional opportunities for contracting and cooperating.

The annual cost for this alternative scenario would have to be developed based on the current conditions in the private sector. Contracting does not produce "free" fish. It is unlikely that contracting to purchase all of the identified fish will be as cost effective as the State hatchery system producing them. This is because of the purchasing power that the State system has when buying feed, equipment, supplies and that there is no margin added for profit. Also, most quoted prices for the purchasing of fish from private fish farms either do not include distribution costs or includes distribution of a truckload of fish to only one location. Given that fish are stocked in many waters, often with several stops on larger waters, and are often scattered over a wide geographic area, distribution costs can add up to 30% or more to the final cost of stocking purchased fish.

VI. Recommendations

Recommended Alternative:

Operate all existing WDNR facilities at full capacity and in compliance with all State and Federal laws and expand private contracting to fully meet projected stocking needs.

Total One-Time Capital Development Costs = $32,028,950

Compliance needs subtotal	$22,655,000
Critical needs subtotal	$2,292,300
High Priority needs subtotal	$5,733,400
Facility Enhancements subtotal	$604,500
Maintenance needs subtotal	$743,750
	$32,028,950

Total Additional Annual Operation Costs = $1,394,100

Fully fund existing DNR facilities	$400,000
Private contracting costs for walleye production shortfalls	$706,600*
Fully staff existing DNR facilities 5.75 FTE	$287,500
	$1,394,100

*Note: Private contracting prices may be 30% or more higher than amount listed due to additional distribution costs.

This is the most cost effective action that allows the Department to fully meet all projected stocking needs as outlined in "An evaluation of stocking strategies in Wisconsin with an analysis of projected stocking needs (WDNR 1999). This recommendation addresses facility and staffing needs to fully implement all of the strategies outlined. This includes provisions for purchasing products from the private aquaculture industry. This action maximizes use of existing facilities, thus mini-

mizing the need for additional capital costs. It optimizes the existing staff and fiscal resources in full compliance with State and Federal environmental laws and public expectations that agencies will show leadership in minimizing ecological inputs through ecosystem restoration at some facilities such as restoration of wetlands, spring areas, and stream channels. Finally, it allows the expansion of public education and outreach efforts using existing facilities as focal points.

Issues: Additional staffing and funding must be found for capitol development and hatchery operations budgets. Development costs could be offset by bonding and hatchery operations costs could be recovered from SEG funding sources.

Alternative Recommendation: Minimal Funding: Address Only Compliance and Critical needs.

Total one-time capital development costs = $24,947,300

Compliance needs subtotal	$22,655,000
Critical needs subtotal	$2,292,300
	$24,947,300

This recommendation would allow the Department to meet compliance needs at the Wild Rose and Osceola State Fish Hatcheries and to proceed with implementing the critical needs for feral (wild trout production at the Nevin State Fish Hatchery. This alternative only funds Compliance and Critical Needs under strategy A. Propogation system efficiency gains under Strategy C would be limited to those ideas that do not require a capital expenditure or increase in operational costs.

Issues: Additional funding must be found to meet development needs. Long term bonding is a likely source. This recommendation does not provide what the Department feels to be the optimal choice for meeting the public trust to provide angling opportunities, but would allow the Department to move forward at two of its most important coldwater facilities. Strategy B – "Fully staff and fund existing WDNR facilities" would not be possible under this alternative. This would limit the Department's ability to solve production problems. Over time there will be a loss of fish production as other rearing units are taken off-line because of continued physical plant deterioration. Non-compliance at the Wild Rose and Nevin hatcheries could force closure of these facilities with the resulting 27% loss of statewide trout and salmon production at Wild Rose alone. In addition, Wild Rose produces approximately 64% of all northern pike and 100% of the spotted muskellunge and lake sturgeon stocked by the Department. The Osceola SFH is the home of the domestic rainbow trout brood stock used for Wisconsin trout stocking (100%) and in addition rears nearly 24% of the feral brown trout for stocking in Wisconsin. Other system component failures will result in small, but significant cumulative losses over time.

Alternative Recommendation: No Action.

Not taking action will inevitably result in a significant loss in fish production capacity. Non-compliance at the Wild Rose SFH and Osceola SFH could end fish production at these hatcheries. Closure of the Wild Rose SFH would result in dramatic reductions in the number of fish produced for stocking. This would result in a statewide reduction of trout and salmon production of 27%, northern production of 64%, great lakes spotted muskellunge production of 100% and lake sturgeon of 100%. Great lakes spotted muskellunge and lake sturgeon are raised for important restoration efforts. Closure of the Osceola SFH would eliminate 100% of the domestic rainbow trout broodstock and production of those rainbow trout for stocking. These reductions would be devastating to Wisconsin's fisheries management program.

Full implementation of "Increasing Efficiency within the WDNR Fish Production System would be the Departments primary recourse. Expanded use of Cooperative Agreements would be maximized in an effort to meet demand.

Money available to purchase products from the private aquaculture industry would remain at current levels and decline over time as increased maintenance needs would reduce the money available for outside purchases.

A large portion of the propagation system's infrastructure is 50 to 100 years old and past its "useful lifetime". The result would be a rapid decline in the Departments fish production capacity over the next 10 years as production units and facilities large out of use. The public trust to provide fishing opportunities would be severely compromised. Budgets would have to be re-prioritized which would result in the closure of one or more facilities and the relocation or loss of key experienced and trained personnel to provide enough operation money to perform critical maintenance at the remaining facilities. This would cause the distribution of high priority fish to become even less efficient as production is shifted to other facilities as rearing units come off-line due to failure or facility closures.

Innovation, fisheries management evaluations and experimentation to maximize the return of fish to Wisconsin's anglers would be severely hampered. Wisconsin's reputation as a leader in propagation and fisheries management would be compromised.

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Contents

Fish propagation has always been an important tool in managing Wisconsin's fisheries and, when combined with todays' habitat protection and enhancement activities, offers the best opportunity for sustained fisheries in the state.

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