

**LAKE CHAMPLAIN WALLEYE FISHERY  
RESTORATION PLAN**

**SUPPLEMENT TO : A PLAN FOR MANAGEMENT  
OF WALLEYE FISHERIES IN  
LAKE CHAMPLAIN:**

**Vermont Waters**

**1999 - 2003**

**VERMONT DEPARTMENT of FISH and WILDLIFE  
WATERBURY, VERMONT  
December, 1998**

**Acknowledgment**

This project was paid for by fishing license sales and matching Dingell-Johnson / Wallop-Breaux funds available through the Federal Sportfish Restoration Act.

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# Lake Champlain Walleye Restoration Plan

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Appendix 1: Comparative analysis of Lake Champlain walleye anglers, 1991 and 1996.

Appendix 2: Lake Champlain Walleye Association minority report

A responsiveness summary will be developed and attached to this document that addresses issues raised in the Lake Champlain Walleye Association Minority Report.

## Introduction

The Lake Champlain Walleye Restoration Plan (**Restoration Plan**) is a complement to the Plan for Management of Walleye Fisheries in Lake Champlain (**Management Plan**) that was released in July of 1998. These plans have been developed by the Vermont Department of Fish and Wildlife (VTDFW) in cooperation with the Lake Champlain Walleye Association (LCWA), and with public input from open-house meetings held during the development and review of the Management Plan. The Management Plan's goal is "to enhance and maintain self-sustaining walleye population levels in Lake Champlain in order to provide a high quality sport fishery." The Management Plan also described several objectives to achieve the goal as well as some potential challenges that could prevent reaching the goal if they are not addressed.

This Restoration Plan describes the actual field work, research, culture and survey "projects" that will be undertaken to implement the Management Plan. The projects described in the Restoration Plan will not all be worked on simultaneously. The number of projects that will be worked on over the next five years will depend upon state-wide priorities, funding and staff days available. Estimated costs of projects planned for 1999 are about \$210,000 requiring about 915 staff days (Table 1). This estimate does not include the cost of improvements to the Bald Hill Fish Culture Facility, access area improvements or acquisitions, major equipment purchases, or habitat protection and improvement efforts. Funding research projects focusing on mortality of young walleye would require an additional \$217,000. These projects would help fisheries managers focus restoration efforts on factors limiting Lake Champlain walleye populations. As more is learned about the Lake Champlain walleye populations, projects may be revised, added or deleted. This plan is a working document and is subject to change as new information becomes available.

The projects that make up this Restoration Plan are grouped into three categories based on their potential contribution to achieving the objectives of the Management Plan:

- Group A projects are intended to have a direct effect on enhancing walleye harvest by addressing a potential challenge identified in the Management Plan that could be currently limiting the size of the walleye population, such as reproductive failure or juvenile mortality.
- Group B projects keep track of our progress in achieving the Management Plan objectives by monitoring harvest, so that we know if we are heading in the right direction. Two additional projects are included in Group B; monitoring fish health, and improving degraded habitat. These projects help to support Group A projects.
- Group C projects address angler-related issues such as fishing regulations and lake access, and factors relating to species interactions that may become important in the future if the expansion of the walleye population begins to have an impact on other fish species.

Projects have been prioritized within each group based on potential biological and social impacts, study design, and anticipated cost/benefit.

The highest rated project in the Restoration Plan is to protect existing walleye habitat by

participating in regulatory processes such as Act 250, hydroelectric dam relicensing and stream alteration permit program. Protecting existing habitat is crucial for maintaining or enhancing self-sustaining walleye populations in Lake Champlain.

The next highest priority projects are those that focus on the use of cultured walleye. Studies around North America have highlighted the need to carefully evaluate stocking efforts due to the extremely poor overall success rate for stocking walleye in large waterbodies that have naturally reproducing walleye populations. Rearing, stocking and marking/assessment projects are integrally linked in the effort to determine if different stocking techniques, numbers and fish sizes are contributing to the walleye population in Lake Champlain. These projects will also provide a measure of the relative contribution of natural reproduction to the population so that biologists will be able to determine if and when the walleye fishery can sustain itself without stocking.

Another critical need of walleye management on Lake Champlain is to identify the life stages where significant mortality that prevents the population from expanding is occurring. Project A4 is designed to study early life stages and should provide information required to target restoration efforts.

While Group A contains many of the highest priority projects, all three groups have important projects within them. For example, the project dealing with a review of walleye fishing regulations in Group C is a very important project to anglers and biologists, and is scheduled for work in 1999. Similarly, the monitoring of harvest through creel surveys described in Group B will be critical to determine if we are reaching our harvest objectives. In short, the VTDFW will need to strike a balance between pursuing those projects intended to enhance the fishery and those that address the ongoing monitoring and regulation needs of the existing fishery.

The projects in the Restoration Plan cover the whole of Lake Champlain and its tributaries. However, more work will be directed towards those areas that appear to have shown the greatest decline in walleye harvest over the last forty years. Missisquoi Bay should receive particular attention due to the decline in the walleye fishery, and observations by biologists and anglers that sedimentation has covered areas that should otherwise be suitable for walleye spawning and egg incubation. In 1999, wild broodstock will be collected from the Missisquoi and Winooski Rivers to provide enough eggs to Bald Hill Fish Culture Station to produce 8 million walleye fry (with the predicted survival rate of 70% this would require approximately 12 million eggs). A small portion of these fry (1/4 - 1/2 million) will be stocked into VTDFW and LCWA rearing ponds and raised to fingerling size<sup>1</sup> before being stocked. The majority of the fry and fingerlings will be stocked back into Lake Champlain in the appropriate lake basin as described in the management plan (Winooski River = Main Lake Basin; Missisquoi River = Inland Sea Basin). Some walleye fry

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<sup>1</sup>Fingerlings are walleye that range in length from 1 to 7 inches in their first growing season.

or fingerlings may be used to stock inland waters. All stocked fish will be marked to evaluate stocking success.

At the end of this document are two appendices prepared by the Lake Champlain Walleye Association:

Appendix 1: Comparative analysis of Lake Champlain walleye anglers, 1991 and 1996.

Appendix 2: Lake Champlain Walleye Association Minority Report

Restoration Plan project descriptions follow. Each description includes the project title, need, objective, expected benefits, approach, location and estimated cost.

**Group A:** Projects that are intended to directly enhance walleye harvest by addressing specific factors that may be limiting the size of the walleye population, such as reproductive failure or juvenile mortality. These limiting factors are described in further detail in the Management Plan.

The projects listed within groups are in priority order. Multiple projects at one priority were given equal priority when rated.

**Priority 1:**

**Project A1: Protect Existing Walleye Habitat**

**Need:** Habitat protection is critical to the protection and restoration of self-sustaining walleye populations in Lake Champlain. Identifying existing opportunities for protecting walleye habitat is an important step in ensuring that these opportunities are acted upon.

**Objective:** Identify opportunities for walleye habitat protection in the Lake Champlain basin and participate in environmental regulatory processes to protect and restore fish habitat on an on-going basis.

**Expected Benefits:** Protecting existing aquatic habitat is the most effective and least expensive approach to maintaining viable fish populations in Vermont.

**Approach:** District fisheries biologists will review walleye habitat needs, and list potential threats to walleye habitat in the Lake Champlain basin. Determine how these potential threats might be addressed through regulatory processes such as Act 250, Hydro Relicensing, and Stream Alteration Permits. Develop strategies to deal with threats that are not covered by existing regulatory processes (acknowledging that threats such as acid rain and global warming may be beyond our ability to correct).

**Location:** Lake Champlain Basin

**Estimated Costs:** Variable due to unpredictable nature of development and other activities that require regulatory review.

**Priority 2:**

**Project A2:** Evaluate Stocking Effectiveness

**Need:** To evaluate the contribution of stocked fry and/or fingerlings to the Lake Champlain walleye population.

**Expected Benefits:** Maximize the return on investment of stocked fish by determining their contribution to the sport fishery, and the comparative advantages of stocking different fish sizes, numbers and locations.

**Job I:** Oxytetracycline (OTC) Marking

**Project Co-Leaders:** Eric Palmer - Tom Jones

**Task I:** Annual OTC marking of cultured walleye.

**Objective:** To annually mark all cultured walleye fry with the chemical marking compound, oxytetracycline (OTC), for distinguishing stocked fish from wild fish.

**Approach:** VTDFW - Tom Jones and the Bald Hill FCS staff will annually immerse cultured fry in 600ppm OTC bath for 6 hours. (Reference: Brooks, R.C., R.C. Heidinger and C.C. Kohler 1994. Mass-marking otoliths of larval and juvenile walleyes by immersion in oxytetracycline, calcein, or calcein blue. North American Journal of Fisheries Management 14:143-150)

**Location:** Bald Hill Fish Culture Station

**Estimated Annual Cost:**

Personnel (20 Staff Days):	\$4,000
Operational costs (chemicals, etc.):	1,000
<b>Total:</b>	<b>\$5,000</b>

**Task ii:** OTC Program - Examination of known marks

**Need:** To assess the quality and efficacy of the OTC marking technique

**Objective:** Annually determine the visibility of marks and percent of readable marks over time in a sub-sample of cultured fish not stocked.

**Approach:** VTDFW district fisheries staff will extract otoliths (inner ear bones) from juvenile walleye that have been immersed in OTC and held in the hatchery for a period of time to determine the success of OTC marking. Tom Jones will prepare an annual Investigational New Animal Drug (INAD) exemption report to satisfy federal requirements.

**Location:** Waterbury lab.

**Estimated Annual Cost:**

Personnel (18 Staff Days):	\$3,600
Operational costs	400
Total:	\$4,000

Note: costs are directly related to the number of fish collected and examined for marks. The current cost estimates are for examining fewer than 100 fish per year.

**Task iii:** OTC Program - Evaluation of hatchery contribution

**Objective:** Ongoing. Determine the percentage of marked fish in the population.

**Approach:** VTDFW district fisheries staff will extract otoliths (inner ear bones) from juvenile walleye that are collected during sampling in stocked areas of Lake Champlain to examine for OTC marks.

**Location:** Lake Champlain and Tributaries



**Estimated Annual Cost (per 100 otoliths):**

Personnel: (8 Staff Days)	\$1,600
Operational costs:	300
<b>Total:</b>	<b>\$1,900 /100 otoliths</b>
Special equipment needs:	\$10,000 Dedicated microscope with UV light-source

Note: cost to collect juvenile walleye from Lake Champlain is unknown. Other projects which are directed toward collecting juvenile walleye are described elsewhere in this plan. Costs listed above are only for otolith removal, preparation (mounting and grinding) and examination.

**Job II:** Evaluate the contribution of stocked walleye fingerlings to Lake Champlain

**Project Leader:** Jon Anderson (Essex District), Chet MacKenzie (Pittsford District)

**Objective:** 1) To determine contribution of stocked walleye fingerlings to adult spawning populations.  
2) To determine if there is a difference in survival of walleye fingerlings stocked directly in rivers versus those stocked in the lake.

**Approach:** Prior to stocking, walleye fingerlings will be marked by removal of a fin. One hundred fish will be sub-sampled at each stocking location on each day of stocking and examined to determine fin clipping success rates. A different fin clip will be applied to walleye stocked in riverine and lake locations. The contribution of stocked walleye fingerlings will be evaluated by collecting adult walleye during the spring spawning run and examining these fish for fin clips.

**Location:** Spawning tributaries to Lake Champlain

**Estimated Annual Cost:**

Personnel	
Permanent (4 staff days)	\$ 420

Operation	200
<b>Total</b>	<b>\$ 620</b>

Note: Field sampling costs are covered under project B8 and are not included here.

**Job III:** Juvenile (Age 0+) walleye sampling and contribution of stocked walleye fingerlings in Malletts Bay and the Lamoille River.

**Project leader:** Jon Anderson

**Objectives:** 1) To refine techniques for collecting late summer and fall fingerlings in Malletts Bay and the Lamoille River and 2) to determine the contribution of stocked walleye fry and fingerlings to the juvenile (Age 0+) walleye population in Malletts Bay and the Lamoille River.

**Approach:** Juvenile walleye will be sampled by bottom trawling off the mouth of the Lamoille River in Malletts Bay in August and electrofishing<sup>2</sup> in the river in the fall. Recent sampling in these areas was successful in collecting juvenile walleye and continuation of this work will allow us to refine sampling techniques and locations. During years when Malletts Bay may be stocked (to be determined at a later date), all stocked walleye will be marked with OTC. Fingerlings will also be fin clipped before being stocked. Juvenile walleye collected by trawling in August and by electrofishing in the fall will be examined for OTC marks and fin clips.

**Location:** Lamoille River and Malletts Bay

**Estimated Annual Cost:**

Personnel	Permanent (14 staff days)	\$2600
	Equipment	400
Operation		600
	<b>Total</b>	<b>\$3600</b>

Note: Costs for OTC mark detection are included in Project A2, Job I, Task iii.

**Job IV:** Evaluate alternative marking techniques for cultured walleye fry and/or fingerlings.

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<sup>2</sup>Electrofishing is a sampling method that applies electricity into the water to stun fish that are inside the electric field. Fish can then be collected with nets, examined, and released alive.

**Project Leader:** Eric Palmer

**Objective:** Investigate alternatives for developing a mark for cultured walleye fry and/or fingerlings that will last a sufficient number of years to allow biologists to determine the contribution of hatchery fish to the Lake Champlain walleye fishery.

**Approach:** The Vermont walleye team and fish culture division will investigate alternatives by conducting a literature review and discussions with other states, provinces or universities who have experience marking walleye. When promising techniques are identified, a subsequent project will be written to develop, apply and evaluate the techniques.

**Location:** District offices, Waterbury and Bald Hill FCS.

**Estimated Total Cost:**

Personnel (20 Staff Days)	\$4,000
Operational costs:	400
<b>Total:</b>	<b>\$4,400</b>

**Project A3: Walleye Production and Distribution**

**Project Leader:** John Gregory

**Need:** Walleye stocking has been identified as a potential means of achieving management plan objectives.

**Objective:** To maintain or improve the fishery.

**Expected Benefit:** The annual production of walleye fry and fingerlings based on the management request for cultured fish. Stocking walleye may bypass life stages with high mortality rates that may be restricting natural recruitment to the fishery.

**Location:** Bald Hill Fish Culture Facility

***Job I***

**Approach:** The Bald Hill Fish Culture Station will spawn, incubate and hatch eggs to produce walleye fry. In 1999, wild broodstock will be collected from the Missisquoi and Winooski Rivers to provide enough eggs to Bald Hill Fish Culture Station to produce 8 million walleye fry (with the predicted survival rate of 70% this would require approximately 12 million eggs).

***Job II***

**Approach:** The Bald Hill Fish Culture Station will produce early fingerlings, based on the management request for cultured fish and work cooperatively with the LCWA to produce fingerlings in LCWA ponds.

***Job III***

**Approach:** Bald Hill Fish Culture staff, district fisheries staff, and LCWA will distribute walleye fry and fingerlings.

**Estimated Annual Cost:**

Personnel:	\$31,000
Operating:	21,000
<b>Total</b>	<b>\$53,000</b>

(Does not include district staff costs for brood collection or LCWA costs for distribution)

**Priority 3:**

**Project A4:** Investigate walleye mortality at juvenile life stages.

**Project Leader:** Chet MacKenzie

**Need:** One of the challenges that could prevent achievement of the harvest objectives outlined in the Lake Champlain walleye management plan is greater than normal mortality of juvenile walleye.

**Objective:** To further develop appropriate sampling strategies for juvenile walleye and to determine abundance of juveniles .

**Expected Benefit:** Determining the relative abundance and mortality of eggs and juvenile walleye will allow managers to focus restoration efforts on identifying and addressing limiting factors or to stock walleye at the appropriate sizes that may bypass factors limiting survival. Knowing the abundance of juvenile walleye will provide evidence that reproduction or excessive juvenile mortality are or are not an impediment to increasing the Lake Champlain walleye population.

**Approach:** A focused effort at developing sampling strategies and estimating abundance of juvenile walleye will require an effort more intensive than possible with department staff. These projects will be developed in cooperation with the

Vermont Cooperative Fish and Wildlife Research Unit or as proposals from other researchers after funding is established. Below are descriptions of four potential jobs that could serve as a basis for requesting research proposals from the academic community. Actual project descriptions would be determined by submitted research proposals. Walleye stocking numbers and locations may be adjusted to increase the density of stocked fish in sampling locations if the experimental design requests this for an effective evaluation.

**Job I:** Develop sampling strategies and estimate abundance of walleye fry from hatch to 1 month post-hatch. This would be a 2 year research effort.

**Approach:** Use fine mesh nets to collect larval walleye in the river and in the lake as follows: 1) introduce marked walleye fry into two tributaries at the time of larval migration, and 2) introduce walleye fry into the lake near river mouths. Sampling will occur intensively(2-3 times/wk) for approximately one month in the river. Sampling will occur every 1-3 nights in the lake for 2-4 weeks and will likely overlap with river sampling. Data will also be collected to attempt to relate river discharge, ages of larvae, and the beginning of feeding to larval abundance to investigate factors that could be contributing to larval production.

***Budget (annual):***

Personnel (Graduate student and technician):	\$36,000
Operational costs (supplies, boat gas, etc):	6,000
Overhead:	<u>6,500</u>
<b>Total:</b>	<b>\$48,500</b>

Total for two-year project: \$97,000

**Job II:** Spring to summer sampling of age 0-age 2 walleye for purposes of developing a juvenile index. This would be a 2 year research effort.

**Approach:** 1) Spring bottom trawling--Juvenile walleye ( $\geq$  Age 1+) have been collected in bottom trawls at the 25-m contour in Shelburne Bay in late-April. Expanding on this sampling throughout other areas of the lake will help to determine if walleye can be consistently collected during spring in deep-water habitats. Sampling will be intensive for 4-6 weeks.  
2) Summer to late summer bottom trawling to collect age 0 walleye. Selected optimal temperature contours and selected habitat features will be targeted. Sampling will be intensive for two months. Other data will be collected (e.g. temperature and dissolved oxygen) to potentially provide correlations or predictions of walleye distributions in the lake.

***Budget (annual):***

Personnel (Graduate student and technician):	\$36,000
Operational costs (supplies, boat gas, etc):	14,000
Overhead:	<u>7,500</u>
<b>Total:</b>	<b>\$57,500</b>

Total for two-year project: \$115,000

**Job III:** Late summer to fall sampling of age 0-age 2 walleye for purposes of developing a juvenile index.

**Approach:** Age-0 and older walleye in other lakes are typically found in shallow water as temperatures begin to decline. To determine the most effective means of collecting walleye during this time of year, we will use the following techniques: 1) Electrofishing. Two crews will sample walleye for a minimum of 15 nights in three bays (minimum of 5 nights in each area)

2) Trap-netting. A minimum of 15 nights.

3) Seining. Sample nearshore areas for a minimum of 15 nights.

Other data will be collected (e.g. temperature and DO) to potentially provide correlations for predictions of walleye distributions in the lake. (Could also incorporate radio-tagging some individuals or gillnetting.)

***Budget (annual):***

Personnel (Graduate student and 2 techs):	\$50,000
Operational costs (supplies, boat gas, etc.)	4,000
Overhead:	<u>8,100</u>
<b>Total:</b>	<b>\$62,100</b>

Total for two-year project: \$124,200

**Job IV:** Develop sampling strategies and estimate survival of walleye eggs from deposition to hatch. This would be a 2 year research effort.

**Approach:** The actual field methods for this job will be developed in cooperation with the Vermont Cooperative Fish and Wildlife Research Unit or other researchers through written research proposals submitted as bids for contracted funds.

***Budget ( annual):***

Personnel (Graduate student and tech.):	\$36,000
Operational costs (supplies, mileage, etc.)	6,000
Overhead	6,500
<b>Total</b>	<b>\$48,500</b>

Total for two year project \$97,000

**Group B:** Projects that keep track of our progress in achieving the Management Plan objectives by monitoring harvest, so that we know if we are heading in the right direction. Two additional projects are included in Group B, monitoring fish health and improving degraded habitat, that help support Group A objectives.

**Priority 1:**

**Project B1:** Develop Walleye Fishery Monitoring Plan

**Project Leader:** Brian Chipman

**Need:** Harvest information is essential to measure progress towards management plan objectives.

**Objective:** To develop a walleye fishery monitoring plan by 2000 that will determine appropriate methods, seasons, areas, sampling frequencies and precision levels that will provide acceptable estimates of angler harvest, catch rates and other pertinent parameters.

**Expected Benefits:** A fishery monitoring plan will guide the implementation of future walleye fishery monitoring efforts in a coordinated, efficient and accurate manner to measure progress toward stated harvest objectives.

**Approach:** Assess findings of current and past fishery monitoring efforts, review literature, and communicate with walleye managers in other states and provinces. Work on this project will be completed by the end of 2000.

**Location:** District Offices

**Estimated Total Cost:**

Personnel (40 Staff Days)	\$8,400
Operating/supplies	700
<b>Total</b>	<b>\$9,100</b>

**Project B2:** Development of a walleye population monitoring plan

**Project Leader:** Shawn Good

**Need:** Knowing the number of walleye in the rivers and bays of Lake Champlain will give biologists and anglers a tangible measure of the species abundance, and rate of recovery. However, it is difficult to count what you can not see. With Lake Champlain walleye, the task is made more difficult by the fact that walleye mix and move in and out of different areas, so it is possible to miss fish, or count the same fish twice. The sampling that has been done in Lake Champlain in past years has given biologists some insights into broad changes in population size, and general trend information, but obtaining a more precise estimate of actual population numbers will require the development of new and more rigorous population assessment methods such as those used in the Great Lakes and ocean fisheries.

**Objective:** Develop a practical and statistically valid method (or methods) for determining population characteristics for walleye in the different zones of Lake Champlain by 2000.

**Expected Benefit:** A clear and tangible measure of the abundance of walleye in Lake Champlain will serve as a benchmark for measuring the progress of restoration efforts, in addition to angler harvest. This can also be combined with walleye age information to help document the natural population fluctuations that healthy walleye fisheries tend to exhibit as an exceptionally strong year class moves up through the population, often at 7-12 year intervals.

**Approach:** Assess findings of current and past walleye population monitoring efforts, review literature, and communicate with walleye managers and researchers in other states and provinces. Work on this project will begin in 1999 and be completed by April, 2000.

**Estimated Total Cost:**

Personnel(40 Staff Days)	\$8,400
Operating/supplies	700
<b>Total</b>	<b>\$9,100</b>

**Priority 2:**

**Project B3:** Northern and Southern Lake Champlain Creel Survey

**Project Co-Leaders:** Brian Chipman - Chet MacKenzie



**Need:** Harvest information is essential to measure progress towards management plan objectives. Recent harvest data is lacking in the relatively shallow northern and southern ends of Lake Champlain. Walleye harvest for the mainly deepwater portions of the lake was estimated in 1997 in creel surveys that were part of the salmonid restoration program evaluation (Federal Aid Project F-23-R). Creel surveys on these northern and southern areas in 1999, combined with 1997 surveys, would provide a unique opportunity to characterize the daytime walleye harvest throughout the lake in a relatively short time frame.

**Objective:** To estimate daytime winter and open water walleye harvest in northern and southern Lake Champlain (areas not covered by 1997 salmonid restoration program creel surveys) in 1999.

**Expected Benefits:** Completion of these creel surveys will result in a more comprehensive summary of Lake Champlain walleye fishery use. Better baseline harvest information will be obtained for these areas.

**Approach:** Winter (late December through late March) and open water (approx. late April through September) creel surveys will be conducted on the South Lake (South Bay, NY to Champlain Bridge), the northern Inland Sea (north of St. Albans), Missisquoi Bay and northern Main Lake (Isle LaMotte to Canadian Border). Total fishing pressure, catch, and harvest will be estimated from angler counts and interviews. Biological data will be collected from harvested walleyes. Vermont creel clerks can efficiently survey both Vermont and New York waters in both seasons in only some portions of the lake. New York Department of Environmental Conservation (NYDEC) will be assisting with this project by providing seasonal staff positions to assist in the surveys. Vermont will manage the NYDEC employees in the creel survey project in terms of providing training, scheduling, and data collection forms and measuring boards. NYDEC will supply trucks and safety equipment, snowmobiles or ATVs for winter surveys and a boat for open water surveys.

**Location:** Zone 1, from South Bay to Crown Point Bridge (Pittsford Office) and northern portions of Zones 4 and 5, from North Hero to the Canadian border (Essex Office).

**Estimated Cost:** NYDEC will provide creel clerks and operating expenses to survey the NY portion of Zone 4 in winter, and □ of Zone 1 including South Bay, in both winter and open water periods. Vermont costs will include creel clerks for the remainder of the survey areas, and planning, data analysis and report writing for the entire project. New York costs are

not included in the budget.

**Estimated Total Vermont Costs:**

	Essex	Pittsford	VT Total
Personnel			
Field	\$26,400	\$15,300	\$41,700
Spine aging	\$1,800	\$2,700	\$4,500
Report	\$9,500	\$9,600	\$19,100
Operating\Supplies	\$9,400	\$6,000	\$15,400
Equipment	\$4,500	\$4,500	\$9,000
		<b>Total: \$89,700</b>	
Permanent Staff Days	102	60	162
Seasonal Staff Days	241	215	456
Total Staff Days	343	275	618

**Priority 3:**

**Project B4: Lamoille River Spring Creel Survey**

**Project Leader:** Brian Chipman

**Need:** Harvest information is essential to measure progress towards management plan objectives. The Lamoille River spring walleye fishery was last surveyed in 1996. Other rivers (Missisquoi, Winooski, Otter) have more current harvest data.

**Objective:** To estimate the Lamoille River spring, 1999 walleye harvest.

**Expected Benefits:** Current harvest information will be obtained for the Lamoille River spring fishery for comparison with the Management Plan's harvest objective.

**Approach:** A creel survey will be conducted for the first six weeks of the walleye season (May 1 - June 11, 1999). Angler counts and interviews will be used to estimate total fishing pressure, catch, and harvest. Biological data will be collected from harvested walleye.

**Location:** Lamoille River

**Estimated Total Cost:**

Personnel	
Permanent (5 Staff Days)	\$1,000
Seasonal (22 Staff Days)	1,700
Operating/supplies	600
<b>Total</b>	<b>\$3,300</b>

**Priority 4:**

**Project B5:** Walleye - Fish Disease Work at Bald Hill Fish Culture Station

**Project Co-Leaders:** Tom Jones - Barb Johnston

**Need:** The movement of fish stocks from one area to another has been recognized as one of the major factors involved in the spread of fish diseases. The transfer of wild adult walleye into the Bald Hill Fish Culture Station (FCS) has the potential to negatively impact walleye and salmon production at Bald Hill and has further potential to spread fish diseases back to the environment via stocked fish. To date, little is known about the fish health status of walleye transferred and propagated at the FCS.

**Objective:** To ascertain the fish health status and possible disease implications associated with walleye fry, fingerling and adults transferred to or from the FCS.

**Expected Benefits:** To eliminate or reduce the potential for disease transmission to the FCS and to the natural environment via stocked walleye.

**Approach:** Review literature on fish diseases common to all life stages of walleye. Adult walleye from each discrete spawning population will be examined for fish diseases caused by viruses, bacteria and parasites. A maximum of ten fish will be sampled from each spawning population. Fry and fingerling walleye reared in the FCS will also be examined for diseases.

Develop and implement procedures that will prevent, control, and manage possible fish diseases associated with walleye at the FCS.

**Location:** Bald Hill FCS and Fish Health Laboratory, Waterbury

**Estimated Annual Cost:**

Personnel (9 Staff Days)	\$1,417
Equipment/supplies	325
<b>Total</b>	<b>\$1,742</b>

**Priority 5:**

**Project B6:** Volunteer walleye angler diary cooperator program.

**Project Leader:** Jon Anderson

**Need:** Walleye harvest must be monitored to determine if objectives identified in the walleye plan are reached. It is impractical to conduct lake wide creel surveys annually due to the prohibitive cost of such a large program. Night fishing is also difficult to monitor with traditional creel survey methods due to safety and accuracy concerns. Through the use of a volunteer walleye angler diary program general trends in fishing success, measured as cooperator catch rates and harvest rates, may be obtained if the number of participants is sufficiently large. This program will provide information on the walleye fishery during years when a formal creel surveys are not conducted.

**Objective:** To increase participation in the volunteer angler diary program to at least 100 cooperators, representative of all areas of Lake Champlain, who will provide consistent and reliable data. To monitor long term trends in the walleye fishery and to examine the relationship between the night and daytime walleye catch rates and harvest rates.

**Expected Benefits:** The diary program has been in existence since 1984 and provides long term information on trends for both the day and night walleye fisheries. This program costs very little to operate but it provides information that would not be available otherwise unless creel surveys were conducted annually. It also allows the Department of Fish and Wildlife an opportunity to develop and maintain relationships with walleye anglers.

**Approach:** Walleye anglers will be asked to participate in the diary cooperator program with a goal to include at least 100 volunteers. Special efforts should be made to recruit more anglers who fish in areas of Lake Champlain that are under represented by cooperators. The present level of participation is about 40 anglers and has remained fairly constant since 1984. Volunteers will be sought amongst present participants, through news releases, and the LCWA. Anglers who return tags from walleye they catch will also be asked to participate. Information from the diary books maintained by the cooperators will be summarized annually. Those anglers who participate in the program will annually receive a hat and/or patch that identifies them as cooperators, a summary of the cooperator data, and any reports on walleye written that year they request.

**Location:** Essex District Office

**Estimated Annual Cost:**

Personnel (8 staff days)	\$1,240
Operating	400
<b>Total</b>	<b>\$1,640</b>

**Project B7:** Fish tag return reward program.

**Project leader:** LCWA

**Need:** Tags from harvested walleyes and other fish species that are reported by anglers may provide valuable information on fish movements and population characteristics. The reliability of much of this information is affected by tag return rates and it is known that many tagged fish caught are not reported by anglers. Offering a reward program for tag returns provides an incentive for more anglers to report tagged fish to VTFWD.

**Objective:** To increase fish tag return rates by offering a lottery reward program as an incentive for anglers to return tags from harvested fish.

**Expected Benefits:** Angler tag return rates will improve, resulting in more reliable information from tagging studies.

**Approach:** LCWA has developed an annual lottery drawing in cooperation with VTFWD to encourage anglers to return tags and information from fish they catch. After the end of each calendar year, anglers who return tags during that year to VTFWD are entered into a drawing for three monetary awards provided by LCWA (\$200 first prize, \$75 second prize and \$25 third prize). Each tag returned represents one chance to be drawn. Winners are announced by LCWA at their annual spring banquet.

**Location:** Essex District Office and LCWA Office

**Estimated Annual Cost:** \$300 (LCWA funds)

**Project B8:** Fish Culture Research

**Project Leader:** John Gregory

**Need:** Standard techniques for intensive (tank reared) and/or extensive (pond reared) culture have not been developed for walleye in Vermont.

**Expected Benefit:** Small scale experimentation with various techniques will allow

us to rear fry and fingerlings more effectively and efficiently.

**Job #1**

**Objective:** Develop intensive - extensive culture techniques.

**Approach:** Fry will be reared on artificial diets at Bald Hill Fish Culture Station in the hatchery building until 18 days of age. Fry will then be transferred to rearing ponds until harvested as early fingerlings.

**Job #2**

**Objective:** Develop intensive culture techniques to raise fry and fingerlings.

**Approach:** Fry will be reared intensively in the Bald Hill Fish Culture Station hatchery building to fingerling size

**Job #3**

**Objective:** Develop extensive - intensive culture techniques for rearing fall fingerlings.

**Approach:** Fingerling walleye will be reared at the Bald Hill Fish Culture Station in hatchery ponds and then be harvested and reared intensively until the fall.

**Estimated Annual Cost:**

Personnel	\$ 7,600
Operating	5,100
<b>Total</b>	<b>\$12,700</b>

**Priority 6:**

**Project B9:** Monitor spawning concentrations of walleye

**Need:** Sampling spawning concentrations of walleye in Lake Champlain can provide information on trends in population age structure, relative abundance, growth, and the contribution of stocked walleye to adult spawning populations. Adult walleye are also collected for the walleye culture program during spring sampling.

**Objective:** Monitor population characteristics including age/size structure, sex ratio, lamprey attack rates, and general trends in abundance. Provide adult broodstock to fish culture program as needed.

**Expected Benefit:** Population trend information is essential for informed management decisions such as the need for regulation changes, providing anglers with current resource information, and assessing the effects of land and water development proposals on the walleye population, their habitats and recreational opportunity. Spring monitoring provides information on recruitment, growth, distribution, age composition, and general trends in abundance. Walleye captured during spring surveys are provided to the Bald Hill Fish Culture Facility to supply eggs as needed. Spring sampling also provides information on the contribution of stocked walleye to adult spawning populations.

**Job I:** Monitor river spawning walleye populations in the spring.

**Approach:** Adult walleye will be collected by electrofishing during spring spawning runs in April and May. Frequency of sampling (e.g. annually, biannually, etc) will be determined during development of Project B2 ( Develop Walleye Population Monitoring Plan). All walleye will be measured, marked, sexed, and examined for lamprey attack data, external parasites, lymphocystis (external infection commonly found on walleye), and marks. Dorsal spines will be removed for aging as needed. Walleye will be collected for the Bald Hill Fish Culture Facility to supply eggs as needed.

Note: project costs are separated by location along fisheries district lines.

**Location:** Missisquoi, Lamoille, and Winooski Rivers.

**Project Leader:** Jon Anderson

**Estimated Annual Cost:** Missisquoi, Lamoille, Winooski (Essex District) monitoring 1999 - 2003

Personnel	
Permanent (60 staff days)	\$10,708
Seasonal (12 staff days)	840
Equipment	900
Operation	700
<b>Total</b>	<b>\$13,148</b>

**Location:** Poultney River

**Project Leader:** Chet MacKenzie

**Estimated Annual Cost: Poultney River Monitoring (Pittsford District), 2000.**

Personnel	
Permanent (24 Staff Days)	\$4,300
Seasonal (27 Staff Days)	1,900
Supplies	300
<b>Total</b>	<b>\$6,500</b>

**Job II:** Monitor walleye population in Missisquoi Bay.

**Project Leader:** Jon Anderson

**Approach:** Walleye will be collected by seining during the spring at Sandy Point in the Missisquoi Bay in a consistent and repeatable fashion using the same sampling techniques at the same locations and time of year. Other shoreline areas in Missisquoi Bay may also be investigated for suitability as seining locations. Sampling frequency will be determined during development of Project B2 (Develop Walleye Population Monitoring Plan).

**Location:** Missisquoi Bay

**Estimated Annual Cost: (2000)**

Personnel	
Permanent (20 staff days)	\$3,692
Seasonal (54 staff days)	3,920
Equipment	500
Operation	800
<b>Total</b>	<b>\$8,912</b>

**Priority 7:**

**Project B10:** Improve critical walleye habitat where necessary.

**Need:** If investigations identify that habitat degradation is negatively affecting walleye populations, that degradation will be corrected where possible. Missisquoi Bay has been identified as an area where deterioration of critical walleye habitat may have led to a decline in the fishery.

**Objective:** Focus habitat improvement efforts on clearly identified needs to avoid the high cost and low success of engineering physical [improvements] where there is no biological benefit.

**Expected Benefits:** While fish habitat restoration efforts have a clouded history of high costs with little or no measurable benefit to the fishery, there is the potential



to approach this effort in a scientific manner by identifying what factors are currently limiting walleye survival and growth in the Lake Champlain basin, and then focusing habitat improvement work on the specific areas that have been determined to be critical needs. This approach could result in improvements in the reproductive success, growth or survival of the fish populations dependent upon this habitat.

**Approach:** If the VTDFW walleye team, LCWA, USFWS or other cooperators identify the factor(s) limiting walleye survival, and subsequently determine that habitat degradation is responsible for any of the limiting factors, then the VTDFW will identify habitat restoration techniques that will mitigate or correct for the limiting factors. These restoration techniques will be implemented in those situations where it is economically, physically and politically feasible.

**Location:** Meetings and field work throughout the basin.

**Estimated Cost:** Variable - dependent upon what improvement projects are undertaken.

**Group C:** Projects that address angler related issues such as regulations and access, and factors relating to species interaction that may become important in the future if expansion of the walleye population begins to have an impact on other fish species.

**Priority 1:**

**Project C1:** Review current Lake Champlain walleye regulations and implement changes as needed.

**Project Leader:** Chet MacKenzie

**Need:** Public comments received during the review of the Lake Champlain Management Plan suggest that there may be dissatisfaction with current Lake Champlain walleye regulations.

**Objective:** Assess the effectiveness of current regulations in conserving or enhancing walleye populations and improving angler satisfaction.

**Expected Benefits:** Improved angler satisfaction and /or the conservation or enhancement of walleye populations.

**Approach:** Review literature, communicate with walleye managers and researchers in other states and provinces, and collect input from the public. Work on this project will begin in 1999 and will be completed by the end of 2000.

**Location:** Statewide

**Estimated Total Cost:**

Personnel: (60 staff days)	\$12,600
<b>Total</b>	<b>\$12,600</b>

**Priority 2:**

**Project C2:** Identify areas on Lake Champlain and its tributaries that need new or improved access sites for walleye anglers.

**Project Co-Leaders:** John Guilmette and Jon Anderson

**Need:** Changes in boating regulations have made access to river fisheries more difficult for walleye anglers. Boating laws have restricted speed on rivers to 5 mph. As a result it can often take over an hour to travel from existing access areas to favored fishing locations. Developing additional access areas on rivers closer to popular fishing locations will help alleviate this situation. Also, parking is congested at existing areas during the peak of the spring walleye season and additional access sites will reduce this problem. In addition, several areas of the lake where summer walleye fisheries exist do not have public access areas close by. Developing public boat launches in these areas will provide access to these fisheries.

**Objective:** To provide sufficient access to walleye fishing areas on Lake Champlain and its tributaries.

**Expected Benefit:** By providing additional access and improving existing access areas anglers will have a greater opportunity to utilize the walleye fishery and this may increase the number of participants in the fishery.

**Approach:** There have been several areas identified that need additional access or improved access. Some access sites have been identified that need expanded or improved parking. Additional property may need to be purchased to allow expansion. Access area improvements and purchases should be prioritized after consultation with district fisheries staff and local wardens. Those areas that need to have property purchased should be identified and a real estate agent contacted to determine the availability and cost of appropriate parcels of land.

**Location:** Essex and Waterbury Office

**Estimated Total Cost:**

Personnel (10 staff days)	\$ 2,100 (does not include facilities engineering cost)
Land acquisition	Unknown
Construction	Unknown

**Priority 3:**

**Project C3: Economic Impact of Walleye Fishery Restoration**

**Project Leader:** Lake Champlain Walleye Association

**Need:** In order to gauge whether the costs of restoring walleye to Lake Champlain and its major tributaries is economically feasible, it is necessary to estimate both the value that anglers attribute to walleye restoration efforts and the current and potential impacts of restoration efforts on walleye-related angler expenditures on the Lake Champlain Regional economy.

**Objective:** 1) To estimate walleye angler's willingness to pay (value) for walleye restoration efforts on Lake Champlain. 2) To estimate annual durable and nondurable expenditures directly related to walleye fishing on Lake Champlain.

**Expected Benefits:** The value of walleye fishing on Lake Champlain and the economic impact of walleye angler expenditures on the regional economy will be established. This information will enable those involved in the walleye restoration effort to assess the level of angler support for restoration. It will also make local, state and federal funding agencies aware of the financial impact that walleye-related expenditures have on the economy.

**Approach:** A mail questionnaire survey will be sent to walleye anglers identified during the 1998 economic survey of Lake Champlain anglers that was conducted under the salmonid restoration program (Federal Aid Project F-23-R). The questionnaire used in this survey will be designed to estimate the value of one or more specified walleye restoration efforts. Survey respondents will also be asked to estimate future increases in their walleye fishing associated with improvements in the walleye fishery due to restoration efforts. These data, and other ancillary information, will be used to estimate the mean and total value of selected restoration efforts and estimate increased walleye angler participation and expenditures under various restoration plans.

**Location:** Burlington, Vermont

**Estimated Total Cost:**

Personnel	\$2,950
Operating	1,130
<b>Total</b>	<b>\$4,080</b>

#### **Priority 4:**

##### **Project C4: Bioenergetics Modeling\***

*\*Note: In the simplest terms, bioenergetics modeling is a kind of calorie counting for fish. It looks at how many calories the average walleye burns in a day, and how many calories it gets from the prey it eats for food - for example, calories per smelt, shiner or yellow perch eaten. This simple information is expanded in a model that includes information on fish numbers and sizes to see if there are adequate numbers of prey fish to feed the number of walleye in the lake. The more predator and prey species that are added to the model, the more complex the interactions become.*

##### **Project Leader: Eric Palmer**

**Job I:** Determine the practical uses of a Lake Champlain bioenergetics model that includes walleye and design a sampling strategy that will allow for the collection of pertinent and useful data to aid in the construction of a valid model.

**Need:** A key purpose of this modeling effort is to provide information to better direct management decisions that affect walleye. Models are often most useful for detecting information gaps in current management decision making processes. Before time and effort is put into the development of a bioenergetics model that includes walleye, it is necessary to clarify several points. For example, we need to answer the following questions in chronological order.

- 1) What are the species interactions we need to know more about and why?
- 2) What interactions can we influence through stocking, regulations, etc?
- 3) What is the predictive power of such models vs. their descriptive power?
- 4) What knowledge/information can we acquire through processes less complex than bioenergetics modeling?
- 5) How will the model be used for making fisheries management decisions?

**Objective:** Determine and clearly identify the desired outcomes of the model and the parameters that are necessary to produce these outcomes. Subsequently, develop a sampling strategy, or identify current on-going sampling efforts, that will provide this data in an efficient manner.

**Benefit:** Including walleye in the Lake Champlain bioenergetics model may help biologists understand the interactions between walleye and other fish that prey on smelt. A careful evaluation of the model's capabilities will help to determine the usefulness of this assessment method. Identifying the desired model outputs and the inputs necessary to produce them will help direct fieldwork to gather the necessary information most efficiently. We may also determine that current on-going sampling projects can be utilized to provide some of this data.

**Task 1:** Determining the usefulness and anticipated application of a bioenergetics model that incorporates walleye and discuss the desired outcomes of the model as well as the parameters needed to produce these. An understanding of how the model output will be used to manage walleye in Lake Champlain is needed.

**Approach:** A thorough review of relevant literature in conjunction with discussions with modeling experts will be conducted by members of the VTDFW walleye team, the Lake Champlain Fisheries Technical Committee, the Vermont Cooperative Fish and Wildlife Research Unit and the LCWA. Following this, meetings will be held involving all interested parties to discuss the findings.

**Estimated Total Cost:**

Personnel (30 Staff Days)	\$6,000
Operational costs:	200
<b>Total:</b>	<b>\$6,200</b>

**Task 2:** Develop sampling strategies to collect necessary data for operation of the model.

**Approach:** The VTDFW Walleye Team, or a sub-contractor in consultation with Walleye Team will:

- 1) Examine current on-going sampling projects and determine whether these may provide a portion of the modelling data.
- 2) Coordinate with other programs (other states, other species teams) to
- 3) Prioritize and schedule sampling efforts.
- 4) Prepare sampling budget (time and costs).

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**Estimated Total Cost:**

Personnel ( 10 Staff Days)	\$2,000
<b>Total Cost:</b>	<b>\$2,000</b>

\*\*\*\*\*

Note: Project C4: The tasks under Job I describe the planning and design of a bioenergetics model. The actual data gathering and model development would be a separate step. It is difficult

to estimate the cost of actually building the model at this early stage before the modeling and data collection needs are fully known. Previous experience developing the salmonid bioenergetics model for Lake Champlain indicates that the project would take two years and the cost would probably fall within the following ranges -

**Estimated Annual Cost:**

Personnel (Graduate student and technician):	\$36,000 - 50,000
Operational costs	6,000 - 10,000
Overhead:	6,300 - 9,000
<b>Total:</b>	<b>\$48,300 - 69,000</b>
Total for two-year project:	\$96,600 - 138,000

**Priority 5:**

**Project C5:** Collect walleye diet information.

**Project leader:** Jon Anderson

**Need:** Collecting diet information for walleye in Lake Champlain could provide useful data on the amount of diet overlap among walleye and other predator species such as trout, salmon, perch, bass and northern pike. It may also give insights into the prey preferences of walleye and seasonal prey availability. This information may help in understanding juvenile walleye growth and survival, and adult walleye competition with other fish species for common prey.

**Objective:** To determine the food habits of walleye in Lake Champlain at various seasons of the year.

**Expected Benefit:** This information will assist biologists in determining the potential for species competition, and the importance of species such as smelt and yellow perch in the diet of walleye at different seasons and life stages.

**Approach:** During normal sampling in other projects in Lake Champlain dead walleyes will have stomachs removed and contents identified. If more information is needed than what is provided by dead walleye, then live walleye captured in other projects will have their stomachs pumped before they are released.

**Location:** Lake Champlain and its tributaries.

**Estimated Annual Cost:**

Personnel	
Field Collection	\$ (included in other projects)
Report and Lab	1,500
<b>Total</b>	<b>\$ 1,500</b>

Approved by:

\_\_\_\_\_  
Ron Regan, Acting Commissioner  
Department of Fish and Wildlife

\_\_\_\_\_  
Date

\_\_\_\_\_  
Tim Hess, Director of Fisheries

\_\_\_\_\_  
Date

**Table 1: Project timetable and Cost Estimates**

Project #	Description	1999	2000	2001	2002	2003	Annual Cost	Annual Staff Days
A1	Walleye Habitat Protection	X	X	X	X	X	Unknown	Unknown
A2: Job I	Evaluate OTC marking techniques	X	X	X	X	X	\$10,900	46
A2: Job II	Evaluate stocked walleye fingerlings contribution to spawning populations	X	X	X	X	X	\$620 <sup>3</sup>	4
A2: Job III	Evaluate stocked walleye contribution to fall fingerling (Age 0+) populations	X	X	X	X	X	\$3,600	14
A2: Job IV	Evaluate alternative marking techniques for cultured walleye	X	X	X			\$4,400	20
A3	Walleye production and distribution	X	X	X	X	X	\$52,000	
A4: Job I	Determine abundance of larval walleye in spawning tributaries						\$48,500 <sup>4</sup>	
A4: Job II	Develop a spring-summer index of juvenile walleye abundance						\$57,500 <sup>2</sup>	
A4: Job III	Develop a summer-fall index of juvenile walleye abundance.						\$62,100 <sup>2</sup>	
A4: Job IV	Estimate survival of walleye from egg deposition to hatch						\$48,500 <sup>2</sup>	

<sup>3</sup> Field sampling costs are not included in this estimate but are included in other projects such as B8.

<sup>4</sup> Funding and timelines for these projects have not been established. These projects are designed as research to be conducted by the Vermont Cooperative Fish and Wildlife Research Unit or others in the academic community.



Project #	Description	1999	2000	2001	2002	2003	Annual Cost	Annual Staff Days
B1	Develop a walleye fishery monitoring plan	X	X				\$9,100	40
B2	Develop a walleye population monitoring plan	X	X				\$9,100	40
B3	Estimate winter and open water walleye harvest in North and South Lake Zones	X	X				\$89,700 <sup>5</sup>	618
B4	Estimate spring walleye harvest in the Lamoille River	X	X				\$3,300 <sup>3</sup>	54
B5	Fish pathogen survey	X	X	X	X	X	\$1,800	9
B6	Volunteer Angler Diary Cooperator Program	X	X	X	X	X	\$1,600	8
B7	Fish Tag Return Reward Program	X	X	X	X	X	\$325	
B8	Fish Culture Research	X	X	X	X	X	\$12,700	
B9: <i>Job I</i>	Monitor river spawning concentrations of walleye	X	X	X	X	X	\$13,148	72
B9: <i>Job II</i>	Monitor Missisquoi Bay walleye population		X				\$8,900	74
B10	Improve critical walleye habitat	X	X	X	X	X	Unknown	
C1	Review current walleye regulations and revise as needed	X	X				\$12,600	60
C2	Develop or improve access sites for walleye anglers	X	X	X	X	X	\$2,100 <sup>6</sup>	10

<sup>5</sup> Total project cost. A small portion of this funding will be spent writing project reports in 2000.

<sup>6</sup> This estimate does not include costs of acquisition, design, or construction.

Project #	Description	1999	2000	2001	2002	2003	Annual Cost	Annual Staff Days
C3	Cost-Benefit Analysis of Lake Champlain Walleye Fishery						\$4,080 <sup>2</sup>	
C4	Bioenergetics Modeling			X	X	X		
C5	Collect walleye diet information	X	X	X	X	X	\$1,500 <sup>1</sup>	