bid process. It is important to also include a copy of the contract in each bid packet. The contract will have to meet legal guidelines for each of the State, Provincial and Federal agencies, but it should also include those items the architect deems important. For example, there should be progressive payments geared to construction progress and paid pending inspection by the architect. There should be a holdback, paid after the boat is delivered or at completion of sea trials. This may vary among architects. There should also be some provision for either removing the vessel if there is a breech of contract, or some provision for stopping payment and litigating if the vessel is not constructed according to specifications. Furthermore, agency's legal staffs should be apprised of this provision and they should be willing to act on the architect's recommendation – this is one of the important levers your architect and you have if you need to deal with an uncooperative and unscrupulous builder. For example, because of construction problems, the Napier Company (marine architects) recommended the transfer to another shipyard for New York's SETH GREEN and Ohio's EXPLORER. New York acted on the architect's recommendation and had a successful construction project, whereas Ohio did not and the EXPLORER was three years late and has required substantial repairs to correct a number of construction flaws.

8. The architect should oversee, or at least be involved in, the bidding process. His expertise at this point may be critical in determining the eventual outcome of the project. He should know of any qualifications or adjustments vendors may make to any of the specifications. He may also need to do some last minute checks and validations before the bid award is finalized.

9. The designer should supervise vessel construction. It may seem expedient to hire a local marine surveyor, close to the construction yard to minimize travel expenses, but there is no better assurance that the builder will comply with the design and specifications than by using the designer for these inspections. The vessel's captain should also make as many visits to the yard during construction as is financially practicable. But the captain should at least accompany the architect during his inspections of the vessel. As previously mentioned, the architect will inspect the vessel during various stages of construction, and pending his recommendation payments will be made at predetermined phases in the construction.

10. Once construction is completed the boat can be launched and the architect can conduct an inclining experiment to establish stability characteristics. This test will indicate any problems with vessel stability and whether there are any restrictions with the vessel's use. If the designer had done his job well, this should not be a problem.

11. Soon after launch and the stability test, sea trials should begin. This should be done prior to accepting the vessel and a substantial payment should be tied to the successful completion of trials. Trials should entail vessel crew outfitting the boat with sampling gear and working the boat to the point that the crew is satisfied with its performance.

12. The final word – not enough emphasis can be placed on having the project team involved in all the decisions that affect the vessel project and a vital member of that team is an experienced captain. Regrettably, as the commercial fishing industry disappears in the Great Lakes it will become increasingly difficult to find captains with the necessary experience, knowledge and skills. An agency with an inexperienced captain would be well advised to contract with a naval architect who is particularly experienced in the design of fishing vessels.

This approach of using an in-house team to work with a professional designer or engineer would be just as applicable if an agency were doing a refit of an existing hull or the purchase and refit of a used vessel. In fact, the initial charge to the architect could be to examine the costs and tradeoffs associated with either a refit of a current or used boat versus construction of a new vessel. Make sure that you contact a marine engineer or architect before purchasing a vessel for refit and not after the purchase. Again, the key to success is finding a capable architect who can work well with a good team of agency staff.

8. Coordinated Management

One of the areas the GLFC wanted us to explore is the potential for better coordination and use of Great Lakes fisheries vessels. More specifically, can the University-National Oceanographic Laboratory System (UNOLS), which has operated effectively for 25 years within the marine science community, become a model for fisheries research vessel management on the Great Lakes? Briefly, UNOLS is a consortium of 57 agencies that operate the U.S. academic research fleet, which is a platform for most of the American oceanographic research. The cost of operating this fleet is shared by the vessel owners, the National Science Foundation (NSF), the Office of Naval Research (ONR), and by the vessel contracting institutions. The UNOLS council is an elective group that is responsible for the scheduling and coordination of cooperating vessels and equipment. They also ensure that the vessels are safe and well maintained. They do this by setting stringent safety standards and also providing for routine inspections to assure compliance with these standards. Most of the work undertaken by the UNOLS fleet is short-term research. Likewise, funding sources can be erratic, varying considerably (2 fold) from year-to-year. They also view long-term contracting as counter productive and inefficient. The UNOLS approach embraces competition among vessel operators in order to provide for the lowest cost and best service for the user – they consider this a key to their success. Although each of the vessels competes with one another for research monies, there is a strong cooperative spirit among institutions that operate the UNOLS ships.

Within the last 4-5 years, representatives of Canadian and U.S. vessel programs have convened a series of annual workshops. The Great Lakes Science Vessel Workshops have been organized by a group of Great Lakes governmental agencies with the intent of developing a coordinated approach to management and operation of Great Lakes science vessels. Although there is no formal connection or tie with UNOLS, there is a close association of purpose between the two groups. However, in spite of these efforts to improve vessel utilization, coordinated management of the Great Lakes science vessel fleet remains an elusive goal.

Our interviews revealed several possible explanations why SGLFMP agencies are reluctant to embrace the UNOLS model for vessel management in the Great Lakes. First, twenty-five percent of the fleet is scheduled to capacity, i.e., operating for 100 days or more, so there is little room for scheduling additional work. For the remainder of the fleet, however, there is considerable capacity for increased usage (58 day average use). For those agencies operating underutilized vessels, however, there is little motivation to solicit outside work because internal sources of funding for vessel operation and maintenance are fairly constant and secure, and because for many agencies moving outside contract dollars into their vessel program is not an easy procedure. Most vessel days (87%) are programmed to maintain long-term monitoring and indexing activities, which by definition involve the same effort, and funding, from year-to-year, whereas moving the contract dollars earned by the vessel back into their program would require special permission and procedures (i.e. Many state agencies would require approval of the state legislature in the form of a special appropriation.). Also, staff reductions at many facilities have created situations where some station staff feel they are “operating on the edge” and cannot undertake additional vessel operations at this time. They are trying to maintain their long-term programs in the face of staff cuts, and staff at some stations are feeling overworked and overburdened. These personnel are reluctant to look for work that will not only require the use of their vessel and crew, but will also require administrative efforts to coordinate and manage the contract work. At some stations, crews are used extensively for work on non-vessel projects and are not available for additional vessel projects.

Surprisingly, when station staff talked about meeting future program needs they frequently mentioned expanding cooperative and collaborative efforts. The key to their concept of expanded collaborative work in the future, however, was the close alignment of their program goals with any potential cooperators. Nearly all vessel station staff indicated they would welcome collaborative work with outside researchers, if their research proposals were compatible with the agency’s vessel program goals and schedule. This could be done with other agencies or entities on a “payment in kind” (personnel or vessel time) basis or gratis if the work could be “piggybacked” with the vessel station program. An indication of whether an agency is willing to accept contract, payment in kind, or piggyback sampling may be found in the Great Lakes Science Vessel Inventory produced by the Great Lakes

Commission in Ann Arbor, Michigan. For those researchers and program managers that are looking for future access to Great Lakes fisheries research vessels, the message here is that money alone will not gain you access to fisheries vessels. But, if your project is compatible with one of the vessel programs described in the following station summaries, then possibilities for future collaborative work is very good.

9. Issues and Recommendations

The following are a list of issues that surfaced during the course of our interviews and some recommendations we have made relating to these issues. We believe the issues are relevant to the safe and efficient operation of the Great Lakes large-vessel fleet and warrant consideration by agency staff.

A. Inspection issues: We believe there is a single overarching need for the Great Lakes fisheries research vessel fleet – *regularly scheduled, comprehensive vessel inspections* . Currently, there is no requirement for any kind of regular inspection for U.S. fisheries research vessels less that 300 gross tons by the U.S. Coast Guard (USCG), therefore all U.S. fisheries research vessels on the Great Lakes, except the USGS vessel KIYI, are considered "Un-inspected Vessels", and are not required to be inspected by the USCG. Consequently, some U.S. vessels have operated for decades without any kind of comprehensive inspection. Some field stations have tried to get their vessels inspected, but found that the USCG had barely enough staff and funds to meet their mandated inspections. Agencies could contract inspections with marine surveyors but this not often done. If the USCG does not require an inspection, there is little incentive to do it privately. The USGS is undertaking to maintain a high level of fitness for their new vessel KIYI by complying with the rigorous American Bureau of Shipping (ABS) inspection standards and services, but other vessels in their fleet or operated by other SGLFMP agencies are not required to meet these standards.

In contrast to the un-inspected status of U.S. fisheries vessels, Canada requires OMNR fisheries vessels to be inspected every four years. Canadian Coast Guard (CCG) inspections focus on hull integrity, life saving equipment and navigational aids and require that the boat be dry-docked to facilitate hull and shaft inspections. However, even these inspections are not fully comprehensive as they give little attention to mechanical, hydraulic, plumbing, and electrical systems. It appears that the purpose of these inspections is to insure that each vessel does not sink and that a disabled vessel can always be towed to shore (worthy purposes indeed). However, that some OMNR captains had their own separate list of maintenance and repair needs above and beyond what was described in the CCG inspection report underscores the need for more comprehensive inspections.

We found that many U.S. and Canadian fisheries vessels have been operating years without any kind of stability assessment. In some instances, vessels have been modified to accommodate large, heavy stocking tanks on their decks (a potentially dangerous situation) without any kind of stability test. Furthermore, we have heard captains describe poor handling characteristics of their vessel in some sea states.

Inspection recommendations: We recommend that the GLFC should facilitate an effort by the agencies to require U.S. fisheries vessels to at least meet the same safety standards that currently apply to Canadian fisheries vessels operating within the Great Lakes. The need for adopting Canadian standards, or some equivalent protocol, should be apparent when U.S. lawmakers and agency personnel consider that U.S. fisheries research vessels have no safety requirements, while similar vessels in Canada must comply with a fairly rigorous Coast Guard safety standard. An ideal inspection protocol would be more comprehensive than the Canadian standards, perhaps akin to the ABS standards, which would include all vessel systems.

We also recommend that each agency ensure that their vessels have had a comprehensive stability test, e.g. an inclining experiment. If a test was done years ago and there have not been any substantive changes in ballast, superstructure, gear placement etc., then a new stability test is probably not required. However, if any of these modifications have occurred, then another stability test should be considered. A qualified marine engineer, architect or marine surveyor should be contracted to conduct these stability tests. At the very least, a rolling test

should be completed in order to alert staff to any potential problems with stability (contact a marine architect or marine engineer for procedures related to conducting an in-house rolling test).

B. Staffing issues: Staffing issues include levels, recruitment, use of dedicated crews, and compensation and overtime for captains. In the next 20-25 years, the capacity for agencies to do anything new and creative, or the capacity to expand any existing program may be limited by staffing levels. There is common belief among all the vessel stations that they will not see any new staff for their stations. With the majority of current staff time and fiscal resources directed toward maintaining long-term databases, it may be difficult for agencies to adapt to new situations that may arise in the future. Rather than having the capacity to move quickly on new issues, Great Lakes fishery agencies may be restricted and inflexible.

In the future, resource agencies may have a more difficult time finding personnel to fill new or existing positions who are sufficiently skilled and interested in working on fishery research boats on the Great Lakes. If the commercial fishing industry continues to diminish, as many Great Lakes managers predict, the future pool of individuals with Great Lakes fishing and fishing gear experience may be much smaller and more competitive. Agencies may have to recruit from areas outside the Great Lakes to find people with the right combination of skills. These trends will likely affect recruitment of captains first, but may also influence engineers and vessel technicians as well.

In the past, it was usual practice that the fisheries vessels had a captain and another staff who had the primary responsibility to operate and maintain the vessel and its gear. Today, some agencies no longer have dedicated vessel crews, believing non-dedicated crews are a more efficient use of staff resources. In extreme cases, the captain may be the only permanent, experienced member of the crew, with the other crewmembers being only inexperienced land-based or seasonal people. On paper this arrangement suggest full vessel staffing levels, but captains can readily envision difficult situations where they may have to run the boat, deal with emergencies, while untrained crewmembers provide limited help or assistance. Common sense and reasonable practice suggest that no fisheries vessel should leave a dock without a crewmember on board who is capable of running the vessel if the captain were to become incapacitated. Field stations that practice this staffing approach should know that their vessels operate at greater risk than vessels with trained, permanent and experienced crews. In the mean time, program administrators should consider a comprehensive training and indoctrination program for these seasonal crews, more so than they might otherwise require of permanent staff.

We are fully appreciative of the skills and responsibilities required of Great Lakes fisheries research vessel operators. From our view, the USGS is the only agency that adequately compensates their vessel crews. Whereas other agencies complained about recruiting and retaining good people to operate their research vessels, the USGS has had no problems either finding capable, reliable personnel nor have they had difficulty retaining these people for long, productive careers. Many other agencies do not seem to recognize the responsibility that goes along with the USCG or CCG boat operator's certifications. These operators are responsible for the safety of crew and vessel, and in the event of an accident, they alone will sit before a review panel to explain their actions. They alone could potentially lose their license and they alone could possibly lose their jobs and benefits. Scientists and other crew do not have any similar responsibility or risks to their job status. Regrettably, some agencies have tried to improve the compensation for their captains, but find that with only one or two such positions in their state, that it is difficult to get any attention from their agency's personnel offices. Some agencies should review their compensation programs for their Great Lakes vessel captains. For example, OMNR captains have low pay relative to other Great Lakes vessel captains and they do not qualify for overtime, yet their crewmembers are eligible for time-and-half overtime compensation. There is only an $800 (US) difference between OMNR's top crewmember and the lowest paid OMNR captain. Theoretically, with only 41 hours of overtime per season, a crewmember would make more than the OMNR captain, but at the same time the captain is their supervisor and is also responsible for their health and safety. Agencies should reconsider their compensation packages for their captains and ensure compensation is properly aligned with responsibilities.

Staffing recommendations: Agencies should evaluate current scientific and vessel-dedicated staffing levels at their Great Lakes stations and prepare staffing plans to ensure that current and future levels are adequate to maintain important long-term databases and explore new programs as needs arise.

Agencies, with support from the GLFC, should initiate training programs that would involve using existing vessel personnel and/or commercial fishers with Great Lakes navigation and fishing-related skills to teach these skills to non-experienced vessel personnel to insure that this pool of knowledge does not run dry.

Large-vessel crew personnel in tiers 1-3 should be vessel dedicated with official vessel-dedicated job title classifications and position descriptions (Boat Captain, Assistant Boat Captain, Mate, Engineer, Seaman, Boat Technician, etc.). Appropriate job titles and position descriptions may convince administrators of the responsibilities of these positions and provide justification for higher pay levels. Employing part-time tier 1-2 personnel (captain, assistant captain, mate or engineer) for only the vessel-operating season should be avoided.

Large vessels should be staffed with at least one person besides the captain who is licensed or otherwise qualified to serve as the vessel operator in the absence of the captain. Tier 4 (seasonal inexperienced non-dedicated employees, students, volunteers, etc.) should not be used to take the place of tier 2 and 3 personnel.

Pay levels for vessel-dedicated tiers 1-3 personnel, especially boat captains, should be commensurate with their responsibility and the hazardous environment of the Great Lakes. Boat captains are usually first-line supervisors and are responsible for the lives of the crew and others onboard their vessel as well as the vessel itself. Other dedicated crewmembers are often in charge of deck operations and share responsibility with the captain. Although some agencies cannot compete salary-wise with other agencies, within-agency salaries for vessel positions should be higher than comparable land-based positions.

C. Safety training issues: Aside from regularly scheduled CPR and First-Aid training, there is little else that agencies require. Several captains indicated that their agencies could do more. They would like to see "situation based" training on a whole host of vessel operation issues. They also suggest that training should be extended to everyone who works on the boats, not just captains and engineers. Many captains expressed concern with "walk-ons", who come aboard with little or no experience or training. They see greatly increased risks of accident or injury with them, particularly in poor weather conditions. They also see this risk increasing with the future trend toward doing more collaborative work with universities and other outside groups resulting in greater numbers of inexperienced personnel onboard. Standardized firefighting training is another need for fisheries vessels in the Great Lakes. Some vessel crews received some firefighting training from local fire departments such as how to use fire extinguishers, but many crews received no professional training at all and rarely was the training situation based.

Safety training recommendations: Safety training protocols, including firefighting, should be developed for all SGLFMP-agency large and small Great Lakes vessels. This would involve extensive training of dedicated members of the crew and an introductory program for temporary employees, students, and other non-dedicated personnel onboard. Developing the protocols and providing some training would seem to be an excellent agenda item for coordination workshops, e.g., GLFC or Science Vessel Workshops.

D. Program support issues: Two factors seem to work together to foster complacency in Great Lakes fisheries programming. First, much of the large-vessel resources are now targeted for maintenance of long-term data series, and tight fiscal management provides few funds for new work. In addition to staff cuts, program managers see more of their time being directed away from traditional biology, which they value, and more toward administration and grant writing, which they value less. Some field station staff also look longingly to the past as a period of "better times." It should not be unexpected that tight budgets, staff reductions, and lost operating funds not only limit field station productive capacity, but also affect morale and staff attitudes. There were more than a few comments that indicated, "We are operating on the edge." This environment may be stifling creative thinking, enthusiasm and program growth.

Most state agencies are not enthusiastic about doing contract work, e.g., renting their boat and crew in exchange for dollars. There are three reasons for the lack of interest: 1) the states generally provide adequate funds to operate their boats, 2) they are limited in staff to support contract operations and 3) any money that may be earned does not get back to their program. Hence, there is little incentive to solicit and schedule work for outside agencies. OMNR provides good support for core program, but requires any other work beyond core assessment activities to be funded with outside dollars. The USGS is more dependent on contract work, using some of the dollars to support their long-term assessment programs. Although there is some discretion in selecting compatible contract activities, soliciting outside funding in a difficult fiscal environment may potentially alter the large-vessel programs. This could result in a substantial proportion of a station's vessel program being dictated by what funds are currently available in the marketplace, rather than what is programmatically appropriate (soft-money effect). This could be exacerbated even more if field stations are required to seek outside funding to support their long-term, core programs. There is a growing frustration with scientists that oversee long-term data sets with the "new environment" where they are expected to find customers to support their work. The "new environment" is one in which hard money (budgetary appropriation) supports staff and hard assets, but where operating funds are generated from soft money (grants and contracts). Unfortunately, it is very difficult for Great Lakes fishery biologists in some agencies to find support for research that comes from long-term data sets; consequently, their funding is erratic and in some instances they may not have sufficient funds to conduct surveys. There is also concern among some station administrators, in particular, that they are spending an inordinate amount of time chasing money and less time on biology. Some agencies need a better understanding that long-term monitoring programs require adequate, long-term funding sources, too.

Program support recommendations: Agency personnel responsible for vessel operations from the boat captain on up should work together to ensure stable funding (hard money) for core programs on the Great Lakes. This might be accomplished by taking steps to educate budgetary administrators and appropriate state or federal legislators as to the importance and expense of maintaining a Great Lakes large-vessel program. This education process would likely involve highlighting the links between large vessel operations and lake wide assessment plans, fish community objectives, and state-of-the-lake reports, and long-term pro-active budget.

E. Maintenance issues: Older boats require more attention and preventive maintenance in order to be operated effectively. Old engines and other equipment are more time-consuming and expensive to repair because the repair parts are difficult to find or must be fabricated. Yet, most program people admit that it is next to impossible to convince central office budget staffs that it makes sense to fix things before they break. Fiscal administrators are much more responsive to a phone call indicating that a research vessel has broken down and was towed into some port far from home. In these situations, nearly all field station staff said their agency finds the money for the needed repairs. But, unforeseen breakdowns during the field season result in lost survey time and they cost more. Shipyard repair costs are higher because yards have usually scheduled their work for the summer season, and agencies generally want their boat fixed ASAP – this costs more money. Fixing problems during the winter season before they occur will usually be cheaper and there will be more time to do the repair correctly. Further, there is not a loss of program time, which is especially important with our limited field seasons. Finally, there is the issue of safety. The maintenance approach that waits until a vessel breaks down is increasing the chance that vessels could be incapacitated offshore, and this situation could have serious consequences for the health and safety of vessel crews. "Fix-it-when-its-broke" is bad vessel management policy and more efforts should be directed toward better preventive maintenance programs.

One captain made a revealing admission, that perhaps "we (captains) aren't the best people to gauge how the vessels should be maintained." He indicated he had to rely too much on people from shipyards and other supposed experts, and found such variation in their opinions that he questions this whole approach. His admission probably describes other circumstances, too, where captains and crewmembers may not be the best suited for determining vessel maintenance needs. This supports the view that fisheries research vessels should have periodic, comprehensive inspections of the hull and all the ship systems by qualified inspectors. Such inspections could provide an excellent foundation with which to gauge the maintenance needs for each vessel.

Everyone should be alerted to situations where a vessel due for replacing may not be properly maintained. Some field and administrative personnel may not want to maintain their boat in tip-top condition because they believe it might jeopardize their prospects of having it replaced (new-boat trap). Or, they may be reluctant to spend money on a boat that is soon to be replaced because it will only benefit the next owner. Not doing the best to maintain these vessels could result in circumstances that affect the health and safety of the crews that use them that otherwise could have been averted with a properly maintained vessel.

One of the problems facing the captains is the vague pressure to "go along" and not disrupt program activities by taking a firm stand on issues that may affect safe vessel operation. Many of the field stations have had to deal with the loss of staff and funding associated with their agency's cost cutting activities. Most field stations have relatively small staffs with a strong esprit de corps that are trying to maintain program in the face of these cuts. In this environment, some captains are very hesitant to make any demands for safe vessel operation that may be impossible to fund. For big repair or maintenance issues this is not problematical, but for little things they see incremental compromises making the boats less safe than they would like.

Maintenance recommendations: In order to gain support for preventive maintenance programs, vessel program administrators and captains should focus on safety aspects of preventive maintenance. Fiscal office personnel should understand that waiting for something to break before authorizing a repair could result in unsafe and dangerous situations for vessels and crews. The advantages of preventive maintenance programs related to less costly, off-season repairs and less disruptions to survey schedules should be secondary considerations behind crew and vessel safety. Educating those administrative personnel that control the maintenance purse strings will be facilitated by a coordinated, consistent refrain that preventive maintenance is a safety issue first.

Boat captains and agency administrators should develop long-term prioritized maintenance plans for their vessels. These plans should be based on the results of regular vessel inspections by a qualified marine surveyor, as well as problems identified by the captain and the crew. Maintenance should be prioritized on the basis of safety first and program second. Putting safety first should avoid the "new-boat trap" and facilitate securing financial support from agency administrators. In addition, captains have a responsibility to notify their station leaders when they feel they are getting near the edge of operating safely, and conversely, program administrators should actively engage their captains to discuss their "gut feelings" about boat maintenance, staffing, schedules and other issues that may have a bearing on safety. Open communication is an important component of a well-run, large vessel program operating on the Great Lakes.

F. Retrofit and replacement issues: There were many complaints about the lack of suitable shipyard services to take care of fishery vessels on the Great Lakes. This is undoubtedly linked to the decline in the number of commercial fishing vessels in the Great Lakes and conversion of many shipyards to servicing fiberglass and aluminum recreational boats. Not only are many of the yards lacking in skilled workers, but also many agencies feel they are being overcharged because of a lack of competition. This has been somewhat less of a problem for the USGS, because they maintain a fleet of five vessels, and therefore, can have more leverage in the marketplace. Other agencies may be able to improve their purchasing power too, by collectively directing their shipyard needs to a small number of yards that meet certain service criteria they established collectively. This might be an approach that could be examined by the captains through the Science Vessel Workshops.

In a previous section we outlined a suggested protocol for vessel replacement. One issue in the vessel replacement process was important enough that it should be highlighted here as well –input from vessel crews. This may seem like a point that is so obvious it should not have to be stated, but there have been recent experiences where vessel and field station staff opinions were either not solicited or they were lost among the many opinions of administrators, budget staff and other "vessel experts." What is even more disturbing is the thought held by some program administrators that "those people are too provincial and can't see the big picture."

Many of the vessels we observed had no watertight compartments within their hulls. If there were a breech of hull integrity, the crew would have to rely on bilge pumps to remove water. The idea behind having at least three watertight compartments is that if one section were flooded, the other two would provide enough

buoyancy to keep the vessel afloat. In addition, a separate, watertight compartment for the engine room facilitates any fire fighting that may be required. By localizing the fire to an engine room, the engine room hatch and air vents can be closed, thereby starving the fire of oxygen. Compare this approach to that of the captain going down into a smoke filled bilge with a fire extinguisher in hand. Again, this issue could be addressed within the context of establishing inspection and retrofit or replacement standards for fisheries vessels operating in the Great Lakes.

Retrofit and replacement recommendations: Establish an interagency committee through the Great Lakes Fishery Commission or via the Vessel Coordination Workshop to evaluate shipyards on the Great Lakes, East Coast, and Gulf Coast. This committee would prepare a shipyard database that would include location, capabilities, and recent reputation. The committee could explore interagency group contracting to secure reduced costs for group members.

Agencies considering a vessel replacement or major retrofit should include establishing at least three watertight compartments in their vessel with one of them being the engine compartment.

G. Coordination and Planning issues: As we suggested in the Coordinated Management Section, most of the vessel program staff operating within the Great Lakes today believe that new, future program needs will be best satisfied by working more cooperatively and collaboratively with other agencies. Agencies with minimal cooperative, interagency vessel programs should recognize the value of cooperative assessment, particularly in a limited fiscal environment. Programs that are tilted toward maintaining long-term data series (nearly all the vessel programs) require stable, reliable support, i.e. crews, vessels and maintenance and operating funding. The principal value of cooperative vessel programs is long-term stability. Agencies with big cooperative programs, such as NYSDEC and USGS operating in Lake Ontario, report firmer support by their agencies to these cooperative surveys, and improved reliability by virtue of two vessels-- if one has a mechanical failure the other can finish the survey. Furthermore, there are other improvements in efficiencies that can come from sharing gear, sharing staff talents, and partitioning the analytical workload.

Planning is an essential component of any Great Lakes program operation. Interagency planning through the GLFC's various lake and technical committees has done much to resolve differences, reach agreement on data needs for fish community assessment, and coordinate assessment efforts by individual agencies in the collection of fish community data, especially those data needed to maintain the long-term databases that have been proven necessary in management of important fish stocks. Although results of lake-wide assessments in all lakes has been presented in agency reports, annual reports to the GLFC, and state-of-the-lake reports; the documentation of the agreed-upon methodology for these assessments remains largely scattered in these reports and minutes of lake and technical committee meetings for all lakes except Lake Michigan. Members of the Lake Michigan Committee and Lake Michigan Technical Committee have documented lake-wide interagency assessment methodology in an unpublished report entitled "Lake wide Assessment Plan for Lake Michigan Fish Communities". Documents such as the Lake Michigan assessment plan are an important planning tool in developing and maintaining a vessel program on the Great Lakes.

Coordinated fish community assessment in the Great Lakes, in most cases, requires the use of large fisheries research vessels. The importance of these vessels should be stressed and documented in all lake or technical committee assessment planning and plans. This would provide interagency peer pressure, which could be used by the agencies to help justify their large-vessel programs. Although methodology and results of lake-wide assessments and special projects on all lakes are presented in the reports mentioned above, rarely is there mention of the large-vessel program required to do the job.

Planning recommendations: Agencies should examine their current vessel program in the context of their lake committee and see what surveys could be accomplished cooperatively. If there are doubts about the value that can be added to their programs by instituting cooperative surveys, they should contact agencies that have had a long, effective cooperative tradition. If there is sufficient interest to work cooperatively, lake committees should then consider preparation of a lake-wide assessment plan similar to the one developed for Lake Michigan to document interagency assessment methodology and provide a source of interagency support for maintaining a large-vessel

program by individual agencies. These assessment plans, including a revision of the Lake Michigan plan, should contain a section detailing large-vessel needs for the lake-wide assessment.

Lake committees should use the assessment plan for their lake and our vessel report to explore and develop interagency vessel management recommendations, including vessel sharing and cooperative assessment. In addition to tailoring vessel management for individual lakes, this effort would provide another source of peer pressure and support for maintenance of individual agency large-vessel programs.

10. APPENDIX A -Vessel Program Summaries

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VESSEL PROGRAM SUMMARY

NAME: **SETH GREEN**
OPERATOR: New York State Department of Environmental Conservation (NYSDEC)
LOCATION: Lake Ontario
HOME PORT: Cape Vincent, New York
CAPTAIN: Eric Muise
LAB DIRECTOR: Steve LaPan

VESSEL DESCRIPTION: The SETH GREEN is a 46x18x9 ft., 50 ton steel fisheries research vessel designed by the Napier Co., Arbroath, Scotland. It was built in Newport, RI in 1984 and delivered in 1985. The SETH GREEN is propelled by a single Caterpillar 3306 and is fitted with a 30kW Northern Lights generator, 2 main winches (1,800 ft., 3/8" cable), a limnological winch (300 ft., 3/16" cable), an anchor winch (400 ft., 5/8" cable), a Crossley 24 in. gill net hauler, and a net drum (6 ft. x 4 ft.). Available spaces (sq. ft.) include: deck 360, wet lab/enclosed deck 216, hold 360, galley/crew quarters 150, and wheelhouse 80.

VESSEL OPERATION & MAINTENANCE COSTS: From 1998 to 2000, the SETH GREEN averaged 59 operating days per year. All of the operating days were used for fisheries surveys. The distribution of gear used during these surveys was roughly 50 percent trawling and 25 percent each for gillnetting and acoustics. During the last three field seasons, the SETH GREEN averaged 383 service hours[3] per year on the main engine, or 6.5 hrs. per day. Total fuel use for the SETH GREEN was 2,482, 2,650 and 4,383 gallons for 1998-2000 field seasons. Fuel use in 2000 was 71% greater than the 1998-99 average, principally because the main engine was run at higher speeds (2,000 rpm) during transit than in previous years (1,800 rpm). Fuel costs averaged $1,779 in 1998-99, but increased substantially in 2000 to $5,742, due to increases in fuel cost as well as usage. Using 1998-99 fuel use and 2000 fuel prices results in an average use of 2,537 gallons and a cost of $3,323, assuming a 59-day average vessel season.

Maintenance and repair costs were $3,009, $3,506 and $9,078 for 1998-00, respectively. In 2000, a special electrical system repair was included at a cost of $4,960. A haul-out was also completed in 2000 that included hull cleaning, painting, and some hull and mechanical work for $8,884. The previous haul-out was in 1997, although haul-outs for the SETH GREEN have usually been on a two-year cycle. New equipment purchased and installed during the last three years included: radar ($6,821), isolation transformer ($1,032), global positioning system ($446), and a freezer ($204). Total annual cost for fuel, maintenance, haul-out (prorated), and new equipment was $14,316. These operational costs averaged $243 per operating day, assuming a 59 operating day average for 1998-00.

Normal operation of the SETH GREEN includes a 2-person vessel crew, a captain and maintenance assistant, and a survey biologist. On three cruises an additional technician assisted the biologist and crew. During each cruise, the maintenance assistant runs the deck machinery, and also does the entire data recording for the biologist.

The last captain of the SETH GREEN had 21 years total vessel experience and had a 200-ton Master's license, but completed less than 2 seasons with NYSDEC. The starting, 10-year and top salaries for a NYSDEC captain are $32,076, $39,111 and $39,860, respectively. From 1998-00, SETH GREEN's captain averaged 112.5 hrs. overtime and earned another $2,642 in overtime pay. For the maintenance assistant, the base, 10-year and top

[3] Service hours are related to how hard the engine works. It does not accurately reflect actual time spent on surveys, but is a minimal estimate of actual time.

salaries are $24,037, $29,714 and $30,464, respectively. The maintenance assistant averaged an additional 145 hrs overtime/year from 1998-00 earning another $3,350 per year. The discrepancy between captain and maintenance assistant earned overtime was due to a half year in 1998 when the SETH GREEN was without a permanent captain. Travel expenses for each of the vessel crew averaged $1,280 per year. A simulation of the total vessel crew operating expense, assuming 10 years of service for captain and maintenance assistant, is $68,825 or $264 per day for a 260-day work year. Assuming a 59-day vessel season, staff costs would total $15,618. Combining operating, maintenance and crew expenses yields a total expense of $29,934 or $507 per operating day.

SAFETY: A stability test (inclining experiment) of the SETH GREEN was completed at the time of commissioning in 1985. Since then, ballast was added to the fish hold and the deck was reconfigured with a gantry and outriggers. The Napier Co. completed another inclining experiment in 1993. The results indicated that vessel stability was within safe limits. For fire fighting, the SETH GREEN is outfitted with a Haylon system in the engine room, two-1 ½ in. fire pumps (one remotely operated), and various alarms. There was no portable pump for fire fighting or de-watering, no fireman's outfits (SCBA), no emergency escape breathing devices and no USCG fire-fighting training for the crew. The SETH GREEN had a complete complement of approved PFDs with lights, life raft, EPIRBS and survival suits.

SURVEYS, INSPECTIONS and FITNESS: The SETH GREEN has had a few courtesy inspections at irregular intervals by the USCG auxiliary for compliance with the 1971 Boating Safety Act. An un-inspected vessel examination was done in the late 1980s by USCG Marine Inspection Office. A marine surveyor completed a detailed hull examination in 2000 and found several areas pitted by electrolysis. Steel plates were repaired during haul-out and the boat fitted with an isolation transformer to prevent further deterioration. In addition, the electrical system was repaired and upgraded. The hull is now considered to be in excellent shape. The main and auxiliary engines have 9,503 and 17,800 hrs, respectively, and have not yet had their first overhauls. NYSDEC has provided good support to maintain the SETH GREEN. The crew has utilized a preventive maintenance approach, i.e., keeping spares on board and replacing components if there is any indication of possible failure. Consequently, few survey days have been lost to mechanical failures.

Lake Ontario Unit staff felt their vessel program is affected as much by vessel crew staffing issues as vessel fitness itself. Within the last three years the SETH GREEN has had three captains and the position has recently been filled. The pool of talent NYSDEC has sought for the captain position has been the coastal commercial fishing industry. These fishermen have the fishing gear construction, maintenance and vessel operation skills that are compatible with requirements for operating the SETH GREEN. In the last two position canvasses few individuals indicated an interest in taking the job. Unit staff believes the transition from being self-employed to a government position is difficult, but more importantly, salary and benefits should be improved to attract and retain quality candidates.

PROGRAM DESCRIPTION: The current biological program undertaken by NYSDEC on Lake Ontario is scheduled for 78 operating days. Nearly all (95 percent) of this effort is directed toward maintaining long-term fisheries databases. Continuing to update these databases has resulted in a relatively stable program – 2/3 of surveys undertaken in 2000 were part of the 1980 program. Individual cruises usually take 7-10 days. Bottom trawling cruises are directed toward assessing alewives (10 days), smelt (10 days), yellow perch (4 days), salmonid survival (4 days) and juvenile lake trout (10days). Gill net surveys for larger predators are used to assess the adult lake trout population (10 days) and the warm-water fish community of the Eastern Basin (10 days). Two lake wide hydroacoustic/midwater trawl cruises were also scheduled for summer and fall (10 days each). These surveys, as well as other lake wide cruises, incorporated some limnological sampling into their designs. Most of these surveys (60 days, 77 percent) are done in cooperation with either the Ontario Ministry of Natural Resources (hydroacoustic surveys) or with the United States Geological Survey, Oswego Biological Station (alewife, smelt, juvenile lake trout, and adult lake trout).

Generally, a 100-110 day program schedule represents an ambitious and busy vessel season within the Great Lakes. In the mid-1980s, the SETH GREEN had a number of 100+ vessel day seasons. More recently, 60-day seasons are more the norm. The lack of fuller utilization of the SETH GREEN is more related to limits

imposed by scientific staffing than by vessel capabilities and capacity. NYSDEC has two biologists – one has fulltime responsibilities aboard the SETH GREEN and the other biologist allocates approximately ¼ of his time (the other ¾ is spent directing a creel census). NYSDEC biologists feel there is not sufficient time to institute short-term studies or experiments. Furthermore, two long-term programs that staff would like to see added to current activities would be a population index of stocked piscivores and a more detailed assessment of lower trophic system dynamics. The Lake Ontario vessel program has room for future expansion, but any expansion will be tied to additional scientific staffing.

FUTURE PROGRAM: Although NYSDEC's Lake Ontario vessel program has room for expansion, both the scientific staff and vessel crew believe it will be relatively unchanged by the year 2020. Their forecast is affected by two factors. First, their program is almost entirely directed toward updating long-term data series of major components of the open water fish community. These databases represent more than 20 years of collection and they have provided fish managers with valuable insights and understanding. Staff felt very strongly that future programs should be directed toward maintaining these data sets. The second factor that suggests the Lake Ontario program will change little in 20 years is the prospect for future staffing additions. Cape Vincent staff concurred that prospects for new staff additions were poor, hence future vessel program expansion is not likely. Moreover, staff does not see future technological improvements that will make scientific staff more productive. In summary, the Lake Ontario program is unlikely to expand or change greatly in the future, and vessel utilization will probably remain unchanged as well. The biggest potential gains in efficiency, however, could come from expansion of cooperative arrangements within NYSDEC's other divisions, with other resource agencies and by developing better working relations with academic institutions.

Both the scientific staff and vessel crew were agreeable to future expansion of contract work with two provisos. One, that contract work should not alter or affect the completion of in-house surveys, and two, some provision should be made to facilitate the acceptance of outside funds. Currently NYSDEC does not have an easy system for accepting contract dollars from outside sources. Furthermore, any monies earned could not be ear marked for the Lake Ontario program. If funds could be paid directly to the Lake Ontario program, it would provide some incentive for unit staff to actively seek additional outside work, coalitions or other funding sources. Staff suggested that the GLFC, in their coordinating role, might be able to help improve the flow of funds between resource agencies and outside funding sources.

VESSEL SUITABILITY: Both vessel crew and scientific personnel agree the SETH GREEN meets current program needs. Positive characteristics of the SETH GREEN include: a strong, safe hull; excellent deck space for its size; a protected, comfortable deck enclosure (wet lab); and relatively inexpensive operating costs. Negatives include: slow speed and extremely tight crew quarters. On balance, the SETH GREEN has proved to be an excellent fisheries survey vessel and should provide adequate service for the next 20 years. Program managers should recognize, however, that engine overhauls will be needed and continued repairs for aging components will be required to maintain vessel fitness.

VESSEL PROGRAM SUMMARY

NAME: **NAMAYCUSH and STEELCRAFT**
OPERATOR: Ontario Ministry of Natural Resources (OMNR)
LOCATION: Lake Ontario
HOME PORT: Glenora, Ontario
CAPTAIN: Chuck Wood
OPERATIONS MANAGER: Dawn Walsh
LAB DIRECTORS: Tom Stewart (Assessment) and John Casselman (Research)

VESSEL DESCRIPTION: The Glenora Fisheries Station uses a small fleet of fisheries vessels to carry out a field program on the eastern end of Lake Ontario. Several small (20-25 ft.) outboard powered boats are used for near shore netting (<100 ft.) and three larger steel vessels are used for deeper sampling. Two steel vessels are diesel powered and have gillnetting and trawling capabilities, however, their operations are limited to the eastern basin and the Bay of Quinte. The third steel boat is used for stocking. These boats, however, are considered too small to be safely operated for any extended, open lake surveys of Lake Ontario.

The NAMAYCUSH (background of photo) is a 49 x 12 x 4.5 ft., 28 ton steel fisheries research vessel designed and built by Matheson Shipyard Ltd. It was purchased as a new boat in 1954 and was repowered with a single Detroit 6V-71 diesel engine (180 hp.) in 1989. Since then, 1,200 hours have been accumulated on the main engine. Other equipment includes an Onan 20 kW generator, a Crossley 24 in. gillnet lifter, two Carron main winches (~450 ft. of 5/16 in. cable), a half-ton capacity crane and a net drum. Navigational aids include: Comnav 2001 autopilot, Furuno FR240 radar, Furuno GP-36 GPS, Furuno LC-90 Loran-C, Furuno FE 606 and FCV 552 color sounders, and a Standard Horizon marine radio. There is 120 sq. ft. of open deck space on the aft deck and 48 sq. ft. of covered wet lab space just forward of the aft deck. The NAMAYCUSH is used principally for index trawling and gillnetting in the Bay of Quinte.

The STEELCRAFT was acquired by OMNR in 1984 in a buyout of a Lake Huron fisherman. It measures 45 x 12 x 5 ft. and displaces 23 tons, and was designed and built by Steelcraft Shipyard Ltd. in 1945. Like the NAMAYCUSH, it is also powered by a Detroit Diesel 6V-71. The main engine was rebuilt in 1984 as part of a refit completed just prior to delivery to the Glenora Fisheries Station. Other equipment is also identical to that aboard the NAMAYCUSH: Onan 20 kW generator, Crossley 24 in. lifter, two Carron main winches (~1,000 ft. of 5/16 in. cable), and a net drum. Wheelhouse electronics include a Comnav 2001 autopilot, Furuno 1931 radar, Furuno GP-36 GPS, Furuno LC-90 Loran C, Furuno FCV 662 and Furuno FE 400 sounders, and an Apelco marine radio. In addition to the nearly identical outfitting of both boats, there is roughly the same open deck and covered deck space on the STEELCRAFT. The STEELCRAFT is used primarily for index trawling and deep water gillnetting in the eastern basin of Lake Ontario.

In addition to these two fisheries research vessels, the Glenora Station also operates the DOROTHY J, which was acquired by OMNR in 1986 in a buyout of a Lake Ontario fisherman. It measures 40 x 13 x 3.5 ft. and displaces 15 tons, and was designed and built by Ralph Hurley at Port Burwell, Ontario in 1976. This fully enclosed gillnet tug is powered by a Perkins 6.354 diesel engine (120HP) and is equipped with a 30 inch Crossley gillnet lifter. The electronics include Wood-Freeman auto pilot, Furuno FR 240 radar, Furuno FMV-605 sounder, Furuno GP-500 GPS, Furuno LC-90 loran-C, Apelco VHF radio. In the past, the DOROTHY J was used as a gillnetter, but recently has been used solely for stocking lake trout during April and May (15 days). Due to the limited use of the DOROTHY J, the following discussion of operation and maintenance expenses will focus on the operation of the NAMAYCUSH and the STEELCRAFT.

VESSEL OPERATION and MAINTENANCE: Not only are both vessels similarly equipped, but their use is nearly identical as well. From 1998 through 2000 field seasons, the NAMAYCUSH and STEELCRAFT averaged 25 and 28 operational days per season and accumulated 99 and 111 hours on their main engines, respectively. The average fuel consumption was 349 and 375 gallons per season for the NAMAYCUSH and STEELCRAFT, respectively. Both boats used about 3.5 gallons of fuel per hour of operation. Seasonal fuel costs for each boat averaged approximately $335 (US)[4].

The captain and crew do all of the routine maintenance (e.g., oil changes, fuel filter and belt replacements etc.) on both vessels. The captain decides what needs to be done to maintain the vessels. More extensive repairs are done by the equipment manufacturer's technicians or in the shipyard. The engine manufacturer's factory mechanic does all the mechanical work on the main engine other than routine maintenance. In the event of a major mechanical problem with either the NAMAYCUSH or the STEELCRAFT, there is no lost program time because both vessels are virtually interchangeable. Recently, there have been no major breakdowns for any of the boats. If there were, there is good local access to shipyard facilities and skilled labor. In the past, OMNR has provided good support for maintenance and operational expenses for Glenora's vessel program.

Maintenance costs for the two vessels were approximated using budget allocations for the last three seasons. For routine maintenance $100 was allotted for each vessel each year. Each vessel is hauled every winter, and prior to the new season, the bottom is cleaned and painted. The cost for each winter haul-out is $1,155 per vessel. The cost of annual inspections of the inflatable life rafts was $782 for each vessel. New equipment installed on both boats in the last three years included new radar for $2,500, two new GPSs for $1,500 each, new trawl cable for $1,400 and a new radio for $350. These costs were annualized and added to the annual maintenance costs for a total annual maintenance expense of $3,245 per vessel. Adding these expenses to the cost of fuel yields an annual operating expense of $3,580 or $133 per day, assuming an average 27-day operating season. Operational costs for both vessels would be $7,160 per 54-day operational season.

SAFETY, SURVEYS and INSPECTIONS: Both vessels had inclining experiments completed in 1990 by Stephen Leake, marine architect for German and Milne Ltd., Ottawa, Ontario. The architects recommended adding ballast to the NAMAYCUSH to correct some stability problems, and ballast was also added to the STEELCRAFT by Glenora staff. Although the handling characteristics of both boats improved, concerns with stability are one of the reasons these two vessels are not used routinely in the open waters of Lake Ontario. Both vessels have a similar complement of safety gear: 6-person inflatable life rafts, six survival suits, 6 PFDs and six work vests. Each vessel has two, ten-pound portable extinguishers, but there are no engine room extinguishing systems, e.g., Halon or CO2. There are no alarms, smoke detectors, or fireman outfits. Each vessel has a belt driven fire pump. OMNR requires all its new employees to take Marine Emergency Duties (MED 1-A) training, which covers worker safety afloat, including fire fighter training. There is also an orientation day for new workers and a requirement that all small boat operators have a pleasure boat operator's certificate. In addition, CPR training is updated annually and First-Aid training is renewed every three years.

Annual haul-outs allow the captain to visually inspect each hull at the end of each season of operation. In addition, the Canadian Coast Guard (CCG) requires an inspection of the NAMAYCUSH every four years, but not the STEELCRAFT. The STEELCRAFT comes under the registered tonnage requirement for inspected vessels. The CCG inspection of the NAMAYCUSH considers hull integrity, lifesaving gear and navigational lighting. Inspections of the mechanical, electrical, plumbing and hydraulic systems are not required. Plating wastage was estimated by locating an area of greatest pitting, drilling a hole through the center of the pit, measuring the amount of steel and then putting a bolt through the hole and welding it. CCG inspections also call for removing both the drive shaft and rudders to assess bearing integrity and potential leakage.

VESSEL STAFFING: There is no crew specifically assigned to either the NAMAYCUSH or the STEELCRAFT.

[4] All subsequent cost figures are expressed as US dollars by assuming $1 US buys $1.43 Canadian. Cost of fuel was based on $0.44 per liter.

There is a single, permanent vessel captain, however, who is responsible for the maintenance and operation of both of these vessels. Currently the captain spends 75 percent of his time on vessel support and the remaining time on other activities related to the overall fisheries program. During the field season, Glenora Station also hires a seasonal captain to help with vessel operations. The normal crew complement is usually five persons for each vessel and includes the captain, a permanent technician (who has had MEDI training), and three seasonal technicians or students. This approach to vessel staffing by OMNR has changed from 20-25 years ago when there were smaller, permanent crews that operated and maintained the vessels.

Qualifications for the captain requires a master's license, MED 1-A training and some fishing experience. The current captain was recruited internally from the resource technician series[5], but any future captains will likely come from outside the agency and local area. The starting and final salary for an OMNR vessel captain is $28,428 and $32,782, respectively. This range includes two Resource Technician grades (Senior 1 & 2) with three steps in each grade level. There is no provision for overtime compensation to captains; neither time-and-half pay nor compensatory time off. In addition, there is no career ladder for Ontario's vessel captains; i.e., the difference between start and final salaries is small. The fish technicians that make up the remainder of the crew have starting and final salaries of $24,723 to $27,620. In contrast to the captain, fish technicians who work on the vessels can accrue time-and-half compensatory time off. Since the vessels are only operating on a day-trip status, overtime and travel costs are generally minimal.

A simulation of the NAMAYCUSH or STEELCRAFT vessel crew operating expense was calculated assuming a two-person crew, with an average annual salary for the captain of $30,605 and an annual average salary for a technician of $26,172. This combined crew salary is $56,777, or $218 per day for a 260-day work year. Assuming a 27-day operating season for the vessels, staff operating costs would be $5,886 for operating either the NAMAYCUSH or the STEELCRAFT. Combining operating, maintenance and staff costs yields a total operating expense of $9,466 or $350 per operating day (27-day season) for either boat.

PROGRAM DESCRIPTION: Glenora Station's current vessel program for the NAMAYCUSH and the STEELCRAFT is confined to an eleven-week period from the end of June to mid-September. Normally, this entails about 27 days for each vessel, or about a 50-60 day program for both. The vessel program represents approximately 25-30 percent of Glenora's overall field program. Other activities include commercial catch sampling, eel ladder monitoring, walleye tagging study, egg collections, creel surveys, Ganaraska rainbow trout studies, hydroacoustic prey fish assessment, as well as near shore sampling activities and stream electroshocking sampling. Outboard powered work skiffs are used for all the near shore sampling (<100 ft.) excepting trawling. The NAMAYCUSH and STEELCRAFT are used to collect fish from deeper water, and to do all the bottom trawling, regardless of depth.

The Community Indexing Program is the core monitoring and assessment activity undertaken by the Glenora Fisheries Station. Begun in the late-50s, this program was designed to sample a broad array of species using graded mesh gillnets and trawls at several index sites within the eastern basin of Lake Ontario and the Bay of Quinte. Sampling sites and sampling protocols have been modified over the years, but currently the approach is to fish three days per week from late-June to August, and then fish four days per week until mid-September. Compared to the original sample design, now there is greater diversification – wider area covered, more near shore sites visited and less attention to few, deeper stations. Other than few days spent on stocking, approximately 95 percent of the vessel operating time is allotted to fisheries work, and there is very little habitat work and limnological sampling.

One of the principal deficiencies with Glenora's current Lake Ontario program is lack of open lake sampling; described by one Glenora staffer as a "vast vacuum for the offshore." Nearly all of the current vessel effort is focused on the Bay of Quinte and the eastern basin of Lake Ontario. Little attention and effort is directed to the open lake because Glenora does not have a suitable vessel for safe operation in offshore waters. Size and stability are the major issues that limit the use of the NAMAYCUSH and the STEELCRAFT. However, with

[5] The current captain also completed necessary course work and testing for his boat operator's license.

additional people and dollar support more could have been done offshore, up to a point[6]. Currently OMNR is working with NYSDEC in a cooperative prey fish assessment program using hydroacoustic and midwater trawl gear. In the past, OMNR has also collaborated with USGS – Oswego in open lake sampling aboard the KAHO. This was done to help mitigate Glenora's inability to collect information from the open waters of Lake Ontario.

The approach that the Glenora Station has taken toward implementing their field program is to cover a relatively restricted geographic area, e.g., eastern Lake Ontario, and to use a number of workboats operating on a day-trip basis. There are no extended surveys that require living aboard the vessels and work is scheduled so that there is minimal overtime and travel costs. This operational scheme is very efficient, but staff caution that working harder to compensate for personnel and budget cuts may compromise effectiveness, e.g., people are pushed to the maximum, maintaining equipment is a lower priority etc. Again, there are no dedicated vessel crews, only a single, permanent captain who is responsible for the vessels. Most technical staff move from one activity to another, depending on what the needs are on any given day. Glenora's large vessel program now encompasses about 50-60 days per year, but could be greater in the future if they acquire a suitable offshore research vessel.

Most core activities are funded internally with OMNR funds; however, in some instances some core programming needed external funding. Beyond core program, external sources of funds are required. This affects the research to a greater degree than the assessment unit because the two units are funded and administered differently. In practice, nearly 50 percent of research is supported with outside funds, whereas grant dollars represent a small component of the assessment unit's budget. Increasingly however the assessment unit is relying more on grant dollars and partnerships to maintain and augment programs. There is no contract work done by either unit for the sole purpose of generating operating funds. But, there have been numerous collaborative studies when they serve the programmatic interests of the Glenora Station, as well as provide funding support for vessels and staff. Not unlike many of the other fisheries stations on the Great Lakes, the information collected by Glenora's vessels exceeds the analytical ability to process the information. Glenora has a strong archival program and they believe they should, as a normal function, collect far more information than they can analyze. In assessing OMNR's support of their current program, Glenora staff feel they receive adequate support to operate and maintain their vessels, but feel their capabilities are limited by staffing constraints.

FUTURE PROGRAM: The biggest concern for Glenora's fisheries program in 20-25 years is to expand their geographic horizon. Glenora staff believe they have done an excellent job with the eastern end of Lake Ontario, but that this gain in knowledge and understanding has come at the expense of ignoring the larger, offshore component of Lake Ontario. This imbalance is linked to an inadequate vessel(s) and staff know how important it is to have a new research vessel that will permit them to collect a wide array of biological information from anywhere within the lake system. Aside from offshore vessel needs, there are other issues that may demand additional effort with exotics, lake trout, Atlantic salmon, habitat, species at risk, salmon production in tributaries and better understanding of land-lake interfaces.

Not only is offshore vessel capability linked to the quality and content of Glenora's overall programming, but it will also affect the ability of research and assessment to attract additional funding. Without the ability to do offshore fisheries and limnological work, there may be limited interest by outside academics, partner agencies, and institutions in collaborating with Glenora's staff.. This also suggests there will have to a process for balancing short-term, grant supported research with core program activities that will be extended to the offshore area of Lake Ontario.

Future staff issues will likely affect what the Glenora Station can accomplish in the future. In the course of the last ten years Glenora's program has regressed, particularly in offshore activities. Cooperative lake trout and prey fish sampling programs with NYSDEC and UGSG were terminated in 1996 because of staff and funding cuts. These programs provided offshore coverage, but were more susceptible to budgetary cuts, when compared to long-

[6] With better funding a vessel could have been moved to an open lake port, staff could have been assigned to the base, travel and overtime support could have been provided, and work could have been completed during periods of good weather.

term sampling programs with 30-40 year databases. Broadening their geographic perspective of Lake Ontario will not only require a new research vessel, but it will also necessitate a dedicated technical crew for maintenance and operational support. The addition of a new boat without appropriate new staffing may force cuts in current program. Glenora staff want a future where they mend their geographic and programmatic deficiencies, but not at the expense of gutting existing programs they have supported for more than four decades. Glenora is guardedly optimistic that the next 20-25 years may bring improvements in staffing. There is the hope that staff cuts may have finally hit bottom, and the future has to be better.

VESSEL SUITABILITY and FITNESS: The NAMAYCUSH and STEELCRAFT are very similar vessels, they serve better as a backup than to complement one another's capabilities. Their strengths are they are well suited for near shore, protected water work, and they have easy access to shallow water harbors. On the negative side, both vessels are 50+ years old, they both are limited in their ability to operate safely in the open lake and their lack of crew accommodations limits their use as day-boats. However, OMNR seems to have a reasonable approach to operating the NAMAYCUSH and STEELCRAFT. OMNR refit both boats within the last 15 years, they provide ample operation and maintenance funds, they have established limits for operating the boats safely, and the CCG provides detailed inspections every four years. Regardless of how effective Glenora manages their vessels and their fisheries program, these boats do not meet their station's current or future needs – they do not provide a suitable tool(s) for operating in the offshore, open water environment of Lake Ontario.

Glenora staff have complained for years about poor vessel capability and their resultant restricted geographic perspective of Lake Ontario, but only recently have they begun the formal process of vessel replacement. There was a recent report submitted to OMNR's budget office outlining capital infrastructure needs within the Great Lakes. Included in the report were two observations: 1) that many of OMNR's fisheries vessels are ageing and are not meeting program needs, and 2) that replacing these boats will cost $500,000 or more. The report also emphasized that failure to address these infrastructure issues may haunt the ministry in years to come. If OMNR's budget office endorses these recommendations, then the next phase in the process will be to outline and prioritize specific vessels for replacement. The following stage in the process will include choosing an architect or marine consultant and beginning the design of a new vessel.

VESSEL PROGRAM SUMMARY

NAME: **KAHO**
OPERATOR: United States Geographic Service –Biological Resources Division
Great Lakes Science Center (GLSC)
LOCATION: Lake Ontario
HOME PORT: Oswego, New York
CAPTAIN: Ed Taber
STATION ADMINISTRATOR: Robert O'Gorman

VESSEL DESCRIPTION: The KAHO is a 65 x 18 x 9 ft., 83 ton steel fisheries research vessel designed by the University of Michigan, built by Hans Hansen of Toledo Ohio in 1961 and operated by the GLSC, Lake Ontario Biological Station (LOBS) in Oswego, NY. The KAHO was re-powered in 1987 with twin Cummins N-855 main diesels, and a Cummins 6B 30kW generator, a MYANMAR/KOHLER auxiliary generator, and Twin Disc reduction gears and the main engines have accumulated 9,200 operating hours since they were installed. Other equipment includes: split winches (2,000 ft., 3/8 in cable), twin-waterfall net drums, HIAB articulating hydraulic crane, limnological winch and a Bandolier gillnet lifter. Wheelhouse electronics include: Comnav 2001 autopilot (installed 2000), Raytheon R81X and R41X radars, Northstar 951X GPS, Raytheon 575 GPS, Simrad EY-M sounder, Raytheon 850 color sounder and three marine radios (ICOM, Horizon and Raytheon). Workspace areas (sq. ft.) are: aft work deck 400, galley 110, and bunk 150 (with separate provision for women and men).

VESSEL OPERATION and MAINTENANCE COSTS: The vessel program for the KAHO totaled 94, 83 and 80 operating days each year for the 1998-2000 season, averaging 86 days per year. Engine use during 1998-2000 averaged 566 hours per year, or 6.6 hours per operating day. All this sampling effort was expended on fishery surveys, with 73 and 27 percent of scheduled days directed at bottom trawling and gill netting, respectively. Total fuel use for the KAHO was 5,178, 4,492 and 3,950 gallons for the 1998-2000 field seasons. Average fuel use was 4,540 gallons per season and 8.0 gallons per hour. Seasonal fuel costs for the last three years averaged $4,512.

Maintenance and repair cost for the KAHO for the 1998-2000 seasons averaged $45,000 per year, which included the new equipment items noted below. Haul-outs are on a 5-year cycle; the last one was completed in 1999 at a cost of $6,500. New equipment and major maintenance purchase for the KAHO in the last three years included: 1998: automatic level wind installed on trawl winches; 2000: engine room fire suppression system refurbished and upgraded to current standards, hydraulic power system for deck equipment re-engineered and upgraded (all hydraulic lines, control valves, and hoses replaced, new hydraulic pump installed, emergency hydraulic pump installed), replaced hydraulic/electric steering system (new electric motor, hydraulic cylinders, hydraulic pump, hydraulic fluid reservoir and hydraulic lines), new autopilot, compass, and helm steering unit installed, emergency steering system replaced ($50,000 spent on hydraulic/steering upgrades), DC electrical distribution panel installed, fuel filtering system installed ($900), new weather instrument package ($2,500), and new marine radios ($800).

The engineer is responsible for maintaining all mechanical systems aboard the KAHO. He services the engines daily, replaces filters and belts when required and does some engine and mechanical system repair. Major engine and system refits, overhauls or replacements are done by factory mechanics or other trained professionals. Total annual cost for fuel, maintenance (haul-out cost annualized), and new equipment (annualized) was $50,812. This estimate was inflated by expensive repair and equipment replacement costs. Assuming an 86-day season average, the average daily operational cost was $591.

The GLSC runs the largest fleet of fisheries research vessels on the Great Lakes (I. e., five vessels). All maintenance and repair activities are coordinated and administered through the GLSC in Ann Arbor, Michigan. In

2000, the LOBS Chief was given responsibility for the KAHO's operational budget (i.e., fuel, crew overtime and per diem, dockage, and day to day operating costs).

In the recent past, mechanical breakdowns, and insufficient operating funds, and government shutdowns/travel restrictions at start of the fiscal year resulted in lost operating days and, in some instances, canceled surveys. Some of the lost time and program might have been averted with better funding for preventive maintenance and, in one instance, better contractor performance (e.g., the contractor performing preventative maintenance on the trawl winches did not reinstall the gears correctly, which resulted in their premature failure and lost operating days). It is usually more cost effective to repair equipment before it fails, and to do it in the winter when the vessel is normally not in operation. Although emergency repair funds usually have been quickly released when a major breakdown has occurred in the middle of a survey, the repair costs are usually greater during the field season, because shipyards or skilled personnel are busy during summer and can command premium pay for emergency repair work.

Station staff feel that they are still in a catch-up mode, trying to address all of the maintenance needs foregone during the budgetary squeeze in the final years with the USFWS and the initial years with NBS and USGS, and would like to see more resources allocated to preventive maintenance, although they note that vessel support of the KAHO is now improved to the point that it is "just enough" to meet minimum needs. The captain and engineer sense that the frequency of repairs has increased, suggesting that they will require additional funds to meet future maintenance and operational needs.

VESSEL STAFFING: Staffing for the KAHO during normal trawling operations is a captain, an engineer, a biologist and a bio-technician. During gill-net surveys, an additional biologist or technician is added to help with the more labor-intensive work. During vessel operations, the captain is responsible for the safety of crew and vessel and makes all the decisions regarding safe vessel operation. The LOBS Chief supervises the captain and engineer. The biologist-in-charge on the vessel ensures that the survey is completed properly and makes any needed adjustments to the cruise schedule.

The present captain has been on the KAHO since 1978, working first as its engineer and as captain for the last 5 years. Job requirements include a United States Coast Guard boat operator's certificate, the ability to handle and repair fishing gear, the ability to maintain various records and logs and the ability to communicate well. The salary range for a GLSC vessel captain is $49,473 to $57,815. Captains currently are compensated for overtime work with time-and-half pay. The engineer on the KAHO has been in the position for 2 years. Job requirements for the engineer include skill in the operation and maintenance of all the mechanical systems found on each vessel and in the operation and maintenance of fire fighting and safety equipment, and writing skills as needed to maintain various maintenance logs and equipment inventories. The salary range for the engineer is $38,771 to $45,271. Overtime compensation for both captain and engineer can add several thousand dollars to their salaries annually. Travel expense information was not available, but a per diem allowance is provided for meals during surveys. A simulation of the total vessel crew operating expense, assuming 10 years of service for captain and engineer, is $103,086 or $396 per day. Assuming an 86-day operating season, the staffing costs to run the KAHO would be $34,097, not including overtime compensation. Combining operating expenses and vessel crew salaries yields a total expense of $84,909 or $987 per operating day (86-day season), plus the per diem allowance for meals during field operations.

SAFETY, SURVEYS and INSPECTIONS: The KAHO's first comprehensive marine survey was completed in 1997 and included a detailed examination of the internal structure, watertight integrity, and hull plate condition. The surveyor recommended repairs or modifications to the steering, hydraulic, and engine room fire-fighting systems and all three systems have been replaced, although the entire list of recommended repairs and modifications has not been completed. The surveyors also recommended that the vessel have a dedicated engineer (at the time, engineers were being detailed from other vessels for each cruise) and an engineer was hired in spring 2000. A hull inspection was done in 1991 by the USCG, but a stability test has not been performed.

The safety gear aboard the KAHO includes a Switlick 10-person life raft, 7 Imperial survival suits, 8