Dauphin Lake
Summary Report 2023

Economic Development, Investment, Trade
and Natural Resources
2023

Manitoba

Introduction

Fisheries staff from Manitoba Economic Development, Investment, Trade and Natural Resources conduct annual fish stock assessments on Dauphin Lake. This report includes results from the stock assessment completed in 2023. Each year, an index gillnetting project is performed on Dauphin Lake to provide an updated assessment on the species composition and to evaluate the success of the walleye recruitment in the lake. Information on length, weight, and age was collected from walleye (*Sander vitreus*) and northern pike (*Esox lucius*) caught in the nets, all other species were counted and bulk weighed. Walleye was the most abundant species caught in the gill nets followed by shorthead redhorse (*Maxostoma macrolepitodum*), northern pike (*Perca flavescens*), and yellow perch (*Perca flavescens*). Data analysis conducted includes Catch-per-unit-effort (CPUE), relative abundance, age frequencies, and a variety of other population health metrics.

Location

Dauphin Lake is located to the south of Lake Winnipegosis and to the west of Lake Manitoba in the province of Manitoba (see *Figure 1*).
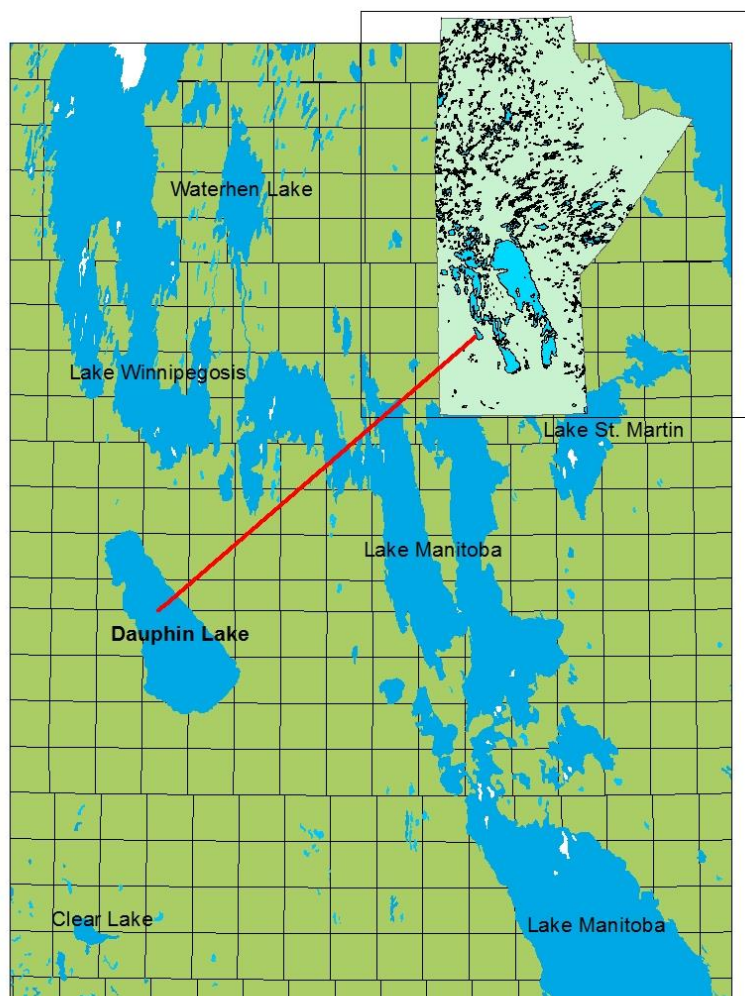

Figure 1: Map of location of Dauphin Lake.

Dauphin Lake is 520 km^2, approximately 42 kilometres long and 12 kilometres wide, with water depths ranging from 1 to 4.0 meters on average. Dauphin Lake drains into Lake Winnipegosis through the Mossy River.

Fish Species

The winter commercial fishery is based primarily on walleye (*Sander vitreus*) as the only species harvested under the annual lake quota of 6,804 kilograms (15,000 lbs). The remaining species harvested have unlimited quota including lake whitefish (*Coregonus clupeaformis*); northern pike (*Esox lucius*); yellow perch (*Perca flavescens*); sauger (*Sander canadensis*); white sucker (*Catostomus commersoni*), and shorthead redhorse (*Moxostoma macrolepidotum*), marketed as "mullet"; cisco (*Coregonus artedi*), marketed as "tullibee"; and common carp (*Cyprinus carpio*).

Stock Assessment

Manitoba Economic Development, Investment, Trade and Natural Resources (Fisheries) conducts annual index gill net surveys and beach seining to assess the status of walleye and other fish stocks in Dauphin Lake. Figure 2 shows the catch composition from index gill net surveys in 2016-2023. Walleye were the dominant species in the catch in all years, with a slight decrease in percent composition of the catch from 2022 to 2023.
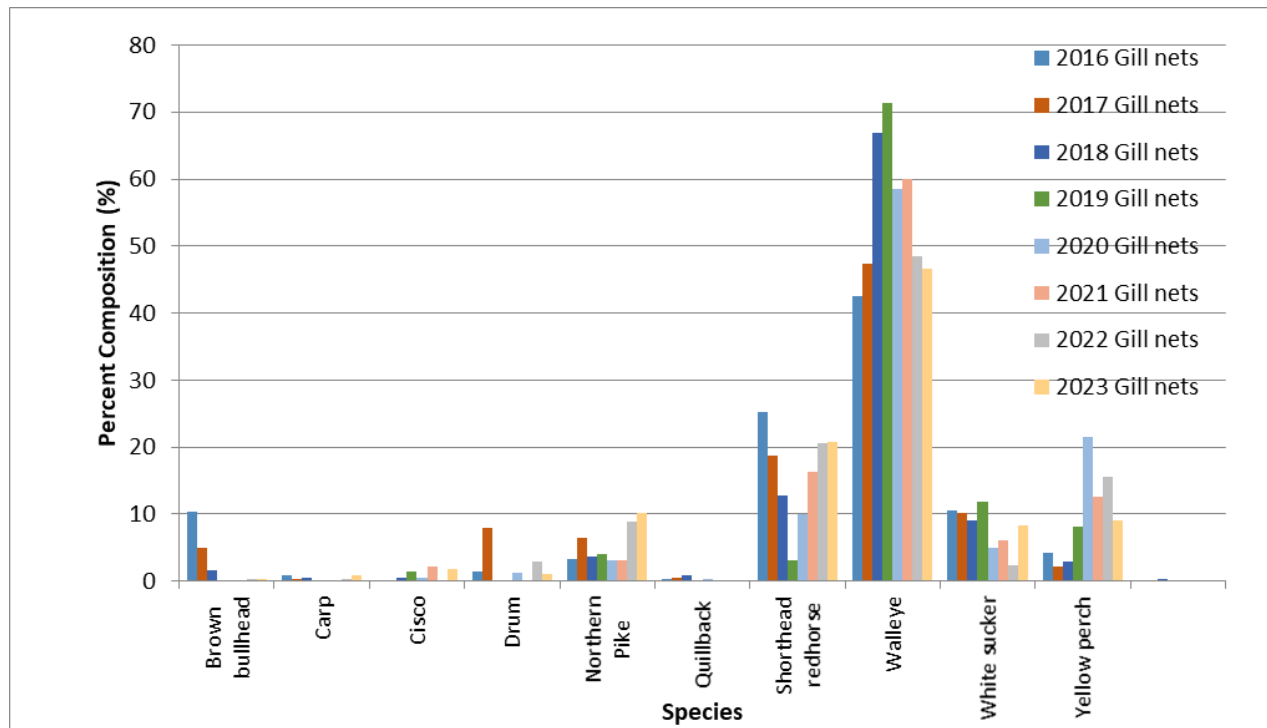

Figure 2: Catch composition of species from index gill net surveys from 2016 to 2023.

Walleye

Relative abundance of all walleye from index netting generally exhibited an increasing trend since the mid 1990s, but has shown occasional declines based on variable recruitment and harvest rates over the years (Figure 3a and 3b).
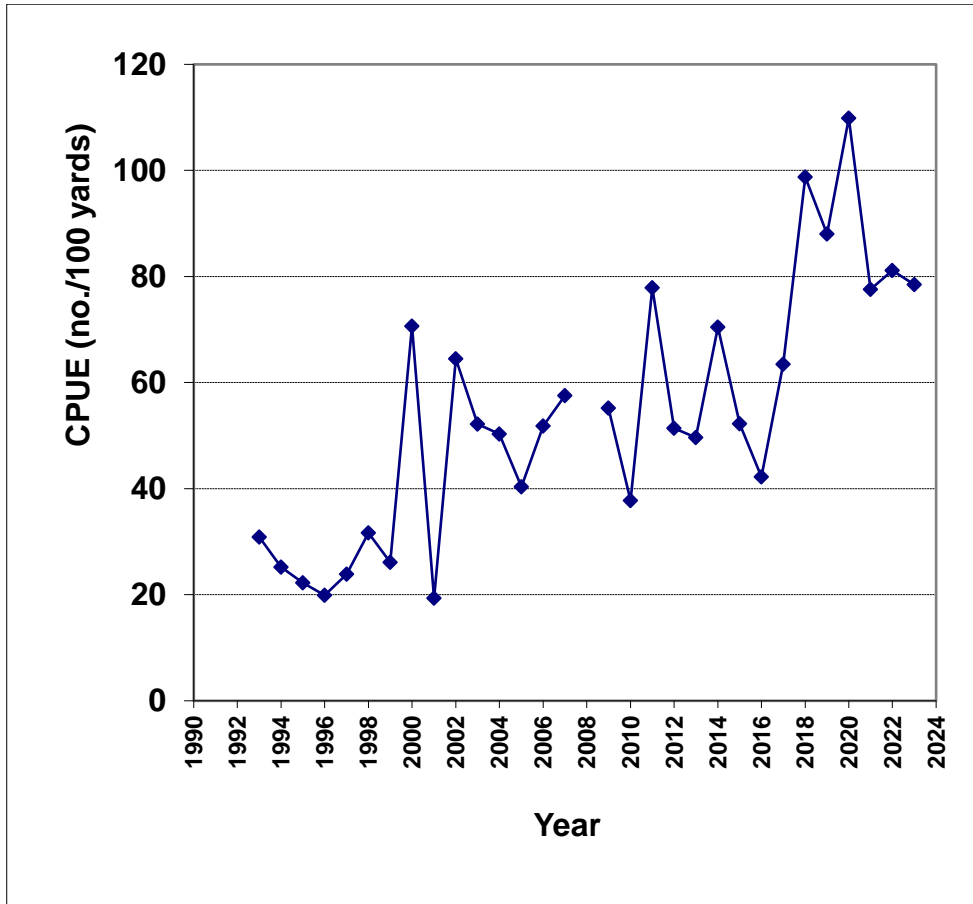
Figure 3a: Catch-per-unit-effort of all walleye caught during annual monitoring, 1993 to 2023.
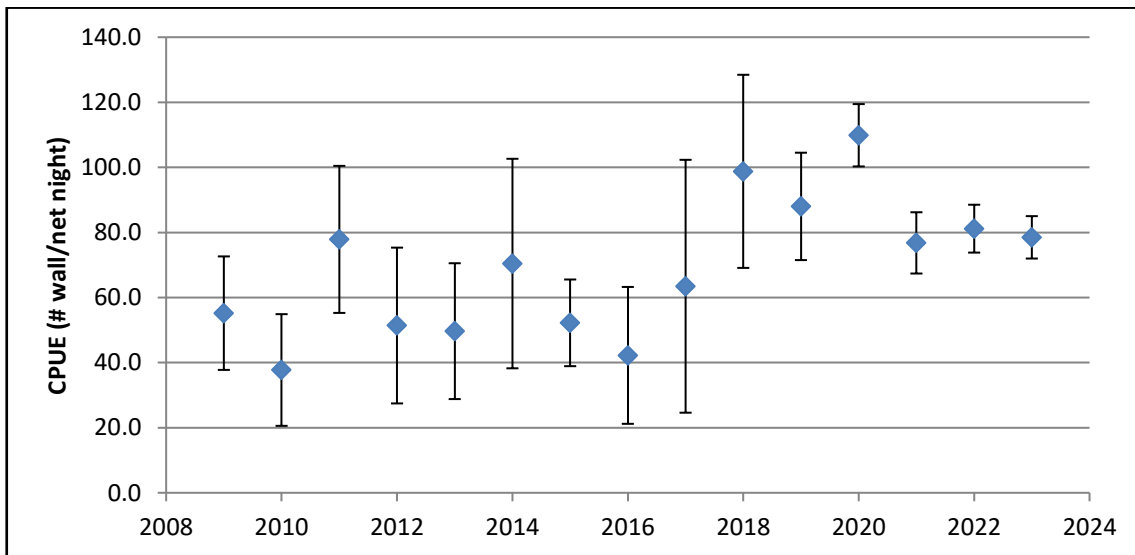

Figure 3b: Catch-per-unit-effort of all walleye caught during annual monitoring and associated variation in catch, 2009 to 2023.

A wide variety of age classes with variable abundance were found from aging 175 walleye caught (Figure 4). A total of 18 age groups were caught during 2023, ranging in age from 1 to 18 years. The strong 2012 and 2013 year classes (ages 10 and 11) were the most abundant year classes in the sample (13.7%). The number of age groups in the walleye population in Dauphin Lake (more than 8 age classes) is one indicator of a stable stock (Sullivan 2003). Figure 5, shows historical walleye age class abundance from 2015 to 2022 assessments.
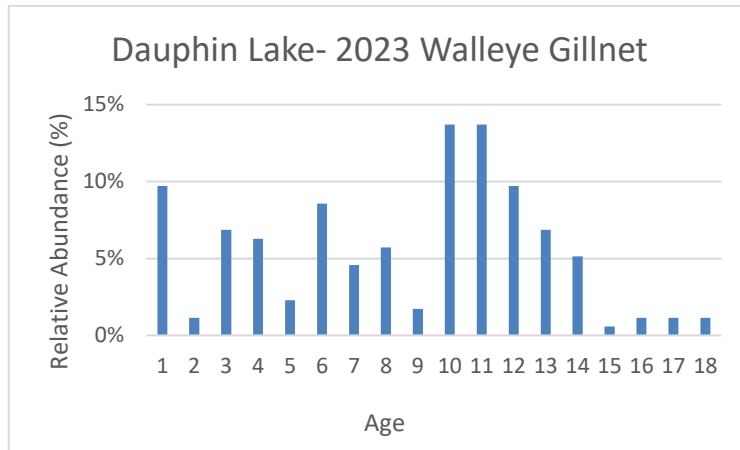

Figure 4. Relative abundance of walleye age classes from index gillnet survey from 2023.
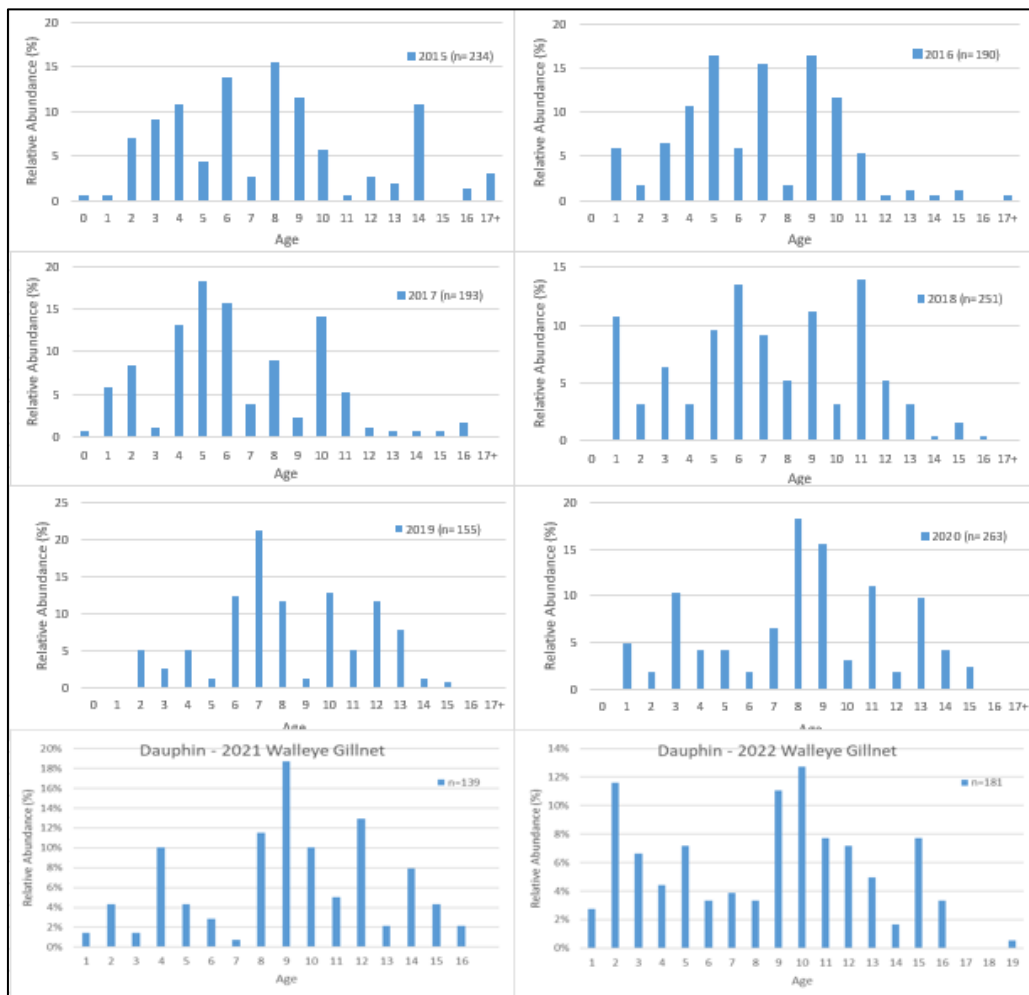

Figure 5: Relative abundance of walleye age classes from index gillnet surveys from 2015 to 2022.

In 2023, the mean age of walleye captured in the stock monitoring program increased from 8.38 (in 2022) to 8.46 years of age. A mean age between six to nine years is an indicator of a stable population, in combination with other positive stock status indicators (Sullivan 2003). For early growth (ages 1 to 7), using omega (ω = Linf*k), Dauphin Lake walleye grow faster than expected, based on growing degree days (GDD from Environment Canada - Canadian Climate Normals 1971-2000). Gangl and Pereira (2003) estimated early growth (omega), based on climate, for the area to be about 105, in Dauphin Lake it was 197 in 2020 (and 183.5 in 2019). The rapid growth is likely due to the nutrient rich waters and abundance of food sources available.

Reproductive rate of walleye populations increase with the mean age of adult female walleye, in part because older female walleye produce larger and potentially higher quality eggs (Venturelli et al. 2010). In 2023, mean age of mature female walleye was 9.97 years old (Figure 6). Mature female walleye ranging in age from 4 to 18 represented 44% of all walleye caught in index gill nets. This suggests a high proportion of prime spawners in the Dauphin Lake walleye population, which is important for recruitment.
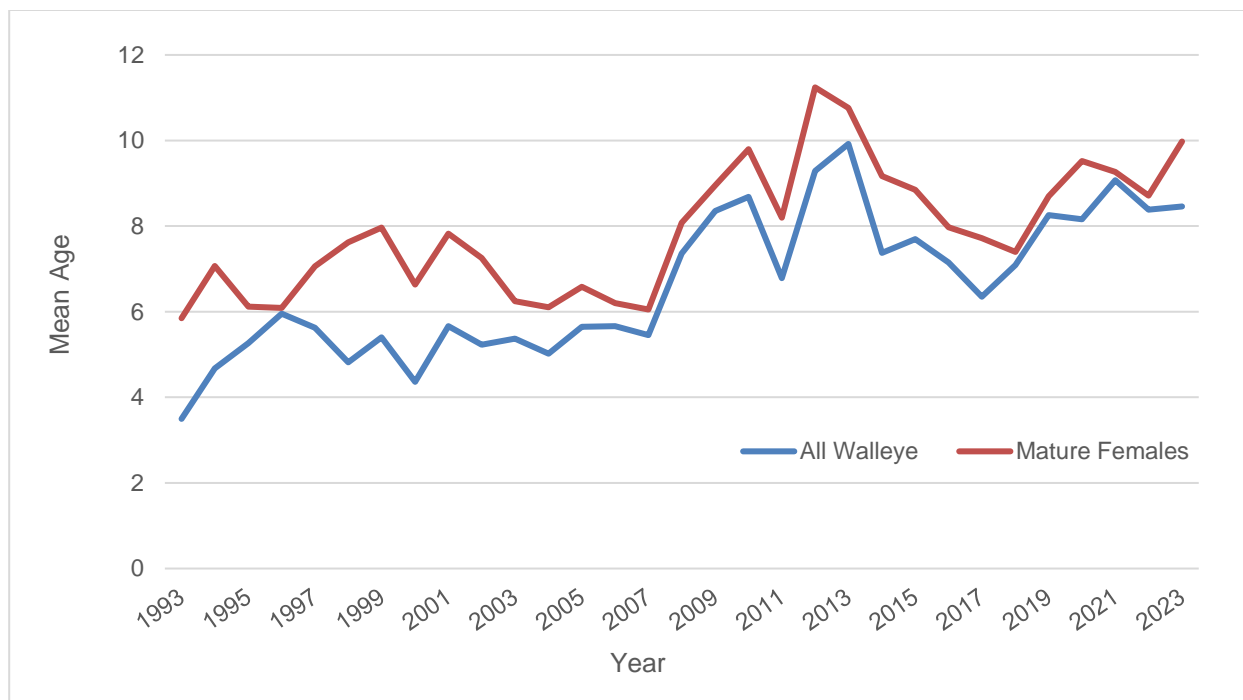

Figure 6: Mean age of walleye (sexes combined and mature females only) from 1993 to 2023.

Biologically, mature female fish are considered to be more important than mature male fish for the production of future year classes. In the Valley River, larval walleye abundance was positively related to mature female biomass in Dauphin Lake (Johnston et al. 1995). The relative abundance of mature female walleye decreased from 51.6 in 2022 to 34.5 in 2023 (Figure 7). The relative abundance of immature female walleye in the population remained at 10.8 fish per 100 yards of net.
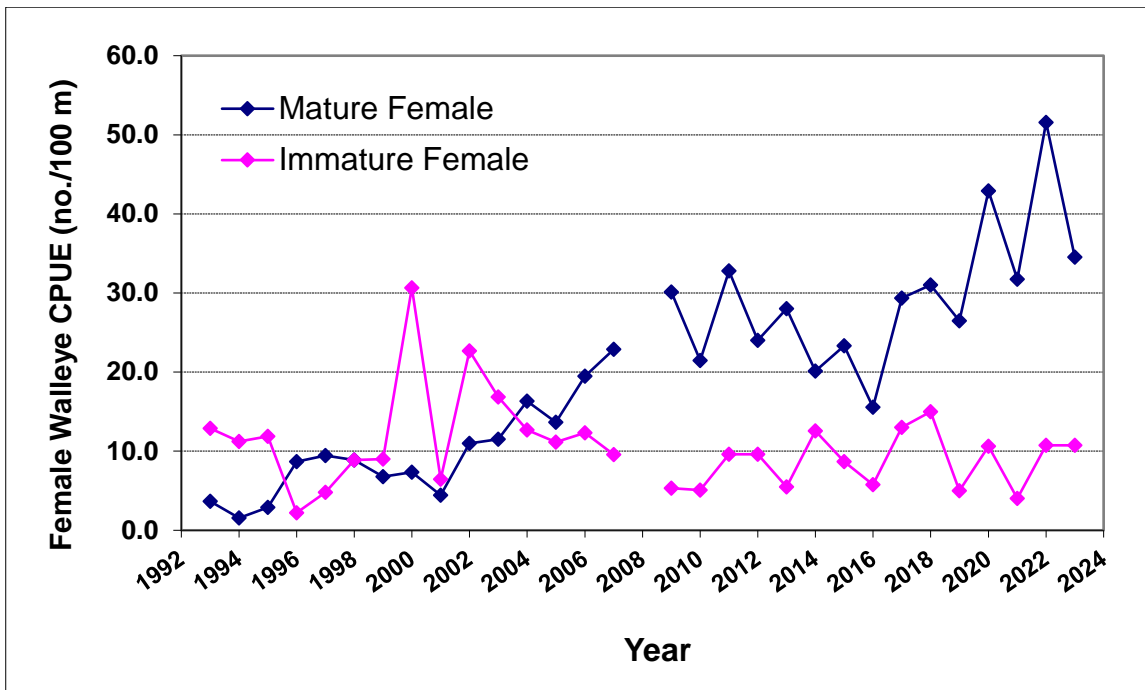
Figure 7: Catch-per-unit-effort of mature and immature female walleye caught during annual monitoring 1993 to 2023.

The age-at-maturity of all walleye generally decreased after 2006 and increased in 2012 to 5.3 years (Figure 8). Female age-at-maturity in 2023 (4.49 years) was up from 2022 (3.72 years). Age-at-maturity is influenced by the strength of year classes ages 4 and 5. In 2023, age-at-maturity of female walleye (4.49 years) was less than a published threshold of 5.1 years, based on growing season length (Gangl and Pereira 2003). Failing to exceed a threshold of a biological performance indicator is considered a negative indicator of stock status.
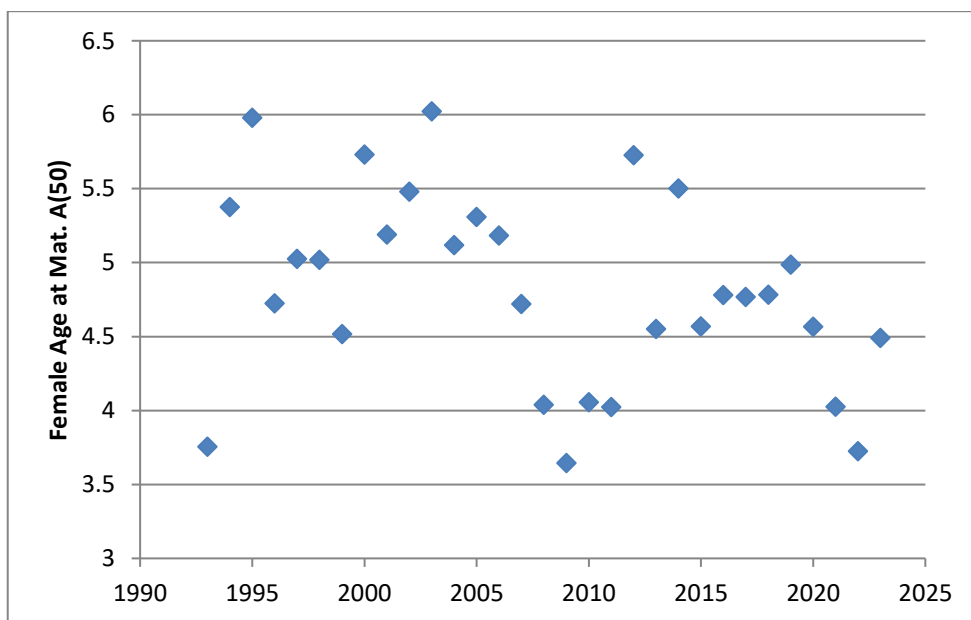

Figure 8: Age of maturity of walleye from annual monitoring in Dauphin Lake, 1993 to 2023.

Based on 2023 stock monitoring results, the annual mortality rate of female walleye ages 10 to 18 was 30.1%. This mortality rate is within recently published sustainable exploitation rates (Lester et al. 2014). In 2023, annual mortality rate decreased slightly compared to the 2015-22 estimate of annual mortality for female walleye (ages 9 to 18) which was 38.5%.

Average length of walleye age classes from index netting have recently exhibited a decreasing trend for ages 8 and over since 2014 (Figure 9). This decline seems to indicate that some growth limiting factors are affecting older walleye either as a biological compensation mechanism (e.g. too many fish and crowding occurring) or limited food supply (e.g. not enough food to support current population levels) for length growth to continue at older ages. When taking into account relative weight indices, walleye are still healthy for their weight (Wr > 0.75).
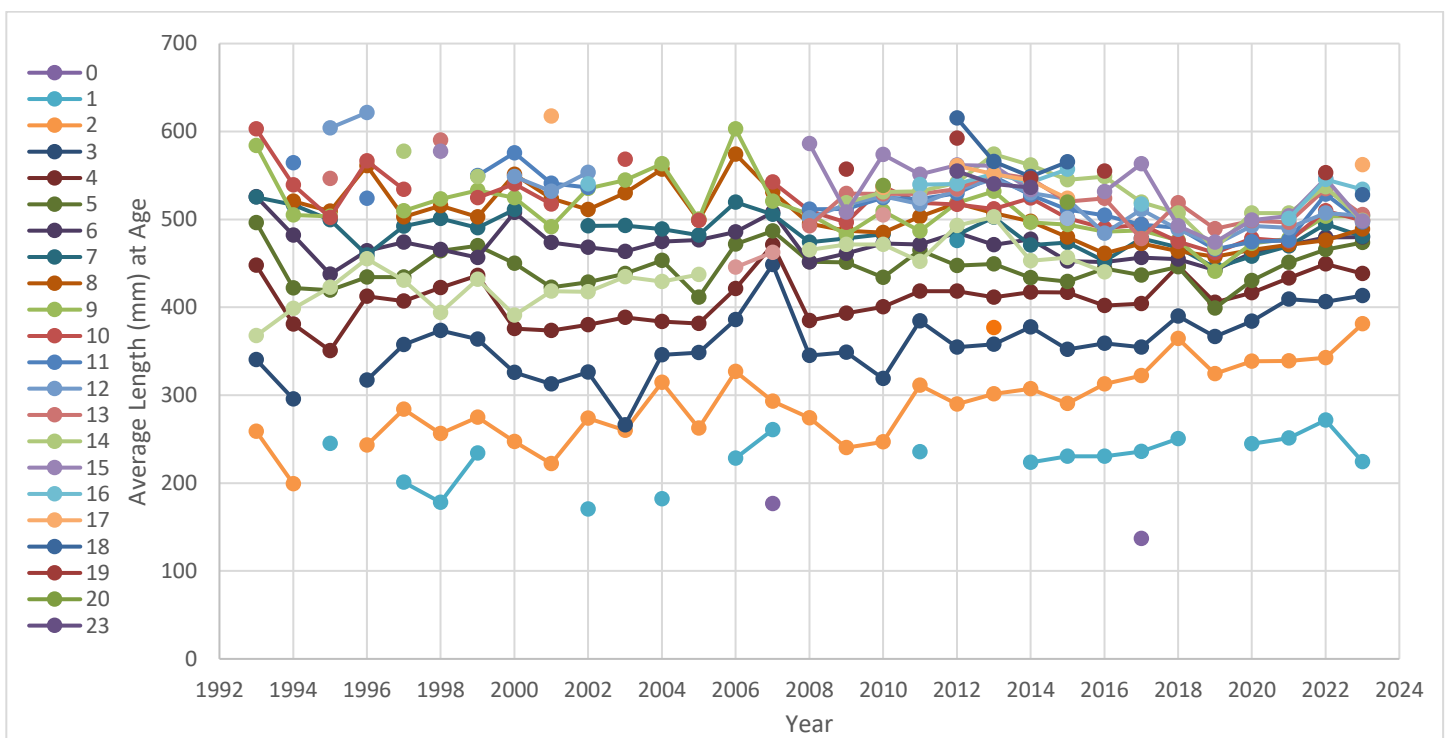

Figure 9: Average total length (mm) of walleye age classes from Dauphin Lake, 1993 to 2023.

The Von Bertalanffy growth function for 1996, 2012, 2017, and 2023 shows that young walleye grow quickly and reach a maximum total length at age 8. It is presumed then that given higher walleye populations that growth is being stunted by physiological compensation functions. This has left a disproportionately large percentage of the fish at the lower end of the slot and few fish that grow to a large size (>50cm) in recent years.
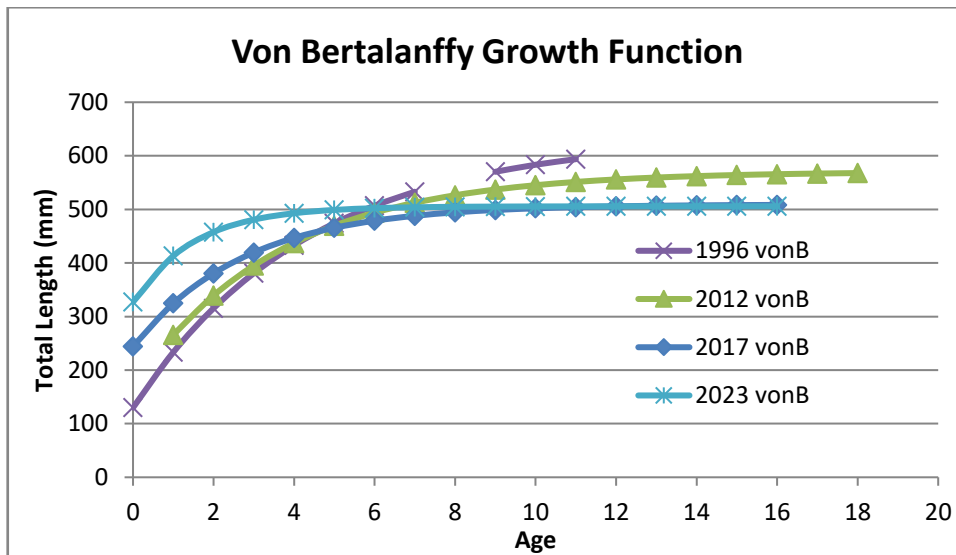
Figure 10: Von Bertalanffy growth function of walleye age at total length from Dauphin Lake, 1996, 2012, 2017 and 2023.

Northern Pike

Near-shore and vegetated habitat areas were too shallow to effectively net, which is where pike are typically found. In the far-shore areas assessed a low level of northern pike abundance with relatively uniform population structure was found (Figure 11). A total of 38 northern pike consisting of 8 age groups were caught during 2023, ranging in age from 0 to 9 years. Due to the low composition of pike stocks, no specific measures are in place to manage the species.
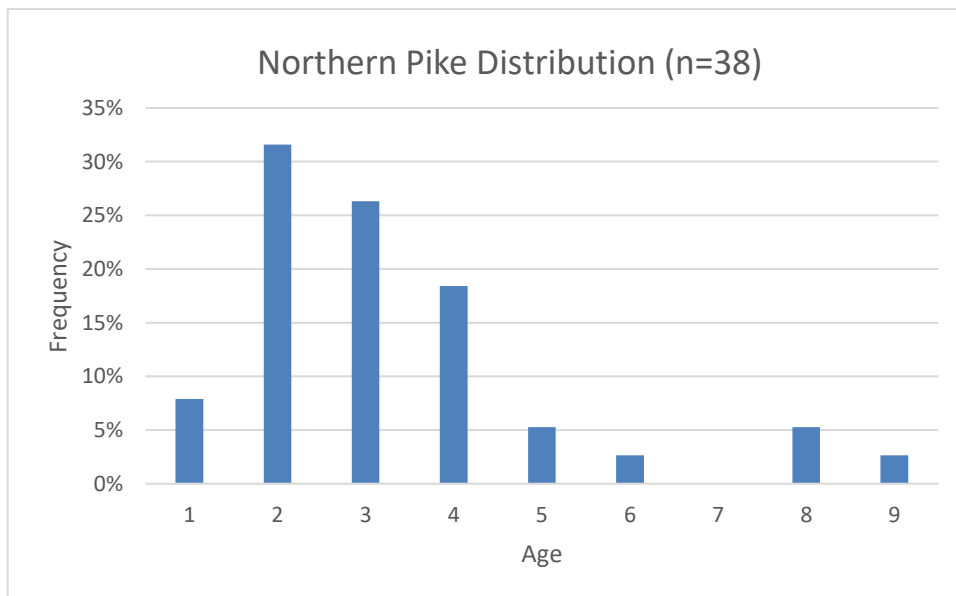

Figure 11. Relative abundance of pike age classes from index gillnet survey from 2023.

Conclusions:

There are a number of indicators that are used to determine the status and health of fish stocks in provincial waters. These include, but are not restricted to, age structure (i.e. variation in year class strength, mean age), mortality rates, mean age of the commercial catch, age of maturity, and catch per unit effort.

Based on 2023 index netting results, the population was composed of a wide range of age groups (18), similar to the last five years, which is an indicator of stable stock status.

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Catch per unit effort (CPUE) has been at a high level in recent years. The number of mature female walleye decreased in 2023 with 34.5 fish per 100 yards. To ensure accurate and up-to-date information is collected, Manitoba Economic Development, Investment, Trade and Natural Resources will continue to refine approaches to enhance monitoring activities.

The Department will continue to undertake annual stock monitoring activities on Dauphin Lake and continue to explore opportunities to enhance assessment efforts. This may include index gill netting, beach seining for age-0 walleye monitoring, and spring spawning monitoring activities.