APPLICATION OF BIOLOGICAL REFERENCE POINTS TO EVALUATE THE STATUS OF WALLEYE (Sander vitreus) IN ONTARIO

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Introduction. Ontario contains more than 4,000 walleye (Sander vitreus) lakes scattered over 1,000,000 square kilometres. Inland lakes vary in size from under 2 hectares to over 150,000 hectares. Historically, data were collected on very few of these lakes using a variety of methods and throughout the year making it difficult to compare between lakes or over time. In 1993, Ontario began testing a fall walleye index netting (FWIN) method that was developed in Quebec. After a slight modification, the FWIN method is now the recommended provincial index netting standard. To evaluate the status of Ontario’s walleye resource we compared the 1993 to 2001 FWIN data to maximum sustainable yield biological reference points for exploitable stock biomass and total adult mortality rate.

Methods. Walleye populations were sampled using the FWIN standard (Morgan 2002). The sampling window for the FWIN protocol generally begins in late summer to early fall when surface water temperatures (at 0.5m depth) have begun to cool to less than 15°C and ends when it reaches 10°C (late fall). During this period walleye are more evenly distributed throughout the water column and the catch rate may be more comparable from year-to-year and lake-to-lake. The sampling gear is a gill net composed of eight 7.6m long by 1.8m deep panels of clear monofilament. The panels are sewn in order with no spacers. Nets are set at a randomly determined site for one day and one night only and then moved to the next site. The gear is set perpendicular from the shore, starting at a depth of 2.0m. The offshore end of the net is in less than 15.0m of water. The sampling effort is stratified into two depth categories: 2 to 5m and 5 to 15m. The small (25mm) and large (152mm) mesh ends of the gill nets are alternated on a daily basis so that half of the efforts have the small mesh to shore and half have the large mesh to shore. Fish are killed over the 24 hour period that the net is in the water at a particular site. Sampling effort is determined by surface area or until 200 to 300 walleye samples are obtained, whichever comes first. All walleye captured were biologically sampled for fork length (mm), total length (mm), wet weight (g), gonad weight (g), and visceral fat (g). Sex and maturity were determined by internal examination of the gonads (Duffy et al. 2000). Fecundity was estimated from mature ovaries collected and preserved in 70% ethanol. Scale, spines, and otoliths were collected for age determination.

To evaluate the status of walleye populations in Ontario, FWIN results from approximately 400 water bodies sampled between 1993 and 2001 were compared to maximum sustainable yield biological reference points (BRP). Walleye relative abundance, biomass, and mortality estimates were derived for each water body after correcting for gear selectivity. The exploitable stock biomass BRP was compared to the observed FWIN kg/net for walleye ≥300mm total length. The total adult mortality BRP was compared to female age 5+ Robson-Chapman mortality estimates (Robson and Chapman 1961). The ratios of abundance and mortality BRP-to-FWIN estimate were log_10 transformed. Individual ratio observations were pooled to determine the 80% prediction interval ellipse for the entire data set.

Results. Results from this extensive provincial survey program indicate that Ontario’s walleye populations appeared to be healthy (Figure 1). Most lakes sampled in Ontario had high abundance BRP values and low mortality BRP values.

![Figure 1. Status of Ontario walleye populations sampled using the fall walleye index netting standard 1993 to 2001 (80% prediction interval ellipse). Inset graphic (histogram) shows proportion of lakes by status classification (Healthy = high abundance and low adult mortality, Stressed = high abundance and high adult mortality, Heavily Stressed = low abundance and high adult mortality, and “Low” Abundance = low abundance and low adult mortality). However, at the regional level there was a significant trend. The proportion of healthy populations declined from the northwest (NW region) to the northeast (NE region) to the south central region (SC region) (Figure 2).](image)
Figure 2. Classification of walleye population status by region (Healthy = high abundance and low adult mortality, Stressed = high abundance and high adult mortality, Heavily Stressed = low abundance and high adult mortality, and “Low” Abundance = low abundance and low adult mortality).

Discussion. Ontario’s walleye resource appears to be healthy as defined by BRP for abundance and adult mortality. This result is somewhat surprising considering that the majority of the lakes that were sampled were issue lakes (i.e., identified by Ontario Ministry of Natural Resources staff to be sampled because of local users complaints over the status of their individual walleye population). Only the south central region was sampled using a stratified random design. Lakes were stratified by surface area, transparency, productivity, and climate. From this framework a 25% random sample was drawn and all lakes were netted in the fall of 2001. Based upon this sample, the walleye resource in the south central region appears to be in the worst shape.

The decline in the proportion of healthy populations from the northwest region through to the northeast region to the south central region is similar to the pattern in resident angler license holders. In the northwest region (where walleye populations were mostly healthy) there are approximately 50,000 resident anglers. There are 4 times as many anglers (200,000 license holders) in the northeast region where there are a lower proportion of healthy populations and more low abundance populations. Compared to the northwest region there are 15 times as many anglers (750,000 license holders) in the south central region. Healthy walleye populations were found in one-half of the lakes sampled in 2001 and over 40% were classified as low abundance. The relationship between population health and the number of licensed resident anglers suggests that exploitation pressure may be a major factor limiting population growth.

This study clearly demonstrates the importance of extensive databases derived from surveys using standard sampling methodologies and appropriate sampling frameworks. Fisheries managers can use this information on overall resource status to evaluate current management actions and propose future changes. Walleye populations in Ontario generally appear healthy but stricter harvest controls may need to be implemented in the south-central region to protect currently healthy populations and rebuild low abundance populations.

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