Ontario

F_1 Splake: An Annotated Bibliography and Literature Review

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Preface

This bibliography and literature review is the second in a set of reference documents developed in conjunction with a review of fish stocking policies and guidelines in the Province of Ontario. It has been prepared to summarize information pertaining to the current state of knowledge regarding splake stocking in a form which can readily be utilized by field staff and stocking proponents.

Material cited in this bibliography includes papers published in scientific journals, magazines and periodicals as well as "gray" literature such as file reports from Ministry of Natural Resources (MNR) field offices. Unpublished literature was obtained by soliciting information (i.e., unpublished data and file reports) from field biologists from across Ontario. Most published information was obtained from a literature search at the MNR corporate library in Peterborough. Twenty-one major fisheries journals were reviewed as part of this exercise. These included Aquaculture (1972 – 1998), California Fish and Game (1917 – 1999), Copeia (1913 – 1999), Environmental Biology of Fishes (1976 – 1999), Fishery Bulletin (1963 – 1999), Fisheries Management (1975 – 1984), Journal of Freshwater Ecology (1981 – 1999), New York Fish and Game Journal (1954 – 1985), North American Journal of Fisheries Management (1981 – 1999), Journal of the Fisheries Research Board of Canada/Canadian Journal of Fisheries and Aquatic Sciences (1950 – 1999), Progressive Fish Culturist (1940 – 1999), and Transactions of the American Fisheries Society (1929 – 1999). Searches were also made of other publications including Proceedings of the Annual Meeting of the Southeastern Association of Fish and Wildlife Agencies, Proceedings of the Annual Meeting of the Western Association of Fish and Wildlife Agencies, Transactions of the North American Fish and Wildlife Conference, Transactions of the Midwest Fish and Wildlife Conference, United States Department of the Interior Fisheries Technical Papers, FAO Fisheries Technical Papers and Circulars, and reports published under the Canadian Technical Report Series of Fisheries and Aquatic Sciences. An excellent synopsis of the life history and ecology of F1 splake has been published by Berst et al. (1980). Several historic references were extracted from earlier reviews by Martin (1960) and Wilton (1971). Some material was also obtained by a search on the Fish and Fisheries Worldwide database (1971 – present) via the Internet.

Information from approximately 170 sources has been assembled. Abstracts from published papers have been included wherever possible. In cases where abstracts were not available, an attempt has been made to extract pertinent material from the document to provide a synopsis of the findings. In some cases, I was unable to obtain a copy of the document but have simply included the citation. Some unpublished data has been included but has not been cited.

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History of Splake Stocking in Ontario

Experimentation with hybrids of brook trout and lake trout have a long history. One of the earliest known references was in 1879 when hybrid trout were believed to have been raised at the Caledonia fish hatchery in New York. By 1881 the hatchery apparently had a small brood stock (Anonymous 1879). The occurrence of a brook trout – lake trout hybrid was described at a meeting of the American Fish Cultural Association held in 1880 (Kmiotek and Oehmcke 1959). In 1889, an article in Forest and Stream magazine indicated that "splake" had been received by the U. S. Fisheries Commission from the Curry hatchery in Pennsylvania. Between 1915 – 1917 reference was made to crossing brook trout and lake trout at the Port Arthur federal fish hatchery in Ontario (Scott 1956).

There appeared to be little interest in the hybrid trout until the mid 1940s. In 1946 park warden J. E. Stenton made some of the first crosses in Banff National Park. His initial attempts were based on crossing a female brook trout and a male lake trout. In the fall of 1947, he conducted both crosses (i.e., female lake trout and male brook trout and vice versa). Parent lake trout originated from Lake Minnewanka and brook trout came from Third Vermilion Lake. He achieved good success with male brook trout x female lake trout crosses but concluded that reciprocal crosses (male lake trout x female brook trout) were largely unsuccessful because the brook trout eggs were too small to permit normal development. Stenton named the brook trout male x lake trout female cross a "splake". Based on these successes, the first crosses were made by the Québec Department of Fish and Game in 1948, the Ontario Department of Lands and Forests in 1951, and the Wyoming Game and Fish Commission in 1952.

In Wyoming, experiments with reciprocal crosses were conducted between 1952 and 1957 (Sowards 1959). The progeny resulting from this cross (male lake trout x female brook trout) were denoted as "brookinaw". These hybrids displayed wild behaviour and were differentiated in physical appearance. Female "brookinaw" more closely resembled lake trout while the male progeny were more like brook trout in appearance.

In Ontario, there was interest in splake for two reasons: (i) to provide recreational fishing opportunities in inland waters where plantings of brook trout and lake trout had been relatively unsuccessful, and (ii) to create a deepwater salmonid predator which could be utilized to rehabilitate degraded lake trout stocks in Lake Huron.

The earliest plantings of hybrid trout in Ontario is believed to have occurred in 1953 when 24,500 F_1 fingerlings were planted in seven lakes in northeastern Ontario. The lakes and the number of fish stocked were: Mace Lake (Township 163, Algoma District) – 15,000 fingerlings; Panache Lake (Dieppe Township, Sudbury District) – 1,500 fingerlings; Pine Point Lake (Ogilvie Township, Sudbury District) – 4,000 fingerlings; three unnamed lakes in Macbeth Township, Sudbury District – 2,000 fingerlings; and Splake Lake (Nipissing District) – 2,000 fingerlings. Parent fish were female lake trout from the Montreal River, a Lake Superior strain, and male brook trout from the Tarentorus fish culture station.

Between 1954 and 1959, the first plantings of splake were made in several lakes in Algonquin Provincial Park. These lakes included Opeongo, Redrock, Sproule, Little Minnow, Brewer, Jack, Scott, Found and Kathryn. These early hybrids were based on male brook trout parents from the Hills Lake and Tarentorus fish hatcheries as well as stock from Dickson and Marmot lakes.

Parent female lake trout originated from the Montreal River (Lake Superior), Lake Simcoe, Lake Manitou and Lake Opeongo (Martin and Baldwin 1960).

In 1957, work began in Ontario to develop a hybrid for trout rehabilitation in Lake Huron. From 1957 – 1965, during the research phase of the project, approximately 500,000 yearling F_1 splake were stocked annually at locations in the North Channel, northern Georgian Bay and northern Lake Huron.

In 1965, a decision was made to attempt to rehabilitate Lake Huron with splake rather than lake trout (Anonymous 1968). The decision was based on the desire for a deepwater lake trout type predator which grew faster and matured at an earlier age thereby being less susceptible to attack by sea lamprey. By 1966 a selection program had provided initial brood stocks for production hatcheries (Spangler and Berst 1978). Further genetic selection was conducted to create a highly select splake. Genetic selection was utilized to produce a fish having desirable qualities of early maturity and deep swimming ability. Between 1969 and 1977, a total of 2.8 million yearling and 0.9 million fingerling splake were planted in Georgian Bay.

Assessment of the highly select splake was conducted in the Cape Rich area of southern Georgian Bay. F_1 splake were found to be subject to high mortality and did not display widespread natural reproduction as hoped. Backcrossing, with a pure lake trout and an F_1 splake was initiated in northern Georgian Bay (Heywood Island) in 1978 and was extended to southern Georgian Bay in 1979. By the early 1980s, production for the rehabilitation of Lake Huron and Georgian Bay had shifted from F_1 splake to lake trout backcross.

Parent stocks have changed from the early days of splake culture. Lake trout eggs have shifted from Lake Manitou stock to other captive brood stocks including Killala Lake, Mishibishu Lake and Slate Islands (Lake Superior). Either Hills Lake or Lake Nipigon strains of brook trout are now utilized. Three provincial fish culture stations (Hills Lake, Dorion and Tarentorus) collect eggs for incubation and subsequent transfer to other stations for rearing and distribution. Although the F_1 splake is a fertile hybrid, it is used primarily to provide put-grow-and-take angling opportunities.

Growth rates of F_1 splake vary according to parent strains and the fish culture station at which they are reared. Growth rates also vary within the same strains at the same hatchery from one year to the next. In 1999, splake varied in average size from 10.5 grams (Lake Nipigon x Slate Island strain reared at the Dorion Fish Culture Station near Thunder Bay) to 63.0 grams (Hills Lake x Mishibishu Lake strain reared at the Tarentorus Fish Culture Station near Sault Ste. Marie). Generally, most hatcheries can produce a yearling F_1 splake in the 30+ gram range.

In 1995 – 96, Heidinger (1999) estimated that 2.339 million splake were planted in North America by ten state and three provincial agencies.

Currently, splake stocking in Ontario involves only inland lakes. Splake are a popular sport fish species and are used by fisheries managers to provife angling opportunities in waters which may be marginal for either brook trout or lake trout. Splake are also used to divert angling pressure away from heavily exploited fisheries for species such as lake trout. Almost eight hundred thousand F_1 splake were stocked in Ontario in 1999 (Table 1).

Table 1. F_1 splake stocking in Ontario waters by the Ontario Ministry of Natural Resources in 1999

Region	MNR District	Number of Fish Stocked
Southcentral	Algonquin Park	31,500
	Bancroft	146,050
	Kemptville	15,500
	Midhurst	5,000
	Parry Sound	13,400
	Pembroke	52,019
	Peterborough	48,800
Northeast	Chapleau	7,000
	Cochrane	33,000
	Hearst	24,000
	Kirkland Lake	106,950
	North Bay	69,636
	Sault Ste. Marie	22,625
	Sudbury	33,366
	Timmins	34,000
	Wawa	17,542
	Northwest Dryden	4,500
	Nipigon	75,700
	Sioux Lookout	2,000
	Thunder Bay	55,000
Provincial Total		797,588

By 1999, F_1 splake had been planted in numerous American jurisdictions including California, Colorado, Idaho, Maine, Maryland, Michigan, Minnesota, New Hampshire, South Dakota, Utah, Wisconsin and Wyoming (Fuller et al. 1999)

Synthesis of Selected Literature

This section is intended to provide a summary and overview of F_1 splake information which has been assembled under the following categories:

1. Factors influencing stocking success
2. Contributions of stocked splake to the fishery
3. Potential impacts of splake stocking
4. Stocking assessment
5. Best management practices for stocking splake

Factors Influencing Stocking Success

Many of the factors influencing post-stocking survival of F_1 splake are similar to those for other hatchery-reared salmonids. Factors which have been identified in the literature for F_1 splake are summarized in Table 1.

Table 1. A summary of potential factors which can influence the success of an F_1 splake stocking project.

Factor	Reference(s)
Poor habitat and/or water quality	Boles and Meyer (1964), Deyne and Arnett (1987), Wilson (1987) Haxton (1991), McCambridge (1991), Thomas (1995)
Predation	Berst and Spangler (1970), Fraser (1972, 1988_d, 1988_e), Anonymous (1985), Matkowski (1989)
Diet and prey availability	Burkhard (1962)
Interspecific competition	Leik (1959_a), Burkhard (1962), Wilton (1971), Fraser (1972, 1978, 1988_e), Anonymous (1985, 1986_c, 1986f, 1987, 1989_b, 1989_c), Haxton (1987), Wilson (1988_a) Deyne (1990), Deyne and Arnett (Undated), McCambridge (1991), Thomas (1995)
Intraspecific competition	Fraser (1972)
Low fertility of waterbody	Fraser (1972), Deyne and Arnett (Undated)
Transport stress	McDonald et al. (1993), Thomas (1995)
Fish health	Thomas (1995)
Age/size of stocked fish	Brynildson and Kempinger (1970), OMNR (1977, 1978), Haxton (1987), Thomas (1995), Anonymous (1989_c)
Stocking density	Liskauskas and Quinn (1991)

Habitat and Water Quality – Splake are generally believed to be somewhat less stringent in habitat requirements than either of their parents (Table 2). For example, Snucins (1992) concluded that splake were more suitable than either brook trout or lake trout for stocking in low pH (4.9 – 5.4) lakes.

Table 2. General habitat requirements of F_1 splake.

Parameter	Requirement
Lake size	• Smaller lakes (e.g., 50 – 100 ha).
Lake bathymetry	• Small littoral zone with steep basin contours.
Maximum depth	• 12 – 24 meters
Lake trophic status	• MEI values between 3.7 – 5.7.
Inlets and outlets	• Minimal lake outflow.
Water clarity	• Clear water (e.g., Secchi ≥ 6 m)
Water temperatures	• 12 – 14º C (not greater than 15.5º C)
Dissolved oxygen	• > 5 mg L^{-1}

Water temperature is an important factor which determines distribution of splake. Generally, splake are found at water temperatures in the 8 – 20º C isotherm. Their preference seems to be in the 12 – 14º C range which, during the summer, means they are usually found in or near the thermocline (Anonymous 1959, Leik 1959_a, Martin and Baldwin 1960, Berst et al. 1980). Straight (1969) attributed this affinity for the thermocline as largely a feeding response. F_3 and F_4 hybrids seem to prefer slightly warmer waters (e.g., 15 – 16º C) than F_1 hybrids (Goddard and Tait 1976, Berst et al. 1980).

Splake have been known to move to seek more preferred temperatures. Berst and Payne (1974) reported movements from Georgian Bay into tributary streams. In inland lakes splake become sedentary as waters warm (Betteridge 1985).

Splake exhibit pronounced schooling behavior (Martin and Baldwin 1960, Martin 1965, Wilton 1971). They generally remain near their planting site (Berst and Spangler 1970, 1973 Grimås et al. 1972) and demonstrate little tendency to migrate out of an inland lake (Leik 1959_b, Burkhard 1962).

Predation – Splake are known to have a number of predators including fish-eating mammals (Fraser 1972), older splake and rainbow trout (Fraser 1988_d) and fish eating birds (Fraser 1972, 1988_e, Matkowski 1989). Matkowski (1989) speculated that, due to the habits of splake (i.e., preference for deeper water), they were probably less susceptible to avian predators than other hatchery-reared salmonids such as brook trout.

In Lake Huron, sea lamprey were also a predator of splake (Berst and Spangler 1970). Predation increased with the size of the fish and the season of the year (highest in September).

Diet and Prey Availability – The predatory habits of splake more closely resemble lake trout than brook trout. Young splake (e.g., yearlings) feed primarily on invertebrates while older splake feed predominantly on fish (Table 3). Brynildson and Kempinger (1970) reported that, by the time fish had reached 3 – 4 years of age in Pallette Lake, Wisconsin, fish comprised almost 100% of the splake diet. Splake have the capability to utilize many different prey types and diet is often reflective of the relative availability of prey. Their diet becomes more limited when they are forced to seek deeper, colder water in the summer although in Parvin Lake, Colorado, nocturnal feeding movements to shallower waters have been recorded (Burkhard 1962). During the winter splake move into shallower water where a greater variety and quantity of food items are present.

Table 3. Food items of stocked F_1 splake.

Food Item	Reference(s)
Aquatic insects	Leik (1959_a), Martin and Baldwin (1960), Berst et al. (1980)
Terrestrial insects	Brynildson and Kempinger (1970)
Zooplankton/Invertebrates (cladocerans, copepods)	Anonymous (1988b), Martin (1965), Straight (1969), Brynildson and Kempinger (1970), Fraser (1980), Betterridge (1985)
Fish eggs (sucker, lake trout, lake herring and splake)	Anonymous (1994), Bynildson and Kempinger (1970), Berst et al. (1980)
Amphibians (frogs, salamanders)	Martin and Baldwin (1960), Martin (1965), Berst et al. (1980), Kerr and Grant (2000)
Crayfish	Anonymous (1987, 1988_b), Martin and Baldwin (1960), Berst et al. (1980), Fraser (1980), Potter (1995)
Leeches	Martin and Baldwin (1960), Burkhard (1962), Martin (1965), Berst et al. (1980), Kerr and Grant (2000)
Snails	Brynildson and Kempinger (1970)
Fish	
Alewife	Berst and Spangler (1970), Spangler and Berst (1976), Berst et al. (1980)
Brook trout	Satterfield and Koupal (1994)
Cyprinids	Brynildson and Kempinger (1970)
Deepwater sculpin	Berst and Spangler (1970), Brynildson and Kempinger (1970)
Fourhorn sculpin	Berst et al. (1980)
Lake herring	Straight (1969)
Largemouth bass	Punt (1997)
Pumpkinseed	Fraser (1980)
Smallmouth bass	Brynildson and Kempinger (1970)
Trout-perch	Berst et al. (1980)
Yellow perch	Straight (1969), Brynildson and Kempinger (1970), Fraser (1980), Rumsey and Lamarre (1994), Punt (1997)
Plant remains	Bynildson and Kempinger (1970)

Although splake often do well in waters with simple fish communities, an abundance of forage fish in the recipient lake is relatively important for stocked splake. Splake have actually been used as a predator to reduce the abundance of stunted populations of both brook trout (Satterfield and Koupal 1994) and yellow perch (Rumsey and Lamarre 1994).

Interspecific Competition – Despite the fact that splake are believed to be a more aggressive competitor than either parent, there is evidence that post-stocking survival is best in waters having simple fish communities. Poor returns of stocked splake have been attributed to competition with smallmouth bass (Anonymous 1989_c), yellow perch (Anonymous 1986_c, 1986_f, 1989_b, 1989_c, Fraser 1978), lake herring (Anonymous 1991, Wilson 1988_a), rock bass (1989_b), lake whitefish (Wilson 1988_a) and smelt (Wilson 1988_a). Both Leik (1959_a) and Burkhard (1962) concluded that splake competed for food with rainbow trout especially during the spring and fall when both species were feeding in shallower waters.

Intraspecific competition – There may be some degree of competition for food and space with both lake trout and brook trout. Fraser (1972) found that recoveries of splake were lowest in lakes having fish communities that included several other species including lake trout and brook trout. In Redrock Lake, Ontario, Hansen (1972) found that splake used the same spawning areas as brook trout and actually suppressed all spawning by early maturing brook trout. He concluded that the main impact of splake's interaction with brook trout was the early and prolonged presence of splake at the spawning grounds which forced brook trout to spawn in a relatively short period of time. For these reasons, Wilton (1971) concluded that the introduction of splake should not be considered in lakes already containing self-sustaining populations of either parent species.

Lake Trophic Status – Fraser (1972) concluded that the poor survival of stocked salmonids, including splake, in some waters may be due, at least partially, to the low supply of nutrients as reflected by the morphoedaphic index (MEI). Deyne and Arnett (Undated) found that the best returns from splake stocking in the Bracebridge area occurred in waters having MEI values in the 3 – 6 range.

Transport Stress – Stress associated with the capture, transfer and release of hatchery-reared salmonids may be responsible for some post-stocking mortality. McDonald et al. (1993) found that splake were particularly stressed by net confinement. In at least one instance (Thomas 1995) poor survival of stocked splake was attributed to handling and transport stress.

Fish Health – The quality of hatchery-reared splake, in terms of fish health, is a potential cause for low post-stocking survival but this has seldom been reported as a major reason for poor stocking success.

Age/Size of Stocked Fish – Generally, there is a correlation between the size of fish and post-stocking mortality. This advantage must be evaluated in terms of increased costs of rearing larger fish. Size of fish stocked was found to have a direct bearing on post-stocking survival in Georgian Bay, Lake Huron (OMNR 1977, 1978). In the Michigan waters of Lake Superior, splake stocked as yearlings and fall fingerlings provided returns of 13% and < 2% respectively. In five Algonquin Park, Ontario, lakes, Fraser (1988_c) reported that recoveries of F_1 splake planted as yearlings were 3 – 5 times greater than recoveries of fish stocked as fall fingerlings. Conversely, in Pallette Lake, Wisconsin, Brynildson and Kempinger (1970) reported that fall fingerlings (averaging 6.8 inches in length) survived as well as those stocked as spring yearlings (averaging 8.2 inches in length). Current provincial stocking guidelines (OMNR 1982) state that fall fingerling splake should only be stocked in lakes having few or no predatory fish species.

In Ontario, splake are usually stocked in marginal waters where plantings of lake trout and brook trout have not been overly successful and where there are often a number of competitive fish species. In these situations, it is desirable to plant the largest sized fish possible. Haxton (1987) recommended that larger-sized splake be stocked in waters where competitors were more abundant. In Granite Lake, Ontario, larger-sized splake were required to compete with high densities of perch in the lake. Plantings of smaller-sized splake survived poorly and produced very low returns (Anonymous 1989_c). Thomas (1995) recommended that yearling splake in excess of 50 grams were needed to improve post-stocking survival and returns to the angler. After four consecutive years of evaluating splake fisheries in southeastern Ontario, Kerr (1992) concluded that large (e.g., 60 – 80 gram) yearling splake were required to maximize survival and provide the highest quality angling opportunities.

There is every indication that growth of splake is rapid. From some of the earliest crosses, Stenton (1950) reported that splake achieved sizes of 12 – 14 inches by the age of 21 months. In Jack Lake, Ontario, splake grew from 4 to 12 inches in length from the time of stocking in May until capture in October (Anonymous 1959). In several Algonquin Park lakes, Martin and Baldwin (1960) recorded splake growth rates of 12 inches at age II, 16 inches at age III and 18 inches at age IV. Budd (1957) reported that, after one year in South Bay, Lake Huron, splake averaged 13.9 inches in fork length.

Growth rates vary among stocks of F_1 splake. For example, of the three F_1 splake stocks currently in the provincial fish culture system, growth rates are markedly lower for the cross involving the Lake Nipigon brook trout and the Slate Island lake trout (both wild strains).

The largest splake, currently on record with the National Fishing Hall of Fame, is a fish weighing 20 pounds 11 ounces (9.38 kg) . This fish was angled from Georgian Bay in 1987. Fraser (1983) reported the capture of two large F_1 splake from Redrock Lake, Ontario. The first fish measured 62.8 cm in fork length and the second fish measured 74.8 cm fork length and weighed approximately 5.5 kg. Both fish were 16 years of age when captured. Other reports of large splake include a 8.626 kg fish angled from the Kaniapiskau River in Québec, a 7.50 kg fish netted from Lake Huron and a 6.293 kg fish netted from Chrysler Lake near Gogama (Berst et al. 1980).

Stocking Density – Stocking rates are important because returns are related to the number stocked but density dependent factors become critical at high stocking rates. In a study of several stocked lakes in Algonquin Park, Liskauskas and Quinn (1991) found that the number of splake recovered was positively correlated with stocking density. In this study, splake stocking rates ranged from 40.3 to 148.6 fish/ha. Orendorff and Fraser (1984) reported that, in the northern portion of southcentral Ontario, splake were stocked at an average density of 110 fish/ha or 2.2 kg/ha.

In Precambrian Shield lakes in Québec, splake are stocked at rates of 20 – 40 fish/ha where other coldwater species are present and at rates of 15 – 25 fish/ha where warmwater species are present. (Québec MLCP 1988). In Ontario, splake stocking guidelines are expressed in one of two fashions:

(i) **# fish per surface area**
- 100 yearling fish per hectare (where yearlings are approximately 40 gm).
- 200 – 250 fall fingerling fish per hectare

(ii) **biomass per surface area**
- 2.5 kg per hectare for both fingerling and yearling splake.
- kg fish/ha = 0.94 MEI (metric)

In northeastern Ontario, modifications (OMNR 2000) were recently made to these guidelines in order to reflect the actual amount of splake habitat instead of the surface area of the waterbody. For “brook trout” type lakes (small) splake are stocked are a maximum density of 4.5 kg/ha of water > 6 m in depth. For “lake trout” type lakes (larger), splake are stocked at a maximum density of 2.3 kg/ha of water > 6 m in depth.

In addition to stocking density, the frequency of stocking must be considered. Fraser (1988_c) found that initial plantings of F_1 splake suppressed stocked splake in subsequent years and recommended planting splake every third year. Liskauskas and Quinn (1991) reached the same conclusion and recommended that splake be stocked every 2 – 3 years. Ihssen et al. (1982) recommended that annual stocking of F_1 splake should only be conducted if each planting was heavily exploited in the year immediately after stocking.

Contribution of Stocked Splake to the Fishery

Despite the number of splake which have been stocked over the years, there have been relatively few comprehensive studies to evaluate post – stocking survival and provision of angling opportunities (see Appendix 3). It is well known that splake are a very catchable fish particularly during the winter and stocked splake have provided important fisheries in many areas of the province. Based on surveys of both the winter and open water splake fisheries in southeastern Ontario in 1991, Kerr (1991_a, 1991_b) estimated that almost 90,000 angler hours of fishing activity was directed toward stocked splake fisheries in that area.

Returns of splake, in terms of the number stocked, is variable. Berst and McCombie (1975) reported that 10% of the splake planted in a small impoundment in southern Ontario were recovered by anglers. Only 62 splake were captured of 9000 planted despite a relatively intense fishery in Redrock Lake, Ontario (Fisher 1986). In Jack Lake, Algonquin Park, Budd (1959) reported that 555 of 700 (78%) splake planted were recovered. In Parvin Lake, Colorado, anglers caught an estimated 2,011 splake from a stocking of 10,172 fish (19.8%) the previous spring (Leik 1959_c).

Potential Impacts of Splake Stocking

Although not well documented, there are several potential impacts of introducing splake into a waterbody. These include:

(i) **Predation –** Splake are highly piscivorous and are known to predate several species of fish and their eggs (Berst et al. 1981, Kerr and Grant 2000). In East Lake, Ontario, the introduction of F_1 splake reduced the density of a stunted yellow perch population (Rumsey and Lamarre 1994). In at least one instance (Satterfield and Koupal 1995) splake have been used as a predator to reduce high density, stunted brook trout stocks.

(ii) **Competition for Food –** There is likely some level of competition for food with other species of fish. Potter (1995) suggested that there may be some competition with smallmouth bass for crayfish. In addition, splake are believed to compete for food with rainbow trout during the spring and fall (Leik 1959_a, Burkhard 1962).

(iii) **Competition for habitat –** Splake can utilize nearshore areas for three seasons of the year but are forced to deeper cooler waters, often in the thermocline, during summer months. There is some evidence that, where the species coexist, splake may compete with brook trout for spawning habitat (Hansen 1972).

(iv) **Hybridization –** The F_1 splake is a fertile hybrid and there is the potential for hybridization with either parent species in waters where they coexist. Genetic impacts may be of particular concern with brook trout (Fisher 1986, Fuller et al. 1999).

Stocking Assessment

Splake stocking assessment in Ontario has been sporadic and inconsistent. There are currently no standards or guidelines to ensure that stocking assessment information is collected in a consistent and comparable manner.

Traditionally, field assessments have involved the use of gill nets, of varying lengths and mesh sizes, set in the summer or early fall. Nets have usually been set in or near the thermocline for periods up to 25 hours in duration. The primary objective of these projects is to provide some evidence of post-stocking survival. There have been very few intensive creel surveys designed to evaluate the contribution of stocked splake to the fishery.

There is a definite need for the development of stocking assessment protocols and the establishment of a central data repository for stocking assessment information.

Best Management Practices for Stocking Splake

Based on a review of the published literature and experiences derived from several decades of splake stocking activities in the province of Ontario, several guidelines have been developed to maximize stocking success and, ultimately, returns to the fishery:

Stocking Objective – With few exceptions F_1 splake are stocked to provide recreational angling opportunities and, in some cases, divert angling pressure away from other heavily utilized species such as lake trout. The need and rationale for stocking splake should be clearly identified. In order to evaluate the success of any splake stocking program, quantified targets should be developed prior to the stocking event. For put-grow-and-take stocking, criteria should usually be based on ensuring the weight of trout returned to the fishery is greater than (or at least equivalent to) the biomass of fish stocked. Put-and-take stocking should be evaluated in terms of a percent return to the fishery based on the number stocked. Managers should expect a return of at least 50 – 60% of the numbers stocked.

Strain of Fish – Fisheries managers should select the most appropriate strain of splake to match the environment being stocked and to meet the desired objectives. Some considerations might include growth potential, maturation and longevity.

Habitat in Recipient Waterbody – Several failed splake stocking projects have been attributed to poor habitat conditions. Managers should ensure habitat conditions in the recipient waterbody are favourable before splake are stocked. Splake generally perform best in smaller (i.e., < 100 ha) lakes with a well oxygenated hypolimnion (i.e., > 4 – 5 mg L^{-1} below the thermocline) and waters in the 12 – 14º C range.

Age/Size of Fish to Stock – Most stocking programs should involve the use of yearling fish stocked in the late spring. The size of fish should be maximized (e.g. > 30 – 40 grams) in order to ensure post-stocking success and maximize returns to the fishery. Plantings of other life stages (e.g., fall fingerlings) should be considered experimental.

Stocking Rate – Stocking rates should account for the size of fish and the amount of splake habitat available. It is recommended that stocking rates be based on biomass instead of the number of fish. As a general rule, splake should be stocked at rates of 4.0 – 4.5 kg/ha of water > 6 m in depth in smaller (< 50 ha) lakes and 2.0 – 2.5 kg/ha of water > 6 m in depth in larger (> 50 ha) lakes.

Stocking Frequency – There is evidence of intraspecific competition when splake are stocked on an annual basis. Unless there is an intense fishery which removes most if not all fish the year they are stocked, it is recommended that splake be stocked every 2 – 3 years in an individual waterbody.

Fish Community in Stocked Waterbody – Splake should not be stocked in waters having a resident, naturally reproducing population of either brook trout or lake trout. There is also some evidence that splake should not be stocked in waters having strong populations of pelagic species such as herring, whitefish or smelt. If possible, lakes supporting a sport fishery for other species, such as smallmouth bass, should not be stocked with splake. To realize optimal growth, an abundance of preferred forage fish should be present in the lake.

Stocking Technique – Fish should be released over the deep water zone of the lake and distributed over a broad area. Splake should not be stocked when receiving waters exceed 16 – 18º C.

Stocking Assessment – Over time, assessment of stocked splake should occur on every lake which is stocked. Assessment programs should be implemented no longer than 1 – 2 years after stocking. Information should be maintained in a central repository.

Annotated Bibliography

ANONYMOUS. 1879. Eleventh report of the Commissioners of Fisheries of the State of New York, p. 7 – 10.

This is the first known reference to hybrid trout which were raised at the Caledonia fish hatchery in New York state. By 1881 there was a small brood stock. Plantings of this hybrid were made but no follow-up assessment was conducted.

ANONYMOUS. 1953. Splake plantings. News Release, Ontario Department of Lands and Forests. 5 p.

The news release reviews the history of the hybrid trout. First plantings were in the fall of 1953 when 24,500 F_1 fingerlings were planted in seven northern Ontario lakes. The parents were female lake trout, Montreal River, Lake Superior origin, and male brook trout from the Sault Ste. Marie hatchery.

ANONYMOUS. 1959. Trout hybrids introduced. p. 9 – 10 *In* A Guide to Angling in Algonquin Provincial Park. Ontario Department of Lands and Forests.

A recent and spectacular arrival on the fisheries scene has been the hybrid between lake trout and speckled trout. This glamorous product first received the most graceless of names “splake” but has now become the “Wendigo”. As far back as 1946, this cross was undertaken in western Canada and third generation fish have been produced there. It may be interesting to note that the cross can only be made successfully by using lake trout females and speckled trout males. In the reverse cross, the speckled trout eggs is too small for the developing embryo.

Plantings of the hybrid trout have been made in a number of Algonquin Park lakes since 1954. Among these are Opeongo, Redrock, Sproule, Brewer and Jack lakes. These introductions have been particularly successful in the smaller lakes.

The average angler, unless quite observant, may not realize he has caught a hybrid. In appearance the hybrid has some of the characteristics of both parents in varying degrees. The sports are usually pinkish, although many fish have little or no color. The tail is generally intermediate between the deeply forked tail of the lake trout and the square tail of the speckled trout. They are somewhat heavier for their length than native speckled trout and lake trout, although they are much less stocky than speckled trout planted in the smaller lakes.

An intensive study of their life history and habits has been made. Their depth distribution in lakes in the summer months is similar to that of the speckled trout, that is, they live in the layer of water between the warm surface layer and the deep cold layer. In the smaller lakes this is generally in depths of 20 to 35 feet. Their food habits are similar to those of the speckled trout as they feed extensively on invertebrate forms of crayfish and insects.

One of the most remarkable features of the hybrid is its rapid growth. Hybrids planted as yearlings (about four inches long) during May in Jack Lake had reached lengths of over 12 inches by October of the same year. They averaged one and one-half inches longer compared with speckled trout of the same age that had been planted in the small lakes, four to five inches longer than native speckled trout and five to ten inches longer than lake trout. Hybrid trout plantings in May of 1954 had reached lengths of over 20 inches and weights of nearly five pounds by the spring of 1958.

There has been no indication of successful natural reproductions by the hybrids in Algonquin Park lakes. It is, however, believed that they at least go through the spawning act.

The hybrid trout is an excellent game fish, although here too, it reveals its split personality. Some fight much more like speckled trout while others fight deep and doggedly like lake trout. The hybrid has a very marked schooling behavior and this profoundly affects your fishing luck.

ANONYMOUS. 1968. A review of plans for Lake Huron rehabilitation with splake in light of new information. Fisheries Division, Michigan Department of Conservation, Ann Arbor, Michigan. 5 p.

Originally the splake held appeal because of the possibility that the new variety might accomplish rehabilitation even if lamprey control failed. The proposed efforts to rehabilitate Lake Huron with splake was based on the need for establishing a large population of splake prior to the establishment of significant lake trout populations in Lake Huron. Without such a headstart, extensive backcrossing of splake with lake trout is expected to occur and with it the loss of splake identity.

Significant new knowledge has been gained and conditions in Lake Huron have changed since the decision to attempt rehabilitation with splake rather than lake trout was made in 1965. It now seems that lake trout is the more desirable deepwater predator for Lake Huron than splake. There is no reason to assume that the lake cannot be successfully rehabilitated with lake trout, conversely, there is much evidence that it can. Rehabilitation with splake is fraught with uncertainties, particularly in view of evidence of significant lake trout migrations into the lake from Lake Michigan and lack of demonstrated superiority of the splake's reproductive potential under heavy size selective mortality.

ANONYMOUS. 1985_a. Schamerhorn Lake splake stocking assessment. File Report, Ontario Ministry of Natural Resources, Parry Sound, Ontario.

Yearling splake were stocked in Schamerhorn (Clear) Lake in 1983 (1,575 fish) and again in 1985 (3,000 fish). During the summer of 1985 a creel census was conducted in which 25 interviews were completed. No splake or lake trout were caught by any of the anglers interviewed. Six overnight gill net sets were made in July 1985 and two splake and one lake trout were captured. The splake appeared to be very large brook trout with some lake trout characteristics and had to be positively identified by a count of pyloric caecae. The two splake captured during gill netting had both exhibited rapid growth since stocking. Both specimens had been feeding on smelt. It appears likely that not many of the fish remain from the 1983 planting. Predation by smelt or mortality caused by competition from smelt may be significant on the newly stocked splake. Further assessment should be conducted to determine at what size the splake enter the fishery and what percentage of the stocked fish are removed by angling. The 1985 stocking of 3,000 splake should be assessed at an earlier date than did those from the 1983 planting.

ANONYMOUS. 1985_b. Splake assessment netting on Grindstone Lake. Unpublished data, Ontario Ministry of Natural Resources, Bancroft, Ontario. 3 p.

Two gill nets, comprised of meshes 2", 3" 4" and 5", were set overnight on October 10 – 11, 1985 in Grindstone Lake to evaluate survival of stocked splake. Nets fished for a period of 20.8 hours and produced a catch of 3 white suckers, 4 splake, 1 smallmouth bass, 1 pumpkinseed and 1 lake whitefish. The splake averaged 32.8 cm in fork length (32.0 – 33.1) and 356.3 grams in weight (325 – 375).

ANONYMOUS. 1985$_c$. 1985 creel census on Granite, Grindstone and Spring lakes. File Report, Ontario Ministry of Natural Resources, Bancroft, Ontario.

For one week in the winter of 1985 and the following summer, the Ministry of Natural Resources conducted a creel census on Granite, Grindstone and Spring lakes. The census revealed that the splake harvest was very low in the summer. For example, there was only one splake sampled on Granite Lake producing a catch-per-unit-effort (CUE) of 0.042 , an estimated yield of 11.2 kg (0.422 kg/ha) and estimated harvest of 37 splake.

The survey recorded no harvest of splake on Grindstone or Spring lakes although the estimated fishing effort on all lakes was similar at 877 rod hours, 1016 rod hours and 890 rod hours on Granite, Grindstone and Spring lakes respectively.

Although higher in the winter creel survey, the observed harvest was poor in Granite and Grindstone lakes with 0 and 4 splake harvested, respectively. This low harvest had a calculated CUE of 0.000 and 0.062, an estimated harvest of 0 and 23 fish and an estimate yield of 0.000 and 0.077 kg/ha for Granite and Grindstone lakes respectively. The observed winter splake harvest on Spring Lake was considerably higher with 22 splake producing an estimated harvest of 57 fish, a CUE of 0.080 and a yield of 0.182 kg/ha.

The yields for Grindstone, Granite and Spring lakes in both winter and summer are far below the morphoedaphic index (MEI) maximum sustainable splake yields of 123.15 kg/ha, 95.92 kg/ha and 240.41 kg/ha respectively.

ANONYMOUS. 1986$_a$. 1986 splake stocking assessment on Egg Lake, South Canonto Township. File Report, Ontario Ministry of Natural Resources, Bancroft, Ontario. 9 p.

Splake stocking assessment was performed on Egg Lake from September 23 – 25, 1986. Water chemistry results indicate suitable water quality for trout to the 7 meter depth. Water chemistry results at the 7 m depth were as follows: water temperature 14.0º C and dissolved oxygen 6.8 ppm. The lake presently has a very large perch population.

Index gill netting involved four overnight sets for a total of 87.7 hours. The total net catch was 5 splake, 13 rock bass, 3 pumpkinseed and 71 golden shiners. Eight splake were sampled during the assessment – three of which were obtained from anglers. Sampled splake ranged in size from 18.1 cm fork length (0.050 kg) to 34 cm fork length (0.275 kg). The splake and rock bass sampled during gill netting were very thin and in poor condition. Egg Lake was stocked with 1,000 yearling splake in 1983 and 1985 and with 15,000 yearling splake in 1986. Angler reports indicate that Egg Lake receives moderate fishing pressure with a moderate to poor angling success.

From this assessment it is recommended that Egg Lake continue to be stocked with the largest splake available. In the future Egg Lake should be reclaimed and stocked with brook trout.

ANONYMOUS. 1986$_b$. Voluntary creel survey report for Egg Lake, South Canonto Township. Unpublished data, Ontario Ministry of Natural Resources, Bancroft, Ontario. 1 p.

Creel survey information was collected on a voluntary basis on Egg Lake in 1985 and 1986. In 1985, 52 angler hours of effort were expended to catch 2 splake for a CUE of 0.038. In 1986, two splake were captured during 38 hours of angler effort (CUE = 0.053).

ANONYMOUS. 1986$_c$. 1986 splake stocking assessment on Granite Lake, South Canonto Township. File Report , Ontario Ministry of Natural Resources, Bancroft, Ontario. 9 p.

Granite Lake has been stocked annually since 1983 with 1,000 – 3,000 splake. These splake are being stocked on a large population of yellow perch and white sucker which exist naturally in the lake.

A splake stocking assessment was performed on Granite Lake from September 22 – 24, 1986. Water chemistry results from the assessment show suitable water quality exists down to the 9 meter depth. Index gill netting on Granite Lake involved four overnight sets for a total of 86.8 hours. The total catch for this netting was 3 splake, 35 yellow perch, 49 white sucker and 2 pumpkinseed.

Several questions have arisen as to the survivability of the stocked splake in Granite Lake resulting from direct competition for forage with the large yellow perch population. A creel census performed in the summer and winter of 1985 indicated a very poor angling return for splake. No other positive voluntary creel data has been submitted for Granite Lake to date. From this assessment it was determined that Granite Lake has suitable year-round water quality for splake as evidenced by the open water chemistry results and the sampling of large, older splake which have successfully over-wintered. In an attempt to minimize the competition from yellow perch and increase the angling return, it is suggested that splake of a catchable size (e.g., 2 year old fish) be stocked on an experimental basis in Granite Lake.

ANONYMOUS. 1986$_d$. Voluntary creel report for Spring Lake, Ashby Township. Unpublished data, Ontario Ministry of Natural Resources, Bancroft, Ontario. 1 p.

Spring Lake is a 46.4 ha lake in Ashby Township which is stocked with splake. Based on information provided voluntarily by anglers, 92.5 angler hours of fishing effort were exerted in 1986 to harvest 25 splake. This accounts for a fishing success rate (CUE) of 0.270.

ANONYMOUS. 1986$_e$. Splake stocking assessment on Labine lake. File Report, Ontario Ministry of Natural Resources, Bancroft, Ontario. 2 p.

Labine Lake, 4.8 ha in surface area, was stocked in 1984 with 500 yearling splake. Angler reports indicate low fishing pressure on Labine lake with poor angling success. Large numbers of pumpkinseed have been observed along the shoreline.

Splake stocking assessment was performed on September 24th and 25th, 1986. Water chemistry results taken during the assessment indicated dissolved oxygen depletion occurred at the 8 meter depth.

Index gill netting involved three overnight net sets for a total of 62.2 hours. The total catch was 1 splake, 3 pumpkinseed and 12 white sucker. The splake sampled measured 56.1 cm and weighed 1.925 kg.

From the assessment, it is recommended that splake stocking be discontinued until Labine Lake can be reclaimed.

ANONYMOUS. 1986$_f$. Splake stocking assessment in Fox Lake, Ashby Township. File Report, Ontario Ministry of Natural Resources, Bancroft, Ontario. 3 p.

Fox Lake was assessed from July 21 to 23, 1986. Water chemistry results showed suitable water quality for trout down to the 24 meter depth. Water quality at that depth was defined by a temperature of 5º C,

dissolved oxygen of 4.2 ppm and a pH of 6.5. The thermocline at the time of the assessment was located from 2 to 8 meters.

Two 400 foot gangs of gill net were set for 22 hours with a total catch of 2 lake trout, 216 yellow perch, 4 white suckers, 1 creek chub and 1 common shiner. Pumpkinseeds were also observed in the lake during the assessment. Fox Lake was stocked in 1984 with 500 splake but none were recovered. From the assessment it was decided that Fox Lake be removed from the splake stocking program and in the future be managed as a lake trout fishery with supplemental lake trout stocking. The stocking of splake in Fox Lake will be discontinued because of the presence of a large yellow perch population and because of the lakes suitability for lake trout (water quality, depth and spawning facilities).

ANONYMOUS. 1986$_g$. Splake stocking assessment on Little Merrill Lake, Effingham Township. File Report, Ontario Ministry of Natural Resources, Bancroft, Ontario. 3 p.

Little Merrill Lake, 57.7 ha in surface area, was stocked with 1500 yearling splake in 1984, 1985 and 1986. Splake stocking assessment was performed on October 2 and 3, 1986. Water chemistry results at this time were quite poor with dissolved oxygen depletion found at the 8 meter depth. Water chemistry results taken in June 1983 showed the lake as having good quality down to 17 meters. During the 1986 assessment water levels on Little Merrill were extremely high resulting from a broken beaver dam on Merrill Lake. This could have affected the water quality on Little Merrill Lake in a detrimental way and it is recommended that subsequent late August water chemistry tests be performed in the future. In 1983 two lake trout were gill netted indicating the presence of a remnant, naturally producing lake trout population. Index gill netting in 1986 produced one splake, one smallmouth bass and several other coarse fish. No lake trout were sampled in 1986. The only splake measured 47.4 cm in fork length and weighed 1.180 kg. Access to Little Merrill Lake is limited in both winter and summer by road conditions and distance from major roadways. From this assessment it is recommended that Little Merrill Lake be removed from the splake stocking program and be left to revert to a smallmouth bass fishery with a remnant self-sustaining lake trout fishery.

ANONYMOUS. 1987$_a$. Splake stocking assessment in Grindstone Lake, Miller Township. File Report, Ontario Ministry of Natural Resources, Bancroft, Ontario. 13 p.

From 1923 to 1970, Grindstone Lake was stocked annually with lake trout, brook trout and rainbow trout. Surveys conducted in 1962, 1974 and 1982 all indicate that suitable water chemistry for trout exists down to the 10 meter depth. Very limited water volume exists in the lake for trout species. Stocking of all trout species was discontinued in 1970 because of the introduction of smallmouth and largemouth bass into the lake and poor water quality in the hypolimnion. Angling success in the past for trout was reported as excellent.

In 1984, Grindstone Lake was placed on the district splake stocking program and has been stocked annually from 1984 to 1987 with 3,500 to 6,000 yearling splake. In October 1985, a splake stocking assessment was undertaken. Angling reports and creel census conducted in the summer of 1985 and the winter of 1986 indicated very poor return of splake. Incidental catches of remnant lake trout have increased with increased angling pressure. Angled lake trout range in size from 3 to 15 pounds indicating that some natural reproduction of lake trout probably occurs in the lake.

In June, 1987 another splake stocking assessment was undertaken in an attempt to recover and sample the stocked splake. Water chemistry results were similar to previous surveys, showing good water quality to the 10 meter depth. Index gill netting involved one overnight set of approximately 1100 feet of gill net of various sizes for a total of 23.4 hours. The total catch was as follows: 5 splake, 3 smallmouth bass, 55 lake herring, 3 yellow perch and 1 white sucker. Four of the five splake collected were sampled, one splake was

destroyed by crayfish in the net. Of the four splake sampled two were from the 1987 stocking (RV fin clip) and measured approximately 18 cm in length and 0.065 kg in weight, one was from the 1986 stocking (no fin clip) measuring 25.5 cm in fork length and 0.150 kg in weight, and one fish was from the 1984 stocking (LV fin clip) measuring 52.5 cm in fork length and 1.675 kg in weight. No splake were recovered from the 1985 stocking.

From this assessment it is recommended that Grindstone Lake be monitored closely in the future and, if there is no improvement in stocking success, the lake should possibly be removed from the district splake stocking program. Poor angling and sampling returns could possibly be a result from a large smallmouth bass population found in the lake.

ANONYMOUS. 1987_b. Splake stocking assessment on Little Yirkie Lake, Denbigh Township. File Report, Ontario Ministry of Natural Resources, Bancroft, Ontario. 2 p.

Little Yirkie Lake, 4.9 ha in surface area, was initially surveyed in June 1969. Previous to this survey the lake had been stocked with brook trout from 1958 to 1962 at which time stocking was discontinued because of the presence of yellow perch in the lake. Sampling done in 1969 confirmed the presence of yellow perch and white sucker. Suitable water quality for trout also existed in the lake to the 4.5 meter depth. In October 1969, Little Yirkie Lake was reclaimed with rotenone. Brook trout stocking commenced in 1970 to 1983.

In 1984 Little Yirkie Lake was placed on the district splake stocking program. The lake was stocked only once in 1984 with 500 yearling splake.

In July 1987 a splake stocking assessment was undertaken on Little Yirkie Lake. Water chemistry results showed suitable water quality for trout down to the 5 meter depth. Index gill netting involved one overnight set of approximately 1,200 feet of net of various mesh sizes (1.5 – 4.5") for a total of 23.8 hours. The netting produced 204 white sucker, 21 yellow perch and 1 splake. The splake sampled was from the 1984 stocking and measured 52.5 cm in fork length and weighed 1.63 kg.

From this assessment it is recommended that Little Yirkie Lake continue to be stocked with splake but at a higher rate of stocking. The stocking rate should be increased to a minimum of one thousand splake per year (204 fish/ha) of the largest hatchery stock available. After two years of stocking at this increased stocking rate, a splake stocking assessment should be done to assess the success of the stocked splake in Little Yirkie Lake.

ANONYMOUS. 1988_a. Splake stocking assessment in Limit Lake, Lake Township. File Report, Ontario Ministry of Natural Resources, Bancroft, Ontario. 8 p.

Limit Lake, a 13.8 ha lake, was initially surveyed in July 1982. Prior to this survey the lake had been stocked with lake trout, brook trout, brown trout and rainbow trout. Sampling during this survey produced golden shiner, rock bass and pumpkinseed. In 1984, Limit Lake was placed on the district splake stocking program. The lake was stocked in 1984 with 750 yearlings and, in 1986, 1987 and 1988 with 1,500 yearlings each year.

In August, 1988 a splake stocking assessment was conducted on Limit Lake. Water chemistry results showed suitable water quality for trout down to the 5 meter depth. Index gill netting involved one overnight set of approximately 1,200 feet of net of 2.5" mesh for a total of 23 hours. This netting produced 16 splake, 215 brown bullheads, 35 pumpkinseeds and 750 rock bass. The sampled splake ranged in size from 0.08 kg (23.5 cm fork length) to 1.30 kg (45.4 cm fork length). Of the fish sampled, 12 had right ventral clips, 1 had an adipose clip and 3 had no fin clips.

From this assessment it is recommended that Limit Lake remain on the splake stocking program and be managed as a splake fishery in the future. To compete with the spiny rayed fish in the lake it is recommended that over the next 2 – 3 years stocking rates be increased with as large a sized fish as possible. This may help to establish a population of larger splake that can eliminate or control the spiny rayed fish populations.

ANONYMOUS. 1988$_b$. McCausland Lake stocking assessment. File Report, Ontario Ministry of Natural Resources, Bancroft, Ontario. 9 p.

McCausland Lake, with a surface area of 35.6 ha, has been surveyed or partially surveyed several times including 1957, 1963, 1964, 1968 and 1976. The most complete survey was in 1968. This lake has excellent water quality and is lightly developed. It has no habitat stresses for coldwater fish.

Records indicate that it was stocked with brook trout from 1929 to 1958 and provided excellent fishing prior to the introduction of yellow perch around 1950. Rainbow trout were stocked from 1953 to 1956 as they are expected to do better in competition with perch. Rainbows were recorded to be present in the lake in the 1957, 1963, 1964 and 1968 surveys and angler catches were reported in 1965; nine years after the last stocking.

Splake were introduced in 1957 as an experimental planting. Eight hundred splake were stocked. These fish were reported in angler catches but very few positive identifications were made. Lake trout were stocked annually from 1961 to the early 1980s and splake were re-introduced in 1984 with annual plantings since then. In 1988 both splake and lake trout were planted in McCausland Lake.

In June 1988, a stocking assessment was completed on McCausland Lake. Water chemistry tests indicated good trout habitat throughout the hypolimnion with oxygen levels of 5.2 mg L^{-1} at the bottom. Index netting produced 10 splake, 7 lake trout, 1 smallmouth bass, 64 yellow perch, 63 white suckers and 5 golden shiners. This is the first recorded occurrence of smallmouth bass in the lake. Splake ranged in size from 24.9 – 36.2 cm in length and from 0.15 – 0.55 kg in weight. All fish were from the 1986 stocking. Stomach contents of captured splake included plankton, invertebrates, small fish and crayfish.

The splake and the lake trout were spatially separated in the lake. All the splake were caught in or near the bottom of the thermocline whereas the lake trout were caught in or near the deeper waters of the lake. There was a substantial gap between the depths where the two species were taken.

From this assessment it is recommended that McCausland Lake continue to be stocked with both splake and lake trout as it appears to be able to support a two tier coldwater fishery. The presence of unclipped lake trout indicates that natural reproduction is occurring in McCausland Lake. As 1988 was the first year that the two species were both planted, it is recommended that further assessment be done in 1993 to determine the longer term success of coincidental stocking of these two species.

ANONYMOUS. 1988$_c$. Splake stocking assessment on Little Long Lake, Effingham Township. File Report, Ontario Ministry of Natural Resources, Bancroft, Ontario. 9 p.

Little Long Lake, 28.8 acres in surface area, was initially surveyed in August 1975. Prior to this survey the lake had been stocked with brook trout. Sampling during the survey produced brook trout, golden shiners and pumpkinseed. In 1982 Little Long Lake was stocked with rainbow trout. In 1984 Little Long Lake was placed on the district splake stocking program. The lake was stocked in 1984 with 750 yearlings, in 1987 with 1,000 yearlings and in 1988 with 500 yearlings.

In July 1988, a splake stocking assessment was undertaken on Little Long Lake. Water chemistry results showed suitable water quality for trout down to the 6 meter depth. Index gill netting involved one overnight set of approximately 1,200 feet of net of various mesh sizes (1.5 – 4.5") for a total of 22.5 hours. This netting produced 23 splake, 12 white suckers and 1 pumpkinseed. No rainbow trout were sampled in the nets. The sampled splake ranged in size from 0.08 kg (28.0 cm fork length) to 0.64 kg (37.0 cm). Of the 23 sampled splake, 21 were from the 1986 stocking and 2 were from the 1987 stocking. All but six splake had plankton in their stomachs.

From this assessment it is recommended that Little Long Lake remain on the splake stocking program. The large number of splake caught favour the future stocking of splake. Subsequent plantings of splake on alternate years should be followed by stocking assessment to determine the success of stocked trout.

ANONYMOUS. 1989_a. Splake stocking assessment on Horne Lake. File Report, Ontario Ministry of Natural Resources, Blind River, Ontario. 2 p.

Prior to cultural eutrophication, Horne Lake maintained a resident lake trout population. With recent improved environmental conditions an attempt to return an artificial salmonid fishery was carried out. Splake were chosen since they produce better returns than lake trout or brook trout and individuals tend to grow at a much faster rate. In 1988, 1,000 splake (37.8 gm/fish), bearing an adipose fin clip, were introduced. In 1989, 1,500 more splake (18.0 gm/fish), bearing a left ventral fin clip, were stocked.

The success of these plantings were evaluated by assessment netting in the summer of 1989. Splake, rock bass, brown bullhead, shiners, white suckers and pumpkinseed were captured in the nets. Of the 38 splake captured, 35 were sampled and 3 released. The overall catch rate (CUE) was 6.3 fish per 100 feet of gill net set overnight (1.2 for 1988 stocked fish and 4.7 for 1989 stocked fish). There was a 4 : 1 ratio of 1989 : 1988 splake. No weights of fish were obtained.

Initial catch-per-effort indicate splake to be a good candidate for put-grow-take stocking in Horne Lake. Both ages of stocked fish are well represented and growth appears to be above what could be achieved by lake trout or brook trout stocking.

ANONYMOUS. 1989_b. Splake stocking assessment on Plump Lake, Scarfe Township. File Report, Ontario Ministry of Natural Resources, Blind River, Ontario. 12 p.

Plump Lake, Scarfe Township, was planted with splake in 1986 (2,500 fish with a right pectoral fin clip), 1987 (3,100 fish with a right ventral fin clip) and 1989 (3,100 fish with a left ventral fin clip). Six gill net sets were made in the fall (October 25 – 25; November 1 – 2) of 1989 to evaluate success of these plantings.

The catch consisted of 308 rock bass, 241 lake herring, 35 lake whitefish, 11 yellow perch, 9 white suckers, 1 burbot, 1 smallmouth bass and 1 splake.

Splake stocked during the spring of this year (1989) should have been very catchable. Only one splake was captured indicating very low returns. A strong herring population exists, as well as several competitors including yellow perch and rock bass.

ANONYMOUS. 1989_c. Splake stocking assessment on Granite Lake, South Canonto Township. File Report, Ontario Ministry of Natural Resources, Bancroft, Ontario. 8 p.

In 1983 Granite Lake was added to the splake stocking program and since that time has been stocked every year with 1,000 – 3,000 yearling splake. There seems to be very little return on these fish. This could be due to the large population of yellow perch and white sucker. The splake cannot compete for forage with the large amount of yellow perch.

Four gill nets were set in Granite Lake on May 23, 1989. The nets fished for approximately three hours each. The total catch was 4 splake, 53 white sucker and 60 yellow perch. The splake averaged 20.7 cm in fork length (20.1 – 21.7) and 76.3 grams in weight (65 – 100).

From this assessment it is recommended that Granite Lake be removed from the splake stocking program unless we can get larger-sized splake to stock in the lake. The larger fish would compete better with the undesirable species. Presently there is no return for the large number of fish that are being put in the lake. The splake obviously can't compete with the yellow perch in the lake.

ANONYMOUS. 1990_a. Trout stocking assessment on Scaup Lake. File Report, Ontario Ministry of Natural Resources, Hearst, Ontario. 2 p.

A stocking assessment was carried out on Scaup Lake, a 30 hectare lake in Rogers Township, on August 27, 1990 to determine the success of previous stockings. A standard lake survey gill net was set across the southern basin of the lake for two hours. Three brook trout and three F_1 splake were captured. It appears that the brook trout and splake in Scaup Lake are surviving the stockings and doing well.

ANONYMOUS. 1990_b. Splake stocking assessment on Horne Lake. File Report, Ontario Ministry of Natural Resources, Blind River, Ontario. 6 p.

Horne Lake has been stocked with F_1 splake for the past few years. This assessment was designed to evaluate the survival of those planted fish especially large splake planted in the spring of 1990. Three lots of splake were planted in the spring of 1990 as follows: May – 1,500 splake (LP fin clip) @ 50 gm each, June 1990 – 1,500 splake (LV fin clip) @ 18 gm each, and June – 1,000 splake (Ad fin clip) @ 378 gm each.

A small mesh gill net was set overnight from July 5 – 6, 1990. Netting occurred under stratified conditions. A total of 24 splake, 75 rock bass, 8 white suckers and 3 pumpkinseed were captured. The splake catch was comprised of fish from both the 1989 (27% of catch) and the 1990 stocking (73% of catch). All splake showed good growth since the time they were planted.

Three factors strengthen the decision to continue stocking Horne Lake on a planned put-grow-take strategy. The high 1+ and 2+ age class catch rates and good growth indicate habitat conditions are well suited for a splake fishery. Secondly, angling pressure remains high particularly during the winter and spring months. Lastly, the absence of 4+ fish suggests fish are being captured and utilized (the perfect scenario for a put-grow-take fishery). Many residents must consider the quality of the lake's fish suitable for foodfare.

ANONYMOUS. 1991_a. 1991 splake stocking assessment in Grindstone Lake. File Report, Ontario Ministry of Natural Resources, Bancroft, Ontario. 4 p.

In September 1991, a splake stocking assessment was undertaken on Grindstone Lake. Water chemistry was not completed at this time because lakes in the area had already started to turnover. Index gill netting involving one overnight set of approximately 800 feet of 1.5" mesh and 400 feet of 5.5" mesh for a total of 22 hours. This netting produced 25 lake herring, 15 white suckers, 8 smallmouth bass, 4 largemouth bass and 3 splake. The sampled splake were of two different size classes ranging in size from 0.8 kg to 1.5 kg.

From this assessment it is recommended that Grindstone Lake remain on the stocking program. The small number of splake caught do not fairly represent stocking success. Anglers are reporting good numbers of splake being caught, one over eight pounds caught this summer. The lake herring and bass populations may be competing with the splake so future stocking of the largest fish possible would be beneficial.

ANONYMOUS. 1991_b. 1991 splake stocking assessment in Blue Lake, Barrie Township. File Report, Ontario Ministry of Natural Resources, Bancroft, Ontario. 4 p.

Blue Lake was initially surveyed in 1983. Water chemistry results at the time of the survey showed suitable water quality to 17 meters. Sampling produced white suckers and smallmouth bass. In 1988, Blue Lake was put on the district splake stocking program. It received 3,000 yearlings in 1988, 3,000 yearlings in 1989, 3,000 yearlings in 1990 and 2,300 yearlings in 1991.

In October 1991, a splake stocking assessment was completed on Blue Lake. Water chemistry was not done because the lake had already begun to turnover. Index netting, involving one overnight set of approximately 800 feet of 2.5" mesh gill net, produced 32 splake, 70 white suckers, 6 largemouth bass and 8 smallmouth bass. There were three different size classes of splake: 25 were from this spring's stocking, 6 were from 1990 and 1 was from 1989.

From this assessment, it is recommended to continue to manage Blue Lake as a splake fishery. A follow-up assessment in 2 – 3 years would help determine if the splake are surviving from year to year.

ANONYMOUS. 1991_c. Splake stocking assessment in Spring Lake. Unpublished data, Ontario Ministry of Natural Resources, Bancroft, Ontario. 4 p.

Gill netting was conducted on Spring Lake, Ashby Township, on July 16 – 17, 1991 to evaluate the survival of stocked splake. Three gill nets were set and produced a total catch of 15 splake, 140 white suckers, 14 rock bass and 3 pumpkinseed. Water chemical analysis revealed that there was an oxygen deficiency below 8 meters in depth.

ANONYMOUS. 1992_a. Voluntary creel survey information for Big Mair Lake. File Report, Ontario Ministry of Natural Resources, Bancroft, Ontario. 4 p.

Big Mair Lake has been stocked with F_1 splake for a number of years. In an effort to determine the survival and contribution of stocked splake to the fishery a volunteer creel census was initiated in 1985. Catch-per-unit-effort (CUE) ranged from 0.115 in 1986 to 0.538 in 1987. In the winter of 1992, thirty-three angled splake were sampled. The splake catch averaged 38.8 cm in length (26.5 – 63.4) and 827.3 grams in weight (400 – 2,625).

ANONYMOUS. 1992_b. Characteristics of splake angled from Brooks Lake. Unpublished data, Ontario Ministry of Natural Resources, Bancroft, Ontario. 3 p.

Sixty-eight splake, angled from Brooks Lake during the winter of 1992, were sampled. Angled splake averaged 28.8 cm in length (26.0 – 41.0) and 321.7 grams in weight (200 – 700).

ANONYMOUS. 1992_c. Characteristics of splake angled from Grindstone Lake. Unpublished data, Ontario Ministry of Natural Resources, Bancroft, Ontario.

Sixteen splake, angled from Grindstone Lake during the winter of 1992 were sampled. Angled splake averaged 28.4 cm in length (22.0 – 35.0) and 287.5 grams in weight (200 – 400).

ANONYMOUS. 1992$_d$. Characteristics of splake angled from Granite Lake. Unpublished data, Ontario Ministry of Natural Resources, Bancroft, Ontario. 2 p.

Twenty-three splake, angled from Granite Lake during the winter of 1992, were sampled. Angled splake averaged 28.1 cm in length (24.0 – 31.0) and 289.8 grams (100 – 400) in weight.

ANONYMOUS. 1992$_e$. Characteristics of splake angled from Machesney Lake. Unpublished data, Ontario Ministry of Natural Resources, Bancroft, Ontario. 2 p.

Nine splake, angled from Machesney Lake during the winter of 1992, were sampled. Angled splake averaged 23.1 cm in length (21.0 – 26.0) and 190 grams in weight (100 – 300).

ANONYMOUS. 1992$_f$. Characteristics of splake angled from McCausland Lake. Unpublished data, Ontario Ministry of Natural Resources, Bancroft, Ontario. 1 p.

Fourteen splake, angled from McCausland Lake during the winter of 1992, were sampled. Angled splake averaged 23.3 cm in length (17.5 – 30.5) and 196.4 grams in weight (100 – 500).

ANONYMOUS. 1992$_g$. Characteristics of splake angled from Spring Lake, Ashby Township, in the winter of 1992. Unpublished data, Ontario Ministry of Natural Resources, Bancroft, Ontario. 3 p.

One hundred and twenty-seven splake, angled from Spring Lake during the winter of 1992, were sampled. Angled splake averaged 30.7 cm in length and 298.0 grams in weight.

ANONYMOUS. 1993$_a$. Splake stocking assessment in Trump West Lake. File Report, Ontario Ministry of Natural Resources, Hearst, Ontario. 4 p.

The purpose of this project was to assess the survival of stocked splake. Assessment consisted of setting one 400 foot “lake survey” gill net (mesh sizes ranging from 1 – 5") in waters of depths from 0 – 10 meters. Nets were checked every two hours until a total of 30 stocked fish were caught or eight hours were spent netting.

After four lifts (8 hours netting), the total catch consisted of 2 splake, 11 white suckers and 20 yellow perch.

ANONYMOUS. 1993$_b$. Splake stocking assessment in Little Merrill Lake, Effingham Township. File Report, Ontario Ministry of Natural Resources, Bancroft, Ontario. 2 p.

Stocking assessment by gill netting was conducted by Conservation Officer Ben Kelly on September 10, 1993. Gill net mesh sizes varied from 1.5 – 4.5". Eighteen splake, one lake trout and one smallmouth bass were captured. Splake averaged 38.3 cm in total length and 523.6 grams in weight.

Both the netting results and the water chemistry indicate that splake are a very suitable species for the lake. Angling pressure has been increasing on the lake and probably will continue to do so with the good catches that are being reported.

ANONYMOUS. 1994. Splake stocking assessment in Machesney Lake, Effingham Township. Unpublished data, Ontario Ministry of Natural Resources, Bancroft, Ontario. 2 p.

Machesney Lake is a 32.3 ha lake situated in Effingham Township, Lennox and Addington County. The lake has a maximum depth of 24.5 meters but has less than 4.0 mg L^{-1} of dissolved oxygen at depths greater than 18 meters. The lake contains several other fish species including white sucker, brown bullhead and several cyprinid species. Splake have been stocked for several years.

A gill netting survey was conducted on August 14 and 15, 1994 to evaluate the survival of stocked splake. Ten splake and 31 white sucker were captured. Splake averaged 35.6 cm in length. The largest splake measured 66.0 cm in length, weighed 2.72 kg and had a girth of 33.0 cm. One of the captured splake had fish eggs in its stomach.

AYLES, G. B. 1972. The inheritance of early survival in *Salvelinus fontinalis* x *Salvelinus namaycush* hybrids (splake trout). Ph. D. Thesis, University of Toronto, Toronto, Ontario.

AYLES, G. B. 1974_a. Fecundity and egg size of a brood stock of *Salvelinus fontinalis* x *Salvelinus namaycush* hybrids (splake). Journal of the Fisheries Research Board of Canada 31 : 717 – 720.

Estimates of average egg diameter and average number of eggs per female from a brood stock of *Salvelinus fontinalis* x *S. namaycush* (splake) hybrids were 0.468 cm and 1,160 eggs respectively. Variation in egg size between females was attributable to variation in both size and age of the fish, whereas differences in fecundity were attributed only to differences in female size. At a given size splake had more and larger eggs than have been reported for lake trout. The significance of the findings is discussed in relation to the re-establishment of a viable trout population in Lake Huron.

AYLES, G. B. 1974_b. Relative importance of additive genetic and maternal sources of variation in early survival of young splake hybrids (*Salvelinus fontinalis* x *S. namaycush*). Journal of the Fisheries Research Board of Canada 31 : 1499 – 1502.

Additive genetic and maternal effects of survival of uneyed eggs, eyed eggs, and alevins were determined from five series of matings within a splake brood stock. Average values for family h^2 (heritability) and family m (maternal variance/total variance) were estimated. There were additive genetic effects in alevin survival ($h^2 = .41 \pm .18$) but not in uneyed or eyed egg survival. Maternal effects were greatest within the uneyed stage ($m = .78 \pm .24$) and were least within the alevin stage ($.40 \pm .19$). The additive genetic effect on alevin survival was attributable to genetic differences in the resistance of young splake to blue sac disease ($h^2 = .76 \pm .28$).

AYLES, G. B. and A. H. BERST. 1973. Parental age and survival of progeny of splake hybrids (*Salvelinus fontinalis* x *Salvelinus namaycush*). Journal of the Fisheries Research Board of Canada 30 : 579 – 580.

While examining the survival rates of eggs in a splake brood stock, it was found that the survival of progeny from egg to the time of yolk sac absorption increased as the age of the parents increased. Examination of spawning success of individual fish in another brood stock indicated that the increased survival rate from eggs to eyed eggs, but there was a significant effect of survival from eyed eggs to hatch and from hatch to the time of yolk sac absorption.

BERST, A. H., A. R. EMERY and G. R. SPANGLER. 1981. Reproductive behavior of hybrid char (*Salvelinus fontinalis* x *Salvelinus namaycush*). Canadian Journal of Fisheries and Aquatic Sciences 38 : 432 – 440.

Observations of the reproductive behavior of splake (*Salvelinus fontinalis* x *S. namaycush*) planted in Jack Lake, Algonquin Park, Ontario, indicated that they spawned on rocky shoals from late October to early November. In mid October, splake approached the spawning locations. By late October females had selected redd sites and dominant males were aggressively defending the sites that had been cleared by the females, against other males. Redd digging was variable in duration and frequency. Depth of water over redds varied between 0.5 and 4 m. No attempts were made to cover the eggs, most of which settled into the crevices between rocks. Males and females used acoustic signals during both aggression and courtship. The male initiated courtship by maintaining his head over the female's tail and crisscrossing over the tail. Parallel positioning of the two sexes was a prerequisite to release of sex products. Visual and sonic cues appeared to be used in sequencing behavior. Circling functioned as a neutral action to which any other courting behavior could revert. Nest digging ceased after completion of egg deposition. A swim-in-place behavior of the female was a positive indicator of egg deposition. Egg predation by adult splake was observed but it appeared to offer no serious threat to natural reproduction. Laboratory observations of splake reproductive behavior in aquaria did not indicate any behavioral obstacles to successful natural reproduction. Courtship behavior in aquaria did not indicate any behavioral obstacles to successful natural reproduction. Courtship behavior and egg deposition in the artificial spawning beds was followed by normal development and emergence of fry.

BERST, A. H., P. E. IHSSEN, G. R. SPANGLER, G. B. AYLES and G. W. MARTIN. 1980. The splake a hybrid charr (*Salvelinus namaycush* x *S. fontinalis*). p. 841 – 887 *In* E. K. Balon [ed.]. Charrs: Salmonid Fishes of the Genus Salvelinus. The Hague, Netherlands.

This chapter provides a detailed review of the morphology, physiology, ecology and life history of the splake. Some selected highlights include:

- Hybrids are intermediate in the characters of both their parents.
- Preferred temperatures can be influenced by the thermal history of the fish but generally F_1 hybrids prefer waters near 12º C while F_3 and F_4 hybrids favor temperatures in the 15 – 16º C range.
- Growth is generally rapid. Relative growth rates change with age.
- F_2 hybrids grow more slowly, in terms of both length and weight, than F_1 hybrids.
- Maturation is intermediate from both parents (i.e., 1 – 2 years later than brook trout and 3 – 4 years earlier than lake trout).
- Splake have a much broader range in seasonal spawning time than either parent.
- Hybrids frequent relatively shallow waters during the spring and fall. In summer they aggregated near the thermocline concentrating within the 8 – 20º C isotherm.

BERST, A. H. and A. M. McCOMBIE. 1975. Rainbow trout and splake in a southern Ontario reservoir. Fish and Wildlife Branch, Ontario Ministry of Natural Resources, Toronto, Ontario. 21 p.

Glasgow Glen pond, an artificial impoundment of 13 ha (32 acres) in area and 7.5 m (25 feet) in maximum depth, is supplied mainly be intermittent surface runoff. Although in midwinter and midsummer the water temperatures and dissolved oxygen concentration lay outside the ideal range for trout, this pond supported a sport fishery for planted rainbow trout (*Salmo gairdneri*), splake (*Salvelinus namaycush* x *S. fontinalis*) and brook trout backcrosses (splake x *S. fontinalis*).

During a 5 year period, 2,529 rainbow trout and 850 splake and backcrosses were recovered in 858 angler trips averaging 2.9 hours duration. The average harvest per trip was 2.9 rainbow trout and 1.0 splake or backcross. The 5 year mean CUE for rainbow trout declined from a peak of 1.5 fish per rod hour in early June to 0.6 in late summer then rose again to 2.0 in late October. Over the first four years the mean annual CUE rose from 0.77 to 1.75 fish per rod hour as fish stocks accumulated. The total harvest each year from 1968 to 1972 averaged 12.1 kg/ha (10.8 lb/acre) for rainbow trout and 1.9 kg/ha (1.7 lb/acre) for splake and backcrosses. Estimated recoveries for rainbow trout and splake were 36% and 10% of the number planted respectively. Rainbow trout planted as yearlings survived to age VI and reached 40 cm (16 inches) total length and 0.91 kg (2 lb) in weight. Splake planted as yearlings survived to age IV and attained a maximum length of 33 cm (13 inches) and a weight of 0.32 kg (0.7 lb).

BERST, A. H. and N. R. PAYNE. 1974. Spring migrations of yearling splake planted in Georgian Bay. Journal of the Fisheries Research Board of Canada 31(2) : 226 – 229.

Yearling splake (*Salvelinus fontinalis* x *S. namaycush*) (F_4, F_5) released into Georgian Bay in 1971 and 1972, when lake surface temperatures averaged 5.5º C lower than the hatchery temperature, tended to move into streams within 3.6 km of the planting site where temperatures approached the hatchery temperature and the temperature preferendum of the hybrid. This tendency was not apparent in splake planted at later dates when the lake and hatchery temperatures were similar. Varying stream flows had no discernible effect on the migration of splake into the study streams.

BERST, A. H. and G. R. SPANGLER. 1970. Population dynamics of F_1 splake (*Salvelinus namaycush* x *S. fontinalis*) in Lake Huron. Journal of the Fisheries Research Board of Canada 27(6) : 1017 – 1032.

Ninety-eight percent of 5,391 F_1 splake recovered from a 1966 planting of 49,000 yearlings in Burnt Island Bay on the south shore of Manitoulin Island were taken within 32 km (20 miles) of the planting site. Remaining recaptures were made at distances up to 322 km (200 miles).

Growth rates of the hybrids in Lake Huron exceeded those reported for native and planted lake trout. A commercial size of 0.9 kg (2 lb) round weight was attained by the fall of their second year in the lake. The splake grew rapidly through the winter months. Yearlings fed mainly on invertebrates and 2 – 4 year olds fed almost entirely on fish.

Eight percent of 3,054 hybrids examined had one or more lamprey marks. Fish less than 30 cm (12 inches) bore no evidence of lamprey attack; larger hybrids showed frequencies of lamprey marks increasing from 5.4% for 30 – 40 cm fish to 11.6% for those larger than 40 cm. The incidence of fresh lamprey marks was minimal in spring and early summer and reached a peak in September when more than 20% of the specimens bore fresh marks.

Of the 2 and 3 year old splake recovered, 50 and 40% respectively, were males. The onset of sexual maturity in both sexes occurred at age II. By age III, 86% of the males and 58% of the females were

mature. Ripe 3 year old hybrids of both sexes were captured over former lake trout spawning grounds. Fecundity of 3 year old females averaged 2,512 eggs. Although survival to age IV was low, a substantial number of the hybrids attained sexual maturity.

A total of 8.4% of the planting of 49,000 yearling hybrids was reported taken by sport and commercial fisheries during a three year period.

BERST, A. H. and G. R. SPANGLER. 1973. Splake. p. 30 *In* Lake Huron: The Ecology of the Fish Community and Man's Effects on it. Technical Report No. 21, Great Lakes Fishery Commission, Ann Arbor, Michigan.

First generation splake were planted in Lake Huron by the Province of Ontario during the 1950s and 1960s. These fish tended to remain in the general vicinity of the planting sites. Smelt (*Osmerus mordax*) and sticklebacks (*Pungitius pungitius*) were important in the diet of yearling splake whereas older hybrids fed mainly on smelt and alewives (*Alosa pseudoharengus*). The hybrids grew rapidly in Lake Huron and the onset of sexual maturity in the hybrids occurred at age II when the fish were not completely vulnerable to lampreys and commercial fishing gear. Even though the hybrids were completely vulnerable at age III, a small number survived through the spawning season.

The first plantings of F_4 and F_5 splake, selected for early maturity and the ability to occupy deep water, were made in 1969. These plantings are part of a joint program of rehabilitation of the trout fishery of Lake Huron by the Province of Ontario and the State of Michigan, coordinated by the Great Lakes Fishery Commission. Because of the early maturity, it is expected that the hybrids will surpass the native lake trout in their potential to develop self-sustaining populations in the presence of exploitation by the fisheries and residual lamprey populations.

BETTERIDGE, G. 1985. Movements of rainbow trout (*Salmo gairdneri*) and splake (*Salvelinus fontinalis* x *S. namaycush*) in a small Ontario lakes as revealed by ultrasonic telemetry. Ontario Fisheries Technical Report Series No. 18, Ontario Ministry of Natural Resources, Toronto, Ontario.

The movements of three rainbow trout and three splake, carrying surgically implanted ultrasonic transmitters, were monitored in a 93 hectare lake over a one month period. Tracking was continued for a further 51 days for one of the rainbow trout and 70 days for one large splake. Rainbow trout behavior seemed to be influenced by food item availability and splake movements by water temperature changes. Both species ranged widely throughout the lake, but only splake were regularly located within or near any of four man-made brush shelters. Splake became more sedentary as waters warmed, and one large fish "homed" to a cool seepage area for three months. Rainbow trout were generally more active on a day-to-day basis than splake, and were often found in warm, nearshore waters. Two of the rainbow trout exhibited distinct daily movement patterns.

Surgical procedures proved successful, as three transmitters were recovered from angler-caught rainbow trout 62 to 385 days following implantation. Two units were surgically removed from trap netted splake which were subsequently released. One of these fish was caught by an angler 208 days later. All five of the fish were in good condition at time of recapture and had increased in length while at large.

BOLES, H. D. and F. A. MEYER. 1964. Splake in Deer and Lower Salmon lakes, Sierra County. Inland Fisheries Administration Report, California Department of Fish and Game 64-6 : 1 – 7.

This report summarizes a creel census which was carried out on two California lakes after F_1 splake were introduced. Poor access to one lake with consequent low angling pressure and the shallow depth of the other lake with probable poor survival could not offset the high cost of artificial rearing since there was no apparent outstanding contribution to the fishery. It was concluded that splake were not suitable for this type of management.

BREZOSKY, P. E. Undated. Observations on the splake trout in Lang Pond, New Hampshire. New Hampshire Fish and Game Department, Concord, New Hampshire.

BROWN, B. E. 1961. Behavior of splake and brook trout fingerlings. Transactions of the American Fisheries Society 90 : 328 – 329.

The present study reports on comparative observations of the same strain of domestic brook trout (*Salvelinus fontinalis*) and the splake (*Salvelinus fontinalis* x *S. namaycush*) or hybrid resulting from crossing a male brook trout with a lake trout female. In the particular cross the parent stock consisted of a domestic strain of brook trout and wild lake trout from Cayuga Lake, New York.

Behavior in the hatchery troughs was decidedly different between the two groups. The brook trout were spread evenly throughout the trough while the splake remained at the bottom and huddled along the edges and in the corners. Under the cover of darkness the splake did not hide but did stay near the bottom.

When originally placed in the tank, the splake immediately dived to the bottom and remained there with little movement while the brook trout swam throughout the area with a definite preference for the surface region. Each of the six trials over a period of three weeks showed similar results.

Trials were run in darkness to test the effects of light on depth distribution. Splake were located in the lower part of the tank and when the light was shown on the base of the tank attempted to swim through the bottom of the tank in what appeared to be an attempt to escape the light.

In summary, splake showed a contrasting behavior to the domestic brook trout in all trials attempted. It is concluded that the responses of this domesticated stock of brook trout relative to these trials were not transferred to the F_1 hybrid.

BRYNILDSON, O. M. 1966. Utilization of available food by splake. Annual Progress Report, Wisconsin Department of Natural Resources, Madison, Wisconsin. 12 p.

BRYNILDSON, O. M. and J. J. KEMPINGER. 1970. The food and growth of splake. Research Report 59, Wisconsin Department of Natural Resources, Madison, Wisconsin. 41 p.

Splake (brook trout x lake trout), released as fall fingerlings and spring yearlings in Pallette Lake, Vilas County, Wisconsin, survived and grew at similar rates during 5 years of observation.

Cladocerans and copepods less than 1 mm long were not present in the stomach contents of splake 7 to 23 inches in total length. When the splake were 1 to 4 years of age, aquatic and terrestrial insects and planktonic crustaceans occurred most frequently in over 300 stomachs examined. Although fish began appearing in stomachs of splake which were 3 years old, not until the splake reached the age of 5 years or

more and ranged in length from 15 to 23 inches were fish their most important food. In the stomachs of splake 5 years of age and older, fish constituted nearly 100% of the total food items.

Growth of the splake in length was highly variable and the average coefficient of condition (*R*) was low after 4 years residence in Pallette Lake. The high average *R* of the splake when stocked was not regained until nearly 5 years in Pallette Lake. The largest splake recorded (25.5 inches in total length – 8.85 lbs.) from Pallette Lake was caught on hook and line in December, 1969.

The splake were readily caught on hook and line when collecting splake for growth and food studies before they were 4 years of age. By the time the splake reached age 4 and older, the stock level had declined through natural mortality and splake were no longer readily caught; less than 2% of the splake stocked were recorded in a permit-type creel census through 1969.

BUDD, J. 1955. Islander hooks strange trout. Sylva 11(5) : 16 – 17.

Fishing the Manitou River near its source, Manitou Lake, Gordon Thomas of Manitoulin Island, had himself a battle when a fine big trout hit his lure. Brought to the net, the fish was a real puzzler. It was greyish with pale yellow markings like a lake trout but had the fin and tail patterns of a speckled trout. It was a Wendigo trout, one of the many planted in South Bay in May, 1954 from the Sault Ste. Marie trout rearing station. It was 17 1/2 inches long which, since it was only 3 – 4 inches long when planted, indicated the rapid growth of this new species. Like any hybrid produced from closely related species, the Wendigo trout is more vigorous and grows faster than its parents. Unlike the lake trout, it prefers shallower waters but is a better lake dweller than the speckled trout. It is easy to produce and will reproduce naturally.

BUDD, J. C. 1957. Introduction of the hybrid between the eastern brook trout and lake trout into the Great Lakes. Canadian Fish Culturist 20 : 25 – 28.

In May 1954, the Ontario Department of Lands and Forests stocked 7,135 marked yearling hybrids between the eastern brook trout (*Salvelinus fontinalis*) and the common lake trout (*Salvelinus namaycush*) in south Bay in northern Lake Huron. The parent stocks were wild female lake trout taken during lake trout spawning operations on the Montreal River, a stream flowing into the east shore of Lake Superior about eighty miles north of Sault Ste. Marie, Ontario and hatchery-reared male brook trout. The cross was made at the Tarentorus hatchery near Sault Ste. Marie in early October 1952. The eggs hatched during the winter of 1952 – 53 and the fry were reared according to standard hatchery procedure. In August 1953, the fingerlings were transferred to a trout rearing station at Chatsworth, Ontario, where they were held until the introduction was made. The fish were marked by removal of the right pectoral fin and planted in South Bay on May 19 and 20, 1954. The planting was done from a slowly moving boat, the fish being scattered in the shallow water over gravel and rubble bottom areas at the rate of about 2,000 fish per mile of shoreline.

No hybrids were captured during rather extensive netting with small mesh gill nets in the summer and fall of 1954. The first hybrids were taken in the first lift of pound nets on May 13, 1955 almost exactly one year after the original stocking. Growth was rapid and after one year in the lake the hybrids averaged 13.9 inches in fork length. A number of the fish were tagged and subsequent recapture data recorded. Seven tags were returned from distances up to 100 miles. Two of the tagged fish had entered streams while the other five were taken by commercial gear. Ripe male hybrids were taken in South Bay during late October and early November.

BUDD, J. C. 1959. The use of the hybrid between the eastern brook trout and lake trout in fishery management. Transactions of the Northeast Wildlife Conference 10 : 115 – 116.

The brook trout x lake trout hybrid has been studied in two areas in Ontario: Algonquin Provincial Park and South Bay on Lake Huron. Data indicate that in these areas they possess some advantages over hatchery plantings of either of the parent species. The advantage seems to stem from certain inherent qualities that may be listed as follows:

- More rapid growth;
- Better survival and greater vulnerability to capture;
- Desirable game qualities;
- The ability to withstand sea lamprey predation in Lake Huron, at least through first spawning.

Growth of hybrids both in South Bay and in Algonquin Park was rapid. Those planted in South Bay as yearlings in the spring of 1954 averaged 3.8 inches in fork length. These fish averaged 13.9 inches in June 1955, 19.4 inches in June 1956 and 21.7 inches as four year olds in June 1957. Growth in Algonquin Park was somewhat less rapid but still better than either of the parent species under similar conditions.

The most remarkable feature of the Algonquin Park study was the high return to the creel of one of the plants. A 78% recovery was made from a planting of 700 yearlings in Jack Lake, a 55 acre barren lake. Anglers caught 420 of a total of 550 fish taken.

The use of the hybrids as a base for a selective breeding program was considered. It is hoped that a "lake trout" that reaches sexual maturity in three years can be developed. Such a lake trout might possess a considerable advantage in the Upper Great Lakes where the sea lamprey has essentially eliminated the native stock that requires six or seven years to mature.

BURKHARD, W. T. 1962. A study of the splake trout in Parvin Lake, Colorado. M. Sc. Thesis, Colorado State University, Fort Collins, Colorado.

A study of several selected factors of the life history of the splake trout was conducted at Parvin Lake, Larimer County, Colorado. This 62-acre montane zone lake is a non-fluctuating reservoir. The first splake trout were planted in the lake in 1958 with succeeding plants in 1959 and 1960. A study on the immature splake trout of age groups 0 and I was conducted at Parvin Lake during 1958 and 1959 while this study on splake trout of age groups 0, I, II, and III, was conducted during the summers of 1960 and 1961. Emphasis was placed on (1) food habits, (2) age and growth, (3) maturation, (4) distribution and migration, and (5) harvest by fishermen.

In nearly all phases of the study, water temperatures seemed to be the most important environmental factor to the splake trout. The splake trout fed predominantly on small crustaceans throughout the year with insects being important only during the spring and again in the fall. During periods of thermal stratification and when surface temperatures exceeded 60º F, the splake trout moved into the cooler, deeper waters and concentrated where water temperatures were near 54º F. When restricted to this zone, the splake trout were forced to shift their diet to the more limited selections available while the rainbow trout, not being restricted to the deep water, were able to remain in the shallows and feed on the available insects.

Due to the restricted habitat during the period of warmer water temperatures, the growth rate of the splake trout was retarded. In the first summer of life and when restricted to the deeper waters, the splake trout's growth rate was significantly less than that of the rainbow trout of the same age. During other periods of the year and in the next three years of life, the growth rates of these two species were approximately equal.

In studying length – weight relationship of the splake trout from 2.0 to 19.7 inches in total length, it was found that during the fourth year of life the splake trout reached one pound of body weight at 14 1/2 inches.

The splake trout were harvested by fishermen on all legal types of fishing tackle except during periods when the splake trout were in the deep water and therefore unavailable.

The majority of the splake trout became mature in the third year of life and spawned in late fall. The spawning areas were in water depths of 6 to 12 feet along the rip-rap of the dams. Frequent observations throughout the year failed to disclose any splake trout fry. A small spawning population and high mortality in the F_2 generation eggs and fry in hatchery studies would indicate little success in natural spawning.

The splake trout showed no tendency to migrate out of the lake except for a limited period of time immediately after introduction into the lake.

BUSS, K. and J. E. WRIGHT. 1956. Results of species hybridization within the family Salmonidae. Progressive Fish Culturist 18 : 149 – 158.

The study on which this report is based was conducted at the Benner Spring Research Station near Bellefonte, Pennsylvania. The original objective of the study was to determine the practicality of utilizing species hybrids of trout for: (a) special purpose stocking fish, (b) possible use of fertile hybrids in the selective breeding program, and (c) fundamental studies of speciation.

A survival of 28% of the original number of eggs, arising from the lake trout female x brook trout male, may have been influenced by the fact that green eggs were held until the second day after fertilization before being transported to the research station. Blue sac disease was the principal killer of the alevins. Very few cripples were noted.

The green eggs of the lake trout male x brook trout female cross were subject to the same transportation factor as described for the reciprocal cross. Significantly, many caudal cripples were found among the progeny. This has been assumed to be directly related to egg size, as lake trout embyros are generally larger than brook trout embryos. Apparently the confinement of a normally larger embryo in the smaller brook trout egg caused the crippling effect.

Overall, of all the crosses attempted, the best egg viability results from crosses of species having the most similar chromosomes, such as the matings of brook trout and lake trout. Survival of the sac fry also seems to be directly related to chromosome similarities.

BUSS, K. and J. E. WRIGHT. 1958. Appearance and fertility of trout hybrids. Transactions of the American Fisheries Society 87 : 172 – 181.

F_1 hybrids between various trout species have been reared to the age of sexual maturity at the Benner spring Research Station and observations have been made of their fertility.

Fertile hybrids found among the fish tested were splake (lake trout x brook trout) and the backcross progeny of splake x brook trout. The growth and longevity of the splake exceeds that of any of the Pennsylvania strain of brook trout and at five years of age they are larger than the same age class of lake trout held at Benner Spring.

CHRISTIE, W. J. 1960. Variation in vertebral count in F_2 hybrids of *Salvelinus fontinalis* x *S. namaycush*. Canadian Fish Culturist 26 : 15 – 21.

Dr. F. Fry suggested a long term program of selective breeding to obtain a fish combining the three year reproductive cycle of the speckled trout with the propensity of the lake trout for the benthic environment.

As a preliminary to the program, the segregation of parental characters in the second filial generation was investigated by the examination of a single meristic character, the vertebral number in a sample of 200 specimens.

The fish used were hatched from eggs obtained from the first stock of splake produced in Ontario at the Dorion hatchery of the Department of Lands and Forests in 1951 of which some matured in 1954. Two thousand of the second generation hybrids produced from these survived to 1957 at the Hill's Lake hatchery.

Vertebral counts for the hybrids ranged from 56 to 66, averaging 61.4 with a standard deviation of ± 1.7. The hybrids exhibited a great deal of variation in vertebral number and the range for this sample exceeds the total range for the other two curves. The wide range in vertebral number in this sample and perhaps also the range in size appear to be good evidence of normal pairing of chromosomes and subsequent segregation in the F_2 generation. We therefore tentatively conclude that the splake is a true hybrid from recently evolved parent species and selection for desirable characters to produce a new form is theoretically possible. It further seems evident that in lake which provide satisfactory habitat for one or the other of the parent species, planted splake will only retain their own identify for a few generations.

CORSON, B. W. 1959. Characters of the hybrid trout – splake. Technical Report, New Hampshire Fish and Game Department, Concord, New Hampshire. 3 p.

CUERRIER, J.-P. 1954. This trout is a great fighter. Forest and Outdoors, May, 1956 : 17 – 18.

The first artificial cross between female lake trout and male eastern brook trout was attempted in the fall of 1946 by J. E. Stenton a park warden in Banff National Park. Through exposure to chlorinated water the eggs died before complete development. The cross was successfully repeated in 1947 and several times since by hatchery staff and offspring were obtained. From information reported in news releases, it appears that similar crossings were carried out in 1948 by biologists of the Biological Bureau of the Québec Department of Fish and Game, in 1951 by the Ontario Department of Lands and Forests, and in 1952, by the Wyoming Game and Fish Commission. A recent news release from the Ontario Department of Lands and Forests indicates that several lakes in Ontario have been stocked with nearly 25,000 of these cross-bred trout.

Experience so far suggests that the splake show angling qualities superior to the parents and may replace either parent for angling in certain waters.

DAVIS, P. 2000. Splake stocking assessment in Round Lake, Timiskaming District. File data, Ontario Ministry of Natural Resources, Kirkland Lake, Ontario.

Splake stocking in Round Lake (Otto, Marquis, Boston and Pacaud townships, District of Timiskaming) began in 1990. There have been reports of splake up to 15 pounds (6.8 kg) being angled. Two fish, weighing 8 pounds (3.6 kg) and 12 pounds (5.4 kg), respectively, have been verified by Ministry of Natural Resources staff.

Assessment netting using the "cisco method" was conducted during the first week of September, 1999. Nets were comprised of 0.75" (1.9cm), 1" (2.5 cm), 1.5" (3.8 cm), 2"(5.1 cm) and 2.5" (6.4 cm) meshes. Each panel of nets was separated by 5 m spacers. Nets were set parallel to the shoreline and usually within the hypolimnion. There were 30 nets set in this fashion – each for a duration of 2 hours. These sets produced a catch of 8 splake, 1 lake whitefish, 27 lake herring, 1 white sucker, 1 spottail shiner, 2 trout-

perch, 3 burbot and 1 walleye. The second set of nets (12) in Round Lake were set in the thermocline. Forty-four fish were captured. These included 5 splake, 2 lake herring, 2 smelt, 3 northern pike, 6 white sucker, 5 spottail shiner, 9 trout-perch, 2 yellow perch and 10 walleye. The splake CUE was 0.27 for nets set in the hypolimnion and 0.42 for nets set in the thermocline.

DECHTIAR, A. O. and A. H. BERST. 1978. Parasite fauna of splake (*Salvelinus fontinalis* x *S. namaycush*). Proceedings of the Helminthological Society of Washington 45(2) : 249 – 254.

During 1962 – 1974, recaptured splake from plantings in Lake Huron were parasitized by 21 species with an incidence of infection of 92.7%. The predominant parasites were the acanthocephalans *Metechinorhynchus salmonis*, *Acanthocephalus jacksoni* and *Pomphorhynchus bulbocolli* (in 56.8%, 5.7% and 5.7% of the specimens respectively); the trematodes *Diplostomulum flexicaudum* and *Tetracotyle intermedia* (9.9% and 5.7% respectively); and the cestode *Eubothrium salvelini* (9.9%). The only heavy infection occurred with *Metechinorhynchus salmonis* (more than 50 parasites per host). No mortalities of splake were recorded attributable to the effects of parasites in Lake Huron.

DECHTIAR, A. O., J. A. MacLEAN and S. J. NEPSZY. 1989. Parasites of fishes from Algonquin Park lakes. Ontario Fisheries Technical Report Series No. 29, Ontario Ministry of Natural Resources, Toronto, Ontario. 19 p.

This paper reports on a survey of parasites of fishes from Algonquin Park lakes between 1961 and 1971. A total of 1,829 individuals from 26 species of fish were examined and 126 species of parasites not recorded in other surveys are listed. Every species of fish and 89% of the individuals examined carried at least one parasite species.

A total of 13 splake were examined with 100% prevalence of parasite infestation. Parasitic infestation may be summarized as follows:

Parasite	Incidence of Infestation	Degree of infestation	Site of Infestation
Hysterothylacium brachyurum	54%	Low	Intestine, liver
Crepidostomum farionis	54%	Medium	Intestine
Eubothrium salvelini	23%	Low	Intestine
Tetracotyle sp.	23%	Low	Heart
Glochidia	15%	Low	Gills
Diplostomulum spathaceum	15%	Low	Eye

DEYNE, G. 1990_a. Fish stocking guidelines for the Algonquin Region. Ontario Ministry of Natural Resources, Huntsville, Ontario. 11 p.

These guidelines attempt to further refine stocking decisions with respect to the suitability of waters. The criteria for stocking salmonids are based on the percentage of natural recruitment, available habitat (temperature and oxygen profiles) and resident fish communities.

Splake should only be planted where naturally reproducing stocks of lake trout or brook trout are not present. The difference in catch and possession limits between lake trout (2 fish) and splake (5 fish) is further reason to avoid overlap between lake trout and splake.

From a habitat perspective, greater than 10% of the lake (by volume) should have > 4 ppm dissolved oxygen and < 16º C or the bottom portion of the thermocline should have more than 4 ppm dissolved oxygen. The selected temperature for F_1 hybrids is between that of brook trout and lake trout.

In terms of resident fish community, there should be not be strong populations of other pelagic species such as herring, whitefish and smelt. The more pelagic habits of splake reduce its dependency on the littoral zone for foraging and thereby avoid the problem of littoral competition generally associated with brook trout. In most cases, the over-riding factor for deciding between splake and brook trout will be the fish community structure determine from pre-stocking inventory. The inability to produce suitable returns of brook trout in the presence of yellow perch, and strong white sucker populations is the primary reason for selecting splake over brook trout.

DEYNE, G. 1990_b. Algonquin region guidelines for pre- and post- stocking assessment. Draft guidelines, Ontario Ministry of Natural Resources, Huntsville, Ontario. 11 p.

The objective of these guidelines is to establish consistency in sampling procedure for inland waters for pre- and post- stocking assessment of salmonids within Algonquin Region. Consistency in the sampling procedure will allow for comparative results between districts to achieve stocking assessment priorities with increased efficiency.

Pre-stocking assessment is necessary for all waters recommended for new stocking and suggested for waters currently stocked that have outdated lake survey information. It is recommended that a minimum of 40 short (e.g., 30 – 60 minutes) sets of large and small gill net be conducted. It is also recommended that temperature and oxygen profiles be completed in the area of maximum lake depth for each basin, preferably in late August.

Post-stocking assessment for splake should involve the use of lake trout standards for larger lakes (e.g., > 75 ha) in the spring or the use of brook trout standards for smaller lakes (e.g., < 75 hectares) after thermal stratification. The objective is to target on age 1+ for the purpose of establishing a catch-per-unit-of-effort (CUE) index. The use of short (e.g., 30 minutes) gill net sets are recommended with the objective of minimizing mortality of planted fish. A minimum of 20 fish should be captured for sampling.

DEYNE, G. and G. ARNETT. 1987. Foote Lake survey. File Report, Ontario Ministry of Natural Resources, Bracebridge, Ontario. 9 p.

Foote Lake is a small (131.1 ha), shallow lake which has had an extensive stocking history including brook trout and rainbow trout. Few fish were angled from these stocking efforts and, in 1986, 3000 F_1 splake (LN x LM) were introduced into Foote Lake to increase fishing opportunities by creating a put-and-delayed-take fishery.

In 1987 (June 1 – 2), Foote Lake was sampled to assess survival and growth of the introduced splake. Assessment gear consisted of one gill net, 122 m in length and having mesh sizes ranging from 2.1 – 12.7 cm. The net set spanned depths of 1 to 9.5 m and was fished for a duration of 23.75 hours. The netting assessment yielded a total of 90 yellow perch, 56 common white sucker and 1 smallmouth bass.

The failure to capture splake considering the 1986 stocking effort is not encouraging for the fishery. The attempt to establish a put-and-delayed take splake fishery in Foote Lake appears to have failed. The reason for the apparent failure of the splake introduction was not evident during the course of the survey and can only be surmised. The inability of the lake to support any of the previous fish introductions lends credence to speculation of water quality governing stock survival. Further plantings of splake should be withheld until such time as a detailed, late summer, dissolved oxygen/temperature profile is completed.

DEYNE, G. and G. ARNETT. UNDATED. An overview of the splake stocking program…Is our program working? File Report, Ontario Ministry of Natural Resources, Bracebridge, Ontario. 13 p.

This study was designed primarily to provide useful information concerning variation in survival, condition and growth of individual splake plantings in the Bracebridge administrative district. Five lakes (Tyne, Foote, Grandview, Widgeon, and Harvey) were chosen for the assessment. Each lake was stocked in the spring of 1986 with F_1 splake (Lake Nipigon brook trout x Lake Manitou lake trout). Assessment was carried out in the spring of 1987. Overnight sets of standard lake survey gill nets were used. Netting intensity varied between lakes from a high of 1.43 100 m hours per hectare in Grandview Lake to 0.22 100 m hours per hectare for Foote Lake.

The survival of introduced splake was documented in two (Widgeon and Tyne) of the five assessment lakes. The introduction of splake in Foote, Harvey, and Grandview lakes apparently failed. In summation, assessment results indicate first and foremost that temperature and dissolved oxygen requirements of splake must be met. The failure of the introduction of splake in Foote Lake can be attributed directly to this factor. Secondly, results illustrate that splake introduced in lakes containing limited or marginal habitat show better survival and growth when the number of competitive species is low. Results of this study and others in the district, indicate that lake which show returns from stocking efforts tend to have MEI values clustered in a range from 3.7 to 5.7.

Stocking assessments can provide useful information concerning variation in survival and growth of individual plantings as well as help in identifying future splake stocking candidate lakes. This information is intended to aid fishery managers in directing splake stocking efforts to lakes which maximize returns. This review emphasizes the need for further information and is a step towards improving present stocking allocations. Although no definitive conclusions can be drawn, information has been gained on factors affecting the survival of stocked splake.

DURANT, G. M. 1985. Quality of splake backcross stocked in Georgian Bay in 1980 and 1981 and lake trout stocked in Lake Simcoe in 1981. File Report, Ontario Ministry of Natural Resources, Chatsworth, Ontario. 34 p. + appendices.

The quality program was initiated with the splake backcross (SPBX) stocked in Georgian Bay and lake trout stocked in Lake Simcoe with the goal of improving the survival of the hatchery-reared fish. The quality data presented for SPBX and lake trout for 1980 and 1981 indicated that the survival potential of all of the SPBX stocked from Sandfield and Skeleton Lake and approximately 30 – 40% of the SPBX stocked from Chatsworth was suspect due to small size and low K. In addition, a high level of fin erosion was suffered especially by the pectoral and caudal fins by both the SPBX and lake trout stocked. A number of recommendations are made which may improve the quality of the SPBX and lake trout produced.

FISHER, J. R. 1986. Stocking programs. p. 42 – 46 *In* Redrock Lake: A review of the fisheries and management history. Algonquin Fisheries Assessment Unit, Ontario Ministry of Natural Resources, Whitney, Ontario.

Original plantings of splake in Redrock Lake occurred during 1954 to 1957 and these were directed by N. V. Martin and N. S. Baldwin. In Redrock Lake, plantings of 22,000 speckled trout and 9,000 splake during this time resulted in the capture of 62 splake and no speckled trout by a relatively intense sport fishery. One age IV splake taken during the summer of 1959 had attained a length of 20.6 inches (52 cm).

Further plantings of splake and speckled trout were carried out from 1962 to 1967 when the brook trout unit conducted research on five study lakes of which Redrock was one. The research was primarily to

assess the effectiveness of planting hatchery-reared fish in a number of small Precambrian Shield lakes. Planting splake in Redrock Lake may have had a profound genetic effect on the native speckled trout. The few splake that survived their planting year grew rapidly and became less vulnerable to anglers. Approximately 25 large splake (50 – 70 cm fork length) were observed on the spawning area in 1969 and 1970, apparently spawning with the native speckled trout.

FRASER, J. M. 1972. Recovery of planted brook trout, splake, and rainbow trout from selected Ontario lakes. Journal of the Fisheries Research Board of Canada 29 : 129 – 142.

Recoveries of hatchery-reared brook trout (*Salvelinus fontinalis*), splake (*Salvelinus namaycush* x *S. fontinalis*) and rainbow trout (*Salmo gairdneri*) planted in lakes having different resident fishes, were highest (9 – 30%) in a lake in which minnows and the brook stickleback were the only other fishes. Recoveries by angling and gill netting were considerably lower (2 – 15%) in two lakes containing the white sucker and minnows, and still lower (0.5 – 5%) in two lakes containing spiny rayed species as well. Recoveries were lowest (< 0.5%) in a lake having a complex fish community that included native brook trout and lake trout. Planted splake and rainbow trout generally yielded higher returns, in weight, than brook trout in comparable situations.

The low survival of planted fish was apparently due to the low fertility of the waters and to competition with, or predation by, resident fish species. Predation by fish-eating birds and mammals may also have had an effect.

The weight of the catch of salmonids exceeded the weight planted in only one lake. Here the mean yield of planted salmonids was 8.4 kg/ha per year in comparison with 2.6 to < 0.5 kg/ha per year in the five other study lakes.

FRASER, J. M. 1978. The effect of competition with yellow perch on the survival and growth of planted brook trout, splake, and rainbow trout in a small Ontario lake. Transactions of the American Fisheries Society 107 : 505 – 517.

Matched plantings of hatchery-reared yearling brook trout (*Salvelinus fontinalis*) and splake (*Salvelinus namaycush* x *S. fontinalis*) or brook trout and rainbow trout (*Salmo gairdneri*) were made in Little Minnow Lake for 6 years prior to and 6 years following the introduction of yellow perch (*Perca flavescens*). The mean return for each kilogram of fish planted was 3.3, 6.8, and 6.1 kg, respectively, for brook trout, splake, and rainbow trout in pre-perch years but after yellow perch became established the mean returns were 0.4, 0.9, and 0.8 kg, respectively, all less than the weight planted.

The 1967, 1969, and 1972 year classes of yellow perch successively dominated the fish community and yellow perch biomass fluctuated between 20 and 30 kg/hectare. The establishment of yellow perch resulted in a drastic change in the food habits of the planted salmonids and a reduction in their growth rates in excess of 50%. This evidence strongly indicates that planted salmonids could not compete successfully with yellow perch for the food supply.

FRASER, J. M. 1980. Survival, growth and food habits of brook trout and F_1 splake planted in Precambrian shield lakes. Transactions of the American Fisheries Society 109 : 491 – 501.

The performance of planted brook trout (*Salvelinus fontinalis*) and F_1 splake (*Salvelinus namaycush* x *S. fontinalis*) were studied in four Precambrian Shield lakes. Splake survived better than brook trout in three

lakes; mean gill net recoveries were 15.3, 13.2, and 8.5% of plantings of splake compared to 2.9, 1.2, and 7.2% for brook trout. The fourth lake showed a mean recovery rate of 28% for both splake and brook trout. Most brook trout were caught in the year of planting or the year following whereas the splake recoveries were spread over 6 – 7 years. Each kilogram of planted yearling splake yielded 2.5 – 7.1 kg among lakes; each kilogram of yearling brook trout planted yielded 0.2 – 1.3 kg. Brook trout and splake planted in the same lake grew at approximately the same rate in the year following planting. There were, however, differences in the growth rate of both brook trout and splake among lakes and for splake the differences were maintained for an additional 5 – 6 years. Diet of both species differed among the lakes but brook trout fed more on aquatic insects and fish while small splake utilized Entomostraca (chiefly Cladocera) and larger splake preyed heavily on Malacostraca (chiefly crayfish) and fish (chiefly yellow perch, *Perca flavescens*).

FRASER, J. M. 1983. Longevity of first generation splake. Progressive Fish Culturist 45(4) : 233.

The purpose of this note is to record the capture of two 16-year-old splake (*Salvelinus fontinalis* male x *S. namaycush* female) in Redrock Lake, Algonquin Park, Ontario, in the summer of 1981. These hybrids were members of a lot of hatchery-reared yearlings (mean length 8.9 cm) stocked in Redrock lake in May 1966. Before stocking the right ventral fin had been excised to facilitate future identification. In October 1969, splake No. 1 , along with 18 others, was trapped, tagged and released in the vicinity of a brook trout spawning area. The splake was recaptured and released at the same location in October 1970. Although Redrock Lake was fished intensively in the intervening years, the fish was not caught until May 1981. The anglers who turned in the tag at the creel checking station had eaten the fish and their only comment was that it was “big and odd looking.”

Splake No. 2 was caught in a survey gill net on August 1981. After capture, entrails and gills were removed and the fish was placed in frozen storage. After two months storage the fish was thawed, measured (74.8 cm fork length), weighed (4,639 gm), and the right ventral fin noted as missing. The 16 annuli, clearly discernible in a pectoral fin ray section, corroborated the age of this splake.

The hybrid splake referred to above are the first generation resulting from the fertilization of Lake Manitou lake trout eggs with sperm from the Hills Lake hatchery domestic brook trout. Their superior ability to survive and attain trophy size in small (< 30 ha) Precambrian Shield lakes has been recorded. More recent studies reveal 12-year-old splake in two study lakes. It is, therefore, not surprising to have 16-year-old fish appear in the larger Redrock Lake. The only older splake recorded is a 20-year-old fish captured in the Kaniapiskau River, Québec, according to a Detroit News item dated April 6, 1969.

FRASER, J. M. 1986. Performance of cultured Nipigon brook trout strain LNDN and hybrid splake (HLLM) planted in five Algonquin Park lakes. File Report, Ontario Ministry of Natural Resources, Maple, Ontario. 5 p.

FRASER, J. M. 1988$_a$. Comparative recoveries of matched plantings of two F_1 splake (*Salvelinus fontinalis* x *S. namaycush*) strains (HLLM versus HLOP) in five study lakes. Manuscript Report, Fisheries Research Section, Ontario Ministry of Natural Resources, Maple, Ontario. 15 p.

Two F_1 splake (*Salvelinus fontinalis* x *S. namaycush*) strains having a common male parent, the Hills Lake domestic brook trout, and either a Lake Manitou or Lake Opeongo female lake trout parent, were reared under similar conditions to the fall fingerling stage. The performances of the two strains were assessed by sampling matched plantings in five Algonquin Park lakes. HLOP splake (Hills Lake brook trout male x Lake Opeongo lake trout female) were recovered in slightly higher numbers than HLLM splake (Hills Lake

domestic brook trout x Lake Manitou lake trout female) in four of five study lakes. General similarity in recovery of the two strains suggests that either would be useful in put-and-delayed-take management.

FRASER, J. M. 1988$_b$. Comparative recoveries of matched plantings of two F_1 splake strains (HLLM versus LNLM) in six Ontario lakes. Manuscript Report, Fisheries Research Section, Ontario Ministry of Natural Resources, Maple, Ontario. 18 p.

The F_1 splake (HLLM) in common use in Ontario since the late 1970s has been the result of fertilizing Lake Manitou lake trout eggs with sperm from the Hills Lake domestic brook trout. More recently, a different cross (LNLM), using the same lake trout egg but fertilized with sperm from Lake Nipigon brook trout has been tried. The HLLM strain grew more rapidly in the hatchery and reached 50 gm at yearling stage compared to ≅ 20 gm for the LNLM strain. Matched plantings of the above strains were made in six Algonquin Park lakes, and in five lakes, survival of the smaller LNLM strain was significantly lower than that of the HLLM strain.

FRASER, J. M. 1988$_c$. Comparative recoveries of F_1 splake planted as fall fingerlings and as yearlings in five small lakes. Manuscript Report, Fisheries Research Section, Ontario Ministry of Natural Resources, Maple, Ontario. 9 p.

In two heavily angled lakes that supported carryover splake and rainbow trout, the recoveries of planted yearling splake were 3 – 5 times higher than the recoveries of fall fingerlings. In lightly angled lakes supporting competitive fish species, initial plantings of both fall fingerlings and yearlings survived well but suppressed the following years plantings. Planting every third year is recommended for these lakes.

FRASER, J. M. 1988$_d$. Comparative recoveries of hatchery-reared Nipigon brook trout strain (LNDN) and hybrid F_1 splake (HLLM) planted in five Algonquin Park lakes. Manuscript Report, Fisheries Research Section, Ontario Ministry of Natural Resources, Maple, Ontario. 13 p.

Plantings of LNDN brook trout were matched with plantings of similar aged F_1 splake in five study lakes. Brook trout grew slowly in the hatchery and, consequently, splake were about three times larger at the time of planting. Brook trout planted as fall fingerlings in three lakes survived poorly compared to planted splake. In two of these lakes, naturalized brook trout apparently competed with the planted fish. Yearling brook trout and splake were matched in two lakes and mean recovery by angling was 5 – 10 times greater for splake. Several age groups of carryover splake and rainbow trout extant in these lakes probably preyed on the planted salmonids. The overall results suggest that the Nipigon brook trout are too small at time of planting to effectively compete. They should be planted only in lakes offering minimal competition.

FRASER, J. M. 1988$_e$. High yields from spring plantings of fingerling brook trout and splake in a small Precambrian Shield lake. Manuscript Report, Fisheries Research Section, Ontario Ministry of Natural Resources, Maple, Ontario. 13 p.

Annual plantings of small spring fingerling salmonids, combined with intensive gill netting (and some angling) resulted in yields of 17.1 kg/ha/year over a nine year period. The lake was tiny (3.3 ha), the competition light (sticklebacks) and bird predation light (too small for loon foraging).

FRY, F. E. J. and M. B. GIBSON. 1953. Lethal temperature experiments with speckled x lake trout hybrids. Journal of Heredity XLIV(2).

The upper incipient lethal temperature of the hybrid was between 23.5º and 24º C at 10º C acclimation and between 24º and 24.5º C at 20º C acclimation. Hybrids were hardy at 0º C.

FULLER, P. L., L. G. NICO and J. D. WILLIAMS. 1999. Nonindigenous fishes introduced to inland waters of the United States. American Fisheries Society Special Publication 27, Bethesda, Maryland. 613 p.

Splake is a fertile hybrid which has been intentionally stocked for sport fishing. Splake have been stocked in Lower Salmon and Deer lakes in Sierra County, California; several lakes and reservoirs in the Arkansas drainage of Colorado; Hayden Lake outlet, Idaho; Basin Pond, Maine; Deep Creek Lake, Garrett County, Maryland; Lake Huron, Michigan; Pierz Lake, Morrison County, Minnesota; Crystal Lake, Carroll County, and Long Pond in Sullivan County, New Hampshire; unspecified areas of New York; Deerfield Lake in South Dakota; Fish Lake, Joe's Valley Reservoir, Seeley Creek and Blind Lake, Utah; in at least eight inland lakes in Wisconsin as well as Lake Superior; and Brooks, Torrey and Louis lakes, Fremont County and Rob Roy Reservoir, Albany County in Wyoming.

Natural spawning of this hybrid has occurred in Lake Huron. The introduction of this hybrid could affect the genetics of co-occurring parent species.

GODDARD, C. I. 1972. The preferred temperature of yearling splake. M. Sc. Thesis, York University, Toronto, Ontario.

GODDARD, C. I. and J. S. TAIT. 1976. Preferred temperatures of F_1 and F_2 hybrids of *Salvelinus namaycush* x *S. fontinalis*. Journal of the Fisheries Research Board of Canada 33(2) : 197 – 202.

Preferred temperatures were determined for samples of four generations, F_3, F_4, "F_{4-5}" (F_4 x F_3) and F_5 of yearling splake (*Salvelinus fontinalis* x *Salvelinus namaycush*) acclimated at 4, 8, 12, 16 and 20º C. Final preferenda for the four generations were 16.3, 15.9, 15.7, and 14.8º C, respectively, decreasing as generation number increased. Although these values are close to the 16º C preferendum of *S. fontinalis*, they showed a trend towards the lake trout preferendum of 11.7º C. The hybrids are like *S. namaycush* in having preferred temperatures that are virtually unaffected by changes in acclimation temperature or season.

GRANT, R. E. 1990. 1990 winter aerial creel survey of eastern Ontario inland lake trout and splake fisheries. File Report, Ontario Ministry of Natural Resources, Eastern Region, Kemptville, Ontario. 35 p. + appendices.

A winter aerial creel was conducted for the second consecutive year on 57 of the 81 designated lake trout and splake lakes in Fishing Divisions 9, 10 and 29 during the open lake trout and splake seasons in February and March of 1990. In conjunction with the aerial survey, angler interviews were conducted on four splake lakes in Division 9, three splake lakes in Division 10 and 10 splake lakes and 24 lake trout lakes in Division 29.

A total of 904 anglers were interviewed on 41 splake and lake trout lakes in Divisions 9, 10 and 29. Twelve anglers were interviewed on the four splake lakes in Division 9 during which time one splake was caught and harvested. Two hundred and seven anglers were interviewed on three splake lakes in Division 10.

A total of 30 splake were caught and 29 were harvested. In Division 29, 90 splake anglers were interviewed on ten lakes during which time 53 splake were caught and 45 were harvested. A total of 595 lake trout anglers were interviewed on 24 lake trout lakes. An observed catch of 286 and harvest of 188 lake trout was recorded.

During the aerial survey, 1,011 open ice anglers were observed on 17 designated splake lakes in Divisions 9 and 10 for February and March combined while 63 open ice anglers were observed on 10 splake lakes in Division 29 during march. A total of 401 open ice anglers were observed on the 30 designated lake trout lakes surveyed in Division 29 during March.

Total estimated angling effort on the 17 splake lakes surveyed in Divisions 9 and 10 was approximately five times greater in February (11,185.2 angler hours) than in March (2,198.7 angler hours). Total March angling effort on the ten surveyed splake lakes in Division 29 was 1,588.5 angler hours (4.78 hrs/ha). Splake angling effort per unit of lake area in Division 29 during March was approximately 1.5 times greater than that in Divisions 9 and 10 for February and March combined. Total splake angling efforts estimates for Divisions 9, 10 and 29 increased only slightly in 1990 (14,972.4 angler hours) when compared with 1989 results (14,235 angler hours)

Overall, the estimated harvest-per-unit-effort (number of fish per angler hour) of splake was slightly greater in 1989 (0.065) than in 1990 (0.052). In Division 29, the 1989 splake CUE and HUE estimates (CUE=0.442; HUE=0.374) were approximately four times greater than that in 1990 (CUE=0.108; HUE= 0.089). The mean size of splake harvested in both 1989 and 1990 was significantly larger in Division 10 (0.515 kg, N=25 and 1.19 kg, N=29 respectively) than Division 29 (0.283 kg, N=253 and 0.384 kg, N=45 respectively).

GREAT LAKES SPORT FISHING COUNCIL. 2000. Lake Michigan 1999 stocking summary. Great Lakes Basin Report 11(5) : 3.

Between 1983 and 1999, a total of 1.857 million splake have been stocked into the waters of Lake Michigan. The average number of splake stocked annually during that period was 77,375 fish.

The number of trout and salmon stocked into Lake Michigan in 1999 totaled 12.755 million fish, 1,269,000 (10%) less than in 1998 and 8,851,000 less than the 14.6 million long term average and the lowest total number stocked since 1977. Total stocking peaked at 17.3 million in 1984. Only the State of Michigan stocked splake into Lake Michigan, totaling 51,000 fish, down about 26,000 fish from 1998.

GRIMÅS, U., N.-A. NILSSON and C. WENDT. 1972. Lake Vättern: Effects of exploitation, eutrophication and introductions on the salmonid community. Journal of the Fisheries Research Board of Canada 29 : 807 – 817.

Vättern, the second largest lake of Sweden, contains 28 species of fish, of which Arctic char (*Salvelinus alpinus*) and whitefish (*Coregonus* spp.) are the most important economically. A modest eutrophication is occurring but the lake is still to be characterized as typically oligotrophic.

In Sweden, as in most countries, fish culture utilizing hatcheries started in the latter 1880s and persisted into this century and was considered to be one of the most important approaches in fishery management. In 1968, 500 splake were introduced and subsequent recaptures totalled 25%. Most of the fish were caught around the release sites. The maximum weight was rather low, around 0.5 kg. No further decisions have been made concerning this hybrid.

HANSEN, D. W. M. 1972. Reproductive interactions between the brook trout and splake of Redrock Lake. M. Sc. Thesis, University of Toronto.

Splake were introduced into Redrock Lake from 1954 – 1957 and from 1962 – 1966 but their survival has been very poor. They have spawned on the same spawning grounds as the native brook trout for many years. Structural intermediacy of hybrids between the parent species was the criterion used to determine whether splake and brook trout had backcrossed and produced viable offspring. The meristics were pyloric caeca and vertebrae.

In May, 1971, 372 Redrock brook trout were sampled. Each fish was photographed, measured and aged. The gut contents were preserved. Pyloric caeca were counted in all of them and vertebrae in 118. Samples of allopatric brook trout populations whose taxonomic identity was not in question were used as controls.

Redrock splake grew faster and larger than the native brook trout but size barriers to reproduction between them were not evident until age IV. The smaller size of the "1971" brook trout relative to those prior to the introduction of splake provides some circumstantial evidence that if backcrossing occurred it was not widespread.

The higher average number of vertebrae and pyloric caeca of the Redrock brook trout compared to other brook trout is consistent with the hypothesis that backcrossing of the indigenous brook trout and the introduced splake has occurred. Consideration of the variation and of possible environmental and genetic influences on the meristics of the Redrock brook trout does not contradict the possibility of backcrossing especially if the predominant backcrosses were between female brook trout and male splake. I inferred from the spawning studies that backcrosses of male splake and female brook trout are likely the only successful ones. The positive correlation of the number of pyloric caeca and length of the Redrock brook trout indicates that the splake influence appears to be becoming progressively more remote.

The meristics data seem to rule out the presence of any F_2 splake in the sample of Redrock brook trout. That is, crosses of male and female splake appear to be unsuccessful. The spawning study reinforced this inference and revealed the mechanism likely responsible.

The splake spawned earlier than the brook trout but the brook trout were present throughout the spawning period. Splake spawning behavior showed affinities to that of brook trout in some respects and to that of lake trout in others. In some respects, notably redd construction and egg deposition, their behaviour was intermediate. Splake suppressed all spawning by early maturing brook trout, but the brook trout spawned successfully on the same areas as the splake after the splake finished.

The Redrock brook trout and splake were not subject to premating reproductive isolation. An individual splake female constructed a number of large, partial, ill-defined shallow redds. She deposited eggs in all redds with the majority of them in one. Eggs were not covered and suffered nearly complete mortality due to subsequent digging by female splake, superimposition of brook trout redds on splake redds and egg predation by brook trout. Crosses of female brook trout and male splake were likely the only possible backcross because of the careful redd construction, egg deposition and postspawning behaviour exhibited by the female brook trout. Postmating isolation did act against successful backcrossing. Almost total zygote mortality of crosses involving female splake occurred. I have hypothesized that the extreme narrowness of the habitat in which any viable backcross progeny survived in competition with the native brook trout and lake trout greatly restricted the success of any backcrossing. Low levels of successful backcrossing is consistent with the inferences of the meristics study.

The main impact of the splake's introduction and interaction with the brook trout may have been the early and prolonged presence of the splake on the brook trout spawning grounds that forced the brook trout to spawn in a very short period of time. This could reduce the overall capability of the brook trout population to compensate for unfavourable conditions at the time of spawning, hatching and emergence. The dominance of splake over the limited spawning grounds forced many brook trout to spawn under sub-optimal conditions which could limit the overall success of brook trout spawning.

HART, M. L. 1989. 1989 winter splake fishery on Indian Lake, Otter lake and Lower Beverley Lake. File Report, Ontario Ministry of Natural Resources, Brockville, Ontario.

In 1986, 5,000 fingerling splake were stocked in Indian Lake and Otter Lake, Leeds County. An annual stocking of 5,000 fish has continued to the spring of 1989. In 1987, 5,000 fingerling splake were stocked in Lower Beverley Lake, Leeds County. A stocking of 5,000 fish occurred again in 1988 and 4,100 splake were stocked in 1989.

Conservation officer angler interviews and a voluntary creel survey was conducted during the 1989 winter splake fishery. The splake catch-per-unit-of-effort (CUE) for Indian Lake was 0.23 while the CUE for Otter Lake was 0.01. There were no splake caught from Lower Beverley Lake.

HAXTON, T. 1987. 1987 stocking assessment on selected brook trout and splake lakes within Minden district. File Report, Ontario Ministry of Natural Resources, Minden, Ontario. 7 p.

The 1987 stocking assessment program was conducted to determine the effectiveness of past stocking efforts in thirteen selected artificial brook trout and splake lakes within the Minden district. Gill nets of varying mesh sizes and colours were set in each lake. Nets were set on a 24-hour basis for two nights. In Big East Lake (Hindon Township) six splake were caught in one night of netting. It is recommended to continue splake stocking and monitor angling success. In Black Lake (Lutterworth Township) no splake were caught by netting and anglers also report low success. Due to good habitat and food availability, it is recommended that this lake be restocked (but a lower overall priority). In Depot Lake (Eyre Township) only one splake was caught in nets. In Gooderham Lake (Glamorgan Township) and Horseshoe Lake (Minden Township) no splake were caught. Poor survival may be due to competition with other species. Six splake were captured in Guilford Lake (Guilford Township) and it is recommended that the lake continue to be managed for splake. Five splake were captured in Ross Lake (Harburn Township). Despite the presence of an abundant rock bass population splake appear to be doing well in this lake. In Round Lake (Cavendish Township) five splake were caught. All of the fish were from the most recent planting. Six splake were caught in Rustyshoe Lake (Glamorgan Township) and four splake were captured in Wolf Lake (Havelock Township). The largest catch of splake (29 fish) was recorded in Wildcat Lake (Eyre Township). Anglers report low success despite the abundance of fish. In the future for those lakes in which an abundance of competitors are present, larger sized fish should be stocked to enhance their success in that waterbody.

HAXTON, T. 1991. Post stocking assessment on six Minden district splake lakes. File Report, Ontario Ministry of Natural Resources, Minden, Ontario. 16 p. + appendices.

Post-stocking assessment was conducted on six Minden district splake lakes (Anson, Bivouac, East Galipo, Gooderham, and West Galipo) from July 26, 1990 through August 13, 1990. Nets were set for a total of 9,375 net metre hours. In four of these lakes, a total of 67 splake were caught for a CUE of 2.05 splake/100 net metre hours. The average fork length of these splake were 263.1 mm; the average weight was 298 grams; and the average age was 1.97 years. No splake were sampled in Black lake and Gooderham Lake. Management recommendations for individual lakes are provided.

HEIDINGER, R. C. 1999. Stocking for sport fisheries enhancement. p. 375 – 401 *In* C. C. Kohler and W. A. Hubert [eds.]. Inland Fisheries Management in North America, American Fisheries Society, Bethesda, Maryland.

Fish are currently being raised for stocking in sport fisheries by federal and state agencies and by private fish culturists. Including private stocking, I estimate that approximately 2.5 billion sport fishes are stocked annually in the United States and Canada. In 1995 – 1996, ten states stocked 1.409 million splake while three provincial agencies stocked 930,000 splake. Of the 2.339 million splake which were stocked, 150,000 were released as eyed eggs, 1.974 million were planted as fingerlings and 215,000 were stocked as fish greater than 203 mm in length.

HILL, C. and E. McINTYRE. 1988. F_1 splake stocking assessment in Rankin Lake, Foley Township. File Report, Ontario Ministry of Natural Resources, Parry Sound, Ontario. 6 p.

From August 18 – 20, 1987, an assessment was conducted on Rankin Lake (Foley Township) to determine the success of the 1983, 1984 and 1985 plantings of F_1 splake. Four standard lake survey gill nets were each set for two nights for a total of eight net nights of fishing effort. The total catch was comprised of 2 splake, 22 smallmouth bass, 1 largemouth bass, 10 common white sucker, 17 rock bass and 7 rainbow smelt. The low abundance of F_1 splake in this survey combined with almost no reports of harvest by anglers strongly suggests poor survival from the plantings. The very good showing of naturally reproducing smallmouth bass in the catch indicates that Rankin Lake is currently much better suited for warmwater species than for coldwater species. Consequently it is recommended that further plantings of F_1 splake and/or lake trout be discontinued and that the lake be managed for smallmouth bass on a natural, self-sustaining basis.

HOYLE, J. A. 1989. Results of an aerial creel survey on selected inland lake trout and splake lakes in eastern Ontario during the winter of 1989. File Report, Ontario Ministry of Natural Resources, Eastern Region, Kemptville, Ontario. 23 p. + appendices.

Winter angler effort and harvest of lake trout and splake were estimated for lake trout and splake lakes in eastern Ontario. Observations recorded during 21 aerial flights over 54 of 63 designated lake trout and splake lakes in Divisions 9, 10 and 29 with open fishing seasons in February and March 1989 were used to estimate fishing effort. Angler interviews, conducted by roving ground creels and angler diaries, were used to estimate fishing success and harvest. Angling effort was estimated at 14,235 hours on the 26 designated splake lakes surveyed in Divisions 9, 10 and 29 and 17,542 hours on the 28 designated lake trout lakes surveyed in Division 29. Catch and harvest per unit of effort (HUE) on Division 9 splake lakes were 0.128 and 0.091, respectively, for the 228 anglers interviewed. HUE from Division 10 splake lakes was 0.065 based on angler interviews (188) and angler diaries (6) combined. Catch and harvest per unit effort in Division 29 was higher on splake lakes (CUE = 0.442, HUE = 0.374, 203 anglers interviewed) than on lake trout lakes (CUE = 0.142, HUE = 0.099, 564 anglers interviewed) but the splake were much smaller (mean weights were 0.283 kg, N=253 for splake and 0.626 kg, N=164 for lake trout). Estimated numbers of splake harvested were 910 (680 kg or 0.35 kg ha^{-1}), 107 (55 kg or 0.03 hg ha^{-1}), and 969 (274 kg or 0.83 kg ha^{-1}) in Divisions 9, 10 and 29 respectively. The estimated number of lake trout harvested in Division 29 was 1,737 (1,087 kg or 0.15 kg ha^{-1}).

IHSSEN, P. E. 1973. Inheritance of thermal resistance in hybrids of *Salvelinus fontinalis* and *S. namaycush*. Journal of the Fisheries Research Board of Canada 30 : 401 – 408.

The two reciprocal F_1 hybrids of brook trout (*Salvelinus fontinalis*) and lake trout (*S. namaycush*) had similar times to death on exposure to several lethal high temperatures for a series of acclimation temperatures. These hybrids resembled the brook trout, the more resistant parent, more than the lake trout. The F_2 hybrids were intermediate to resistance to the parent species and the backcrosses intermediate between the F_2 hybrids and the respective parents. After acclimation to 5º and 10º C, F_2 and backcrosses arising from the F_1 hybrid of brook trout maternal origin were consistently higher in resistance than the F_2 and backcrosses arising from the F_1 hybrid of lake trout maternal origin. After acclimation to 20º C and above, differences associated with the maternal origin of the F_1 hybrid were not found.

The number of effective factors segregating was estimated using the techniques of variance component analysis. A genetic model with two codominant factors was found to fit the data for 5º and 10º C acclimation and one with five factors and dominance of the brook trout factors was found to fit the data for the higher acclimation temperatures.

IHSSEN, P. E., M. J. POWELL, and M. MILLER. 1982. Survival and growth of matched plantings of lake trout (*Salvelinus namaycush*), brook trout (*Salvelinus fontinalis*) and lake x brook F_1 splake hybrids and backcrosses in northeastern Ontario lakes. Ontario Fisheries Technical Report Series No. 6, Ontario Ministry of Natural Resources, Toronto, Ontario. 12 p.

Matched plantings of lake trout (*Salvelinus namaycush*), F_1 splake hybrids and lake trout backcrosses, and brook trout (*Salvelinus fontinalis*), F_1 splake hybrids and brook trout backcrosses were made annually in four small northeastern Ontario lakes for three consecutive years. The relative performance of the three different crosses in each lake was assessed by gillnetting in the fall for seven consecutive years. F_1 hybrids were recovered at rates two to three times greater than the backcrosses, brook trout or lake trout, from all lakes, except one, where only one lake trout to 346 F_1 hybrids was recovered. The number of kg recovered per kg planted ranged from 2.5 to 4.4 for the F_1 hybrids, 0.3 to 1.3 for the backcrosses, and 0.0 to 1.0 for the brook trout and lake trout. The first planting gave the best returns, both in terms of numbers and kilograms recovered; the middle plant the poorest. The growth rates, recoveries and condition factors were correlated among crosses, lakes and plantings. The plantings, crosses or lakes that gave the highest returns also gave the fastest growth rates and the largest condition factors. The F_1 hybrids from the two lakes that gave the fastest growth and highest rates of return matured significantly earlier in life (50% mature at about 2.5 to 3.0 sexes combined) than those from the two lakes with the slower growth and lower returns (age 3 to 3.5).

KERR, S. J. 1991_a. Results of a 1991 winter survey of lake trout and splake fisheries, Eastern Region. File Report, Ontario Ministry of Natural Resources, Eastern Region, Kemptville, Ontario.

For the third consecutive year an aerial creel survey, supplemented by on-the-ground angler interviews, was conducted on splake fisheries in Divisions 9 and 10 as well as lake trout and splake fisheries in Division 29. The 1991 survey involved a total of 29 flights comprising 68.6 hours of flying time. During the survey 3,668 open ice anglers were recorded on 56 designated lakes. The majority of these anglers were observed on weekend days. Estimated fishing pressure for F_1 splake ranged from 5,057.3 angler hours in Division 29 to 17,822.9 angler hours in Division 9. An estimated total of 28,704.9 angler hours of effort (7.3 angler hours/ha) was directed to eastern Ontario splake fisheries which were included in this survey. During a three week season in March (March 9 – 31), an estimated 33,914.6 angler hours of fishing effort (4.37 angler hours/ha) were expended on thirty lake trout lakes in Division 29. Winter fishing pressure reached as high as 38.8 angler hours/ha on Crystal Lake.

Overall, it was estimated that 1,464 F_1 splake and 3,222 lake trout were harvested from fifty-six selected lakes in these three divisions during the 1991 winter fishery. Winter lake trout yields, for those lakes on

which calculations were possible, suggests that many waters exceed recommended annual harvests and are probably being overexploited. As noted in earlier surveys, the overall lake trout catch was split almost evenly between native and stocked (hatchery-reared) fish. A review of historic creel data is presented which suggests that earlier amendments to the winter fishing regulations have not resulted in a decrease in lake trout angling activity in Division 29. Several recommendations for future management initiatives and regulation amendments are offered for consideration.

KERR, S. J. 1991$_b$. Results of an aerial survey of the 1991 open water lake trout and splake fisheries in Divisions 9, 10 and 29. File Report, Ontario Ministry of Natural Resources, Eastern Region, Kemptville, Ontario. 18 p. + appendices.

An aerial creel survey was carried out from May 19 to September 8, 1991 to assess angling activity on inland lake trout and splake fisheries. A total of 6,017 anglers were recorded during the survey.

An estimated 30,723 angler hours of fishing effort was exerted on twenty-six splake fisheries in Divisions 9, 10 and 29 during the survey period. Most of the estimated splake angling effort was directed on lakes in Divisions 9 and 29. Annual fishing pressure estimates for southeastern Ontario splake waters was 59,428 angler hours.

To date, creel surveys and stocking assessment programs have focused on lake trout. In order to evaluate the splake stocking program and determine its role in the regional stocking strategy, more concentrated assessment efforts are required.

KERR, S. J. 1992. Results of an aerial creel survey of lake trout and splake fisheries in Divisions 9, 10 and 29, winter 1992. File Report, Ontario Ministry of Natural Resources, Kemptville, Ontario.

An aerial survey was carried out on sixty inland lake trout and F_1 splake lakes in Divisions 9, 10 and 29 during the open season in February and March of 1992. During 41 flights, a total of 6,355 open ice anglers were recorded. In conjunction with the aerial survey, 637 lake trout anglers and 892 splake anglers were randomly contacted and interviewed. Two hundred and six (206) angled lake trout and 523 F_1 splake were weighed and/or measured as well as examined for fin clips.

Estimated winter angling pressure for splake was 23,221.3 angler hours in Division 9; 6,252.6 angler hours in Division 10; and 5,320.5 angler hours in Division 29. An estimated 21,804 splake were harvested from these three areas in the winter of 1992. Splake catches and angling success rates were the highest recorded in all three divisions since the winter survey commenced in 1989.

Winter lake trout angling pressure remained high in Division 29. March angling effort directed at lake trout was estimated at 28,195.9 angler hours. This value probably represents an underestimate since winter angling activity continued well into the month of April. The estimated harvest was 2,594 fish. Lake trout catch rates (catch-per-unit-of-effort) have remained relatively constant during the past four years however the proportion of hatchery reared fish in the catch has increased annually since 1990.

Information collected during the past four years provides an increasing amount of supportive evidence that larger (e.g., 60 – 80 gram) yearling fish are required to produce quality splake angling opportunities in subsequent years. Future requests to the provincial fish culture system for F_1 splake should specify large yearling splake exceeding 50 grams per fish as a requirement. It is important to realize that improved splake stocking success will provide more attractive alternative angling opportunities which, hopefully, will reduce pressure directed at local lake trout stocks.

KERR, S. J. and R. E. GRANT. 2000. Potential interactions and impacts of splake stocking. p. 247 *In* Ecological Impacts of Fish Introductions: Evaluating the Risk. Fish and Wildlife Branch, Ontario Ministry of Natural Resources, Peterborough, Ontario. 473 p.

Despite extensive research into hybrid splake genetics and performance, there have been relatively few studies on the impacts of splake on other species. Splake are often stocked in lakes having a remnant brook trout population. Although the food habits of the two species differ widely there has been some evidence of competition for spawning habitat. The same spawning sites were used by both splake and brook trout in Redrock Lake, Ontario, and some Alberta lakes. The prolonged presence of splake on brook trout spawning grounds may suppress spawning activity by early maturing trout, force brook trout to spawn over a shortened period of time and perhaps under sub-optimal conditions. There is also evidence that introduced splake can hybridize with resident brook trout. As a result it is possible that the introduction of the hybrid splake could affect the genetics of the co-inhabiting parent species.

Splake are largely piscivorous and are know to prey on other fishes including alewives, yellow perch, pumpkinseed, smelt, sculpins, sticklebacks, trout-perch, brook trout and various cyprinids. They have also been noted to feed upon the eggs of both lake trout and other splake.

Splake have been found to host at least 21 different parasites and be infected with several diseases including kidney disease and furunculosis. There are no instances where any of these diseases or parasites have caused widespread mortality however.

KMIOTEK, S. and A. A. OEHMCKE. 1959. Will the splake make good? Wisconsin Conservation Bulletin 1959 (June) : 24 – 34.

Although sometimes reported as a new species, the splake was described at a meeting of the American Fish Cultural Association held in 1880. Records are incomplete but apparently little was done with this species for a number of years. Interest in the splake was revived in the last decade.

In 1957, Wisconsin obtained some splake fingerlings from Marquette, Michigan through the courtesy of the Michigan Conservation Department. During 1958, 4,000 of these splake were stocked in Little Bass Lake, Oneida County. The Crystal Springs trout hatchery recently completed stocking 1,000 6-inch splake from the same source in Crystal Lake, Vilas County. The introduction of splake in Little Bass Lake has been too recent to determine its success. However the state of New York has been managing several lakes for this species since 1954. Fingerlings from 3.5 to 5 inches were stocked in the fall. In one year they had increased in length by 2 1/4 to 8 inches. In the upper peninsula of Michigan, splake were introduced in one lake three years ago which are now 17 inches in length.

The splake is an avid feeder and therefore makes rapid growth gains. Canada reports excellent growth of fingerling splake stocked in Agnes Lake in 1951. By 1953, some of the fish weighed almost 2 pounds. These attributes make splake very popular with anglers. If the splake introduction in Wisconsin lakes is successful, some excellent fishing is in store for our fishermen.

LAWRENCE, S. 1987. 1987 splake stocking assessment on Brooks Lake, Abinger Township. File Report, Ontario Ministry of Natural Resources, Bancroft, Ontario. 9 p.

Brooks Lake was stocked with rainbow trout and brook trout from 1961 to 1983 with moderate to poor returns. In 1984 Brooks Lake was added to the splake stocking program and, since that time, has been stocked every year with 750 – 1,000 yearling splake.

Brooks Lake was initially surveyed in August 1964. Water chemistry results showed suitable water quality for trout down to the 5 meter depth. Netting produced brook trout and rainbow trout of various size ranges indicating suitable over-wintering conditions existed in the lake. White sucker and brown bullhead were also collected in the nets. Some natural reproduction of brook trout was also noted at this time.

In June, 1987, a splake stocking assessment was performed on Brooks Lake. Similar water chemistry results to those found in 1964 were found to still exist in the lake. Index gill netting on Brooks lake involved one overnight set of approximately 1,200 feet of net of various mesh sizes for a total of 23.3 hours. The total catch for this netting was as follows: 47 splake, 5 brook trout, 55 white sucker, 2 brown bullhead, 7 golden shiner and 4 creek chub. Splake from each planting were collected and ranged in size from 18.5 cm (0.075 kg) to 50.3 cm (1.475 kg). The brook trout collected during netting were natural fish and ranged in size from 15 cm to 23 cm in length.

From this assessment it is recommended that Brooks Lake remain a part of the district splake stocking program. All splake stocked in Brooks Lake should be marked (fin clipped) in order that any natural reproduction which may occur in the lake can be verified by the sampling of unmarked fish. A splake-brook trout spawning assessment should be undertaken in the further to identify actual spawning locations in order that they can be protected and enhanced if necessary.

LEIK, T. H. 1959$_a$. An evaluation of the splake trout – Ecology and life history of the splake trout. Colorado Cooperative Fishery Research Unit, Quarterly Report, Volume 5, Colorado A&M College. Fort Collins, Colorado. 25 p.

Splake trout were studied in a lentic environment (Parvin Lake) to determine ecology and life history characteristics. The splake trout were hatched from lake trout eggs and brook trout sperm taken in Colorado, Wyoming and Ontario, Canada. A total of 13,210 marked splake were stocked in 1958 and 10,647 fish were stocked in 1959. All fish were stocked as fingerlings at 2 1/2 – 3 inches in length.

Of 48 splake trout held at the Bellvue hatchery, all of the males and most of the females were sexually mature when two years old. Once stocked splake grew relatively quickly (e.g., up to 0.9 inches per month in the summer and 0.4 inches per month in the winter). In terms of vertical distribution in Parvin Lake, most of the splake trout caught were in the temperature zone between 55º F and 60º F. There was no evidence of splake trout concentrations in shoal areas where the average summer temperatures exceeded 60º F.

Both rainbow trout and splake trout utilized the aquatic invertebrate fauna extensively as food. The principal food items of both species were Isopoda, Decapoda and Diptera. It appears likely that there is some competition between the splake trout and rainbow trout for certain food items during the summer.

The mortality of the splake trout was much lower than that of the rainbow trout through the first two summers.

LEIK, T. H. 1959$_b$. An evaluation of the splake trout – Downstream migration studies. Colorado Cooperative Fishery Research Unit, Quarterly Report Volume 5, Colorado A & M College. Fort Collins, Colorado. 3 p.

The objectives of the migration study at Parvin Lake was to determine the number of splake trout and rainbow trout migrating downstream out of Parvin Lake. Migration was monitored by the use of a weir-type trap situated approximately 50 yards downstream from the surface outlet of the lake.

Migration of the splake trout downstream was negligible. It appeared that each time splake trout were introduced they distributed themselves throughout the lake. In the process some of the splake trout encountered and moved out the outlet stream. The percent of each group stocked that went downstream was small and the downstream migration loss was apparently negligible from the management standpoint.

LEIK, T. H. 1959_c. An evaluation of the splake trout – Creel census. Colorado Cooperative Fishery Research Unit, Quarterly Report Volume 5, Colorado A&M College, Fort Collins, Colorado. 7 p.

The objective of this study was to evaluate the harvest of splake trout by shore fishermen. Approximately 5,000 rainbow trout and 10,172 splake trout were stocked in Parvin Lake in June 1958.

During the summer of 1958 the splake trout were less than six inches long, too small to be accepted by the fishermen and were not harvested. The splake trout were between eight and nine inches long by the end of the following winter and were part of the harvest in 1959.

In the catch of 1959, there were 1,016 rainbow trout and 499 splake trout censused. From this catch it was estimated that 4,094 (2,383 – 5,807) rainbow trout and 2,011 (1,459 – 2,563) splake trout were caught. The lower splake trout catch was probably due to the fact that in the early spring of 1959 when the temperature in the shoal areas were cool and the splake trout were in those shoal areas, the splake trout had not gained enough growth to be as attractive to the fishermen as the rainbow trout. By mid summer, when the splake trout had grown sufficiently to be acceptable to a majority of the fishermen, the splake trout had moved out of the warm shoal areas into the cooler and deeper portions of the lake and were relatively unavailable to shore fishermen. Since public fishing was limited to shore fishing, this could make a difference in the composition of the catch. Had the general public been permitted to fish from boats, it is probable that the harvest would have been increased.

Splake trout and rainbow trout were caught by fishermen on all categories of bait (i.e., natural, artificial, flies or combination). The harvest and consequently the survival of the splake trout was a function of the changing temperatures of the lake.

LEIK, T. H. 1960. Immature splake trout in a lentic environment. M. Sc. Thesis, Colorado State University, Fort Collins, Colorado.

LIN, E. C. 1966. Thermal resistance and the correlation of inheritance among certain characters in F_2 lake trout (*Salvelinus namaycush*) x brook trout (*Salvelinus fontinalis*) hybrids. M. Sc. Thesis, University of Toronto, Toronto, Ontario. 84 p.

LISKAUSKAS, A. and N. QUINN. 1991. Stocking assessment studies on brook trout and splake in Algonquin Park district, 1986 – 1990. File Report, Ontario Ministry of Natural Resources, Whitney, Ontario. 33 p. + appendices.

The survival of planted brook trout and splake in Algonquin Park district lakes were assessed over a six year period. Brook trout and splake were both recovered from a majority of the lakes in which they were stocked (82 and 100% respectively). Brook trout and splake did not differ significantly ($P > 0.10$) in size

after almost two years of growth. The mean percentage recovery and CPUE for splake (1.91%; 4.4 fish per gill net set) was much higher than that for brook trout (1.05%; 1.61 fish per gill net set). The variability in fish size and the number of fish recovered per lake was high within both the brook trout and splake assessment lakes.

For the twenty-eight brook trout lakes, correlation and regression analysis revealed that the size and condition factor of recovered fish was greater on average in lakes where the mean size of planted fish was smaller and where simple fish communities were present. For the splake lakes, the number of fish recovered from a lake was positively correlated with stocking density and negatively correlated with lake maximum depth.

Brook trout and splake stocking assessment lakes differed in their assessment protocol as well as in several important biotic and abiotic variables which confounded comparisons between the two data sets. It was also noted that an increase in gill net effort in both the brook trout and splake lakes had a pronounced effect in reducing gill net catch variability.

LOFTUS, D. H. 1979. The charterboat fishery for lake trout in southern Georgian Bay, 1920 – 1955. Report 79-1, Lake Huron Fisheries Assessment Unit, Ontario Ministry of Natural Resources, Owen Sound, Ontario.

A charterboat fishery for lake trout (*Salvelinus namaycush*) developed in the Georgian Bay waters of Bruce and Grey Counties during the 1920s and 1930s. The presence of good lake trout fishing, the availability of guides and boats and rapid expansion of tourism were important factors in its growth. The fishery reached its greatest size at the end of the 1930s when there were about 90 charterboats in service. The principal ports were Meaford, Tobermory, Lion's Head and Colpoys Bay. The fishery declined rapidly after 1940 in the face of rapidly diminishing lake trout stocks and by 1955 it had come to an end.

The Ministry of Natural Resources has embarked on a program to re-establish a deep water trout in Georgian Bay and it has selected a lake trout x brook trout hybrid (splake) for the this purpose. The propensity of splake for early sexual maturity is an advantage over lake trout in the face of sea lamprey predation. Assuming that a variety of splake, with behavioral characteristics similar to those of lake trout can be established in Georgian Bay, a large summer sport fishery operating from small boats is expected to develop. The ports that hosted the larger charterboat fleets will witness renewed fishing activity because of their proximity to good trout habitat.

Establishment of splake populations in Georgian Bay will foster the development of a summer sport fishery operating from outboard boats. If a charterboat fishing industry is re-established, it is unlikely to attain its former size because of the wide ownership of small boats.

MARSHALL, T. L. and R. P. JOHNSON. 1971. History and results of fish introductions in Saskatchewan, 1900 – 1969. Fisheries Report No. 8, Fisheries and Wildlife Branch, Saskatchewan Department of Natural Resources, Regina, Saskatchewan. 27 p.

Since 1900, 1.6 billion fish comprising 30 species have been introduced to fresh and saline waters of Saskatchewan. Breeding of the splake (*Salvelinus fontinalis* x *S. namaycush*) in Saskatchewan began in 1965 when ova from a Whelan Bay lake trout were fertilized with sperm of a brook trout from nearby McDougal Creek. The 4,500 eggs taken produced 3,870 fingerlings which demonstrated good vigor and rapid growth. These and more recently derived F_1 splake have now been planted in three rehabilitated lakes and a stream in the Nipawin Provincial Park and in Mullock Lake near La Ronge. The hybrids have exhibited excellent survival and growth in all except Mullock Lake. To date, natural progeny have not been observed.

MARTIN, N. V. 1960. Annotated bibliography of the eastern brook trout x lake trout hybrid. Fisheries Research Information Paper No. 7, Ontario Department of Lands and Forests, Maple, Ontario. 12 p.

This bibliography represents a preliminary attempt to bring together all available data on the brook trout x lake trout hybrid. Various states and provinces have contributed towards the compilation of this list. The bibliography contains 93 citations which are arranged in chronological order.

MARTIN, N. V. 1965. Wendigo : The not-so-evil spirit. Ontario Fish and Wildlife Review 4(3) : 12 – 18.

The splake is an excellent game fish, most frequently fighting like the brook trout, but occasionally diving deep like the lake trout. It appears more vulnerable to fly fishing and other means of angling than either the brook trout or lake trout.

Splake seem to have a tendency to "school". They frequent depths of 20 – 35 feet and water temperatures of 50 – 70º F during the summer stratification period. While lake trout are primarily piscivorous, wendigo more closely resemble feeding habits of brook trout by feeding mainly on mayflies, leeches, frogs, salamanders and plankton. They appear to have a more rapid growth rate than either parent.

Most wendigo appear to be mature at age 3 . Conversely, most brook trout are mature by age 3 whereas most lake trout are mature by age 6 or 7. Splake appear to prefer gravelly areas for spawning as do the brook trout, but will spawn on rocky slopes as do lake trout if no gravelly areas are available.

Splake have lived in nature for as long as 9 years versus a maximum of 6 years for brook trout. The maximum size is as yet unknown, although in 1960 a 16 pound wendigo was taken in a northern Ontario lake.

MARTIN, N. V. and N. S. BALDWIN. 1960. Observations on the life history of the hybrid between eastern brook trout and lake trout in Algonquin Park, Ontario. Journal of the Fisheries Research Board of Canada 17(4) : 541 – 551.

Studies of brook trout x lake trout hybrids planted in Algonquin Park, Ontario, lakes since 1954 indicate they are readily available to angling and an excellent game fish. Hybrid trout depth distribution during stratification is between the 8º and 20º C isotherms. Mayfly nymphs, crayfish, leeches and fish are important in the diet. Hybrids average 12 inches at age II, 16 inches at age III and 18 inches at age IV. Their length – weight relationship is similar to the lake trout. Most hybrids are mature by age III. Egg production is similar to the brook trout. Hybrids were observed spawning on rocky shoals in early November and had spawning characteristics of each parent. Hybrid eggs hatched by the end of April.

MATKOWSKI, S. M. D. 1989. Differential susceptibility of three species of stocked trout to bird predation. North American Journal of Fisheries Management 9 : 184 – 187.

Piscivorous birds can remove substantial proportions of stocked salmonids from lakes. To determine whether susceptibility to bird predation differs among trout species, 321 brook trout (*Salvelinus fontinalis*), 330 rainbow trout (*Oncorhynchus mykiss*), and 321 splake (*Salvelinus namaycush* x *S. fontinalis*) were stocked in a small lake in Duck Mountain Provincial Park, Manitoba, in spring 1982. Principal avian predators were common loons (*Gavia immer*) and great blue herons (*Ardea herodias*) which together

averaged 1.5 visits per day to the lake from June through October. No post-stocking mortality was observed. The primary cause of mortality appeared to be birds. Intensive gillnetting in fall 1982 and spring 1983 produced 41 rainbow trout, 138 brook trout, and 173 splake. The pelagic habits of rainbow trout make them most susceptible to bird predation; brook trout, which stay nearer the substrate, and splake, which prefer deep areas, would be more difficult for birds to see and capture.

McCAMBRIDGE, J. 1991. Splake stocking assessment on Little Yirkie Lake, Denbigh Township. File Report, Ontario Ministry of Natural Resources, Bancroft, Ontario. 1 p.

Little Yirkie Lake was originally surveyed in 1969. Water chemistry results showed suitable water quality to 15 feet. Sampling during the survey produced white suckers and yellow perch. In 1984, Little Yirkie Lake was put on the splake stocking program receiving 500 yearlings in 1984, 500 yearlings in 1988, 1,000 yearlings in 1990 and 1,000 yearlings in 1991. Prior to this Little Yirkie was stocked with brook trout.

In July 1991, a splake stocking assessment was completed on Little Yirkie Lake. Water chemistry results showed suitable water quality to 5 meters. Index gill netting involving one overnight set of approximately 800 feet of gill net produced 5 splake, 40 yellow perch and 145 white suckers. All 5 splake were from the 1991 spring planting.

From this assessment, it is recommended that Little Yirkie Lake be removed from the splake stocking program. The large number of white suckers and yellow perch are too much for the splake to compete with. As well, the relatively poor water quality may mean there is low oxygen levels in summer and winter resulting in winter or summer kill.

McDONALD, D. G., M. D. GOLDSTEIN, and C. MITTON. 1993. Response of hatchery-reared brook trout, lake trout, and splake to transport stress. Transactions of the American Fisheries Society 122(6) : 1127 – 1138.

The stress of routine transport practices on hatchery reared brook trout (*Salvelinus fontinalis*), lake trout (*Salvelinus namaycush*), and splake (*S. fontinalis* x *S. namaycush*) was evaluated by measuring changes in plasma levels of the stress hormone cortisol, the key stress metabolite glucose, and the plasma electrolytes Na^+ and Cl^-, and by measuring net ion and ammonia exchanges with the water in the transport tanks. We examined actual transport trips and standardized net confinement stress in the laboratory to quantify differences in stress response among the species. Brook trout were the least sensitive to both transport stress and net confinement, and responded in a similar fashion to both treatments. Splake responded to transport like brook trout but were the most sensitive to net confinement. Species differed most in their ability to maintain ion exchanges with the water under stress. Lake trout experienced ion losses during transport that were about 10 fold higher than losses from brook trout and splake. Trip duration (3.5 – 11 hours) had only a minor effect on physiological responses, and wide variations in loading density (6.9 – 17 kg/100 L) had no significant effect. Increasing O_2 levels in the water (due to oxygenation rather than aeration of the tanks) proved to be moderately stressful to brook trout, based on elevations in plasma cortisol levels. Our results permit an evaluation of the relative contributions of different transport variables to the transport stress imposed on salmonids.

McINTYRE, E. and K. HENRY. 1988. Mill Lake (McDougall Township) F_1 splake stocking assessment. File Report, Ontario Ministry of Natural Resources, Parry Sound, Ontario. 5 p.

From September 15 – 17, 1987, an assessment of the 1983 and 1985 plantings of 5,100 F_1 splake was conducted on Mill Lake, McDougall Township. Eight overnight sets of standard lake survey gill net were made with a resultant catch of 9 lake trout, 17 lake whitefish, 42 lake herring, 6 rainbow smelt, 8 walleye, 1 northern pike and 5 common white suckers. No F_1 splake were caught. Eight of the nine lake trout sampled were from either the 1974 or 1975 plantings of 5,000 LV clipped fish. One large lake trout had an adipose (Ad) clip indicating that it was from the 1968 planting of 3,000 Ad clipped lake trout. The absence of F_1 splake indicates poor survival of the 1983 and 1985 plantings and suggests that future plantings should be discontinued.

McNAUGHTON, J. 1992. Round Lake splake stocking assessment. File Report, Ontario Ministry of Natural Resources, Kemptville, Ontario. 2 p.

Round Lake has been planted with 500 splake in each of the past three years (1990 – 1992). A gill netting project was conducted to assess the status of the stocked splake population in Round Lake. Two gangs of gill nets were set in the lake on September 8 and were left overnight for a fishing time of approximately 21 hours. The first set was approximately 150 feet long and 8 feet in height containing several mesh sizes (4.5", 4.5", 2", 3", 2.5" and 4.5"). The second set was 50 feet in length and contained mesh sizes of 1.5" and 2".

The first net set produced a catch of 7 rock bass, 5 bluegill, 2 northern pike, 5 largemouth bass, 1 yellow perch, 1 smallmouth bass and 6 pumpkinseed. The second net caught 2 splake, 3 northern pike, 1 pumpkinseed and 1 smallmouth bass. The two captured splake were 41.5 and 46.6 cm in length, respectively.

MICHIGAN DEPARTMENT OF NATURAL RESOURCES. 1987. Michigan fish stocking guidelines. Fisheries Division, Lansing, Michigan. 32 p.

Splake are well suited to planting in the cold water lakes of the upper peninsula and in large, deep oligotrophic lakes throughout the state including the Great Lakes where they inhabit shallower water than lake trout and exhibit stay-at-home tendencies.

Experience has demonstrated that splake grow slowly during their first few months of life but are a vigorous, fast-growing fish thereafter. Their role in management lies between that of the brook and lake trout. Compared with other species, splake are costly to produce so their use should be limited to those situations in which they are clearly superior. They should be planted as fingerlings or yearlings. Splake should never be stocked when receiving waters exceed 68 – 70º F.

Splake can be used to stock in two story lakes. Two story lakes are those which shall be managed in combination with the non trout species existing in the lakes by stocking of yearling or large fingerling trout.

MYERS, R. and J. McCAMBRIDGE. 1990. 1990 Splake stocking assessment on Big Mair Lake, North Canonto Township. File Report, Ontario Ministry of Natural Resources, Bancroft, Ontario. 4 p.

Big Mair Lake has been stocked with splake since 1984. Prior to this it had been stocked with lake trout and speckled trout. Since 1984 Big Mair Lake has received 1,000 – 2,000 yearling splake annually.

Big Mair Lake was initially surveyed in 1982, water chemistry results showed suitable water quality to the ten meter depth. Index gill netting produced white suckers and lake trout. On this survey water chemistry results showed suitable water quality to the twenty meter depth. At twenty meters the dissolved oxygen

was 4.5 mg L^{-1} but at fourteen meters the dissolved oxygen dropped to 3.5 mg L^{-1}. The reason for the decrease in oxygen is unknown but probably was a malfunction of the sampling equipment. There were no fish caught in the deep water which would support this theory. Index gill netting which involved one overnight set of approximately 1,200 feet of gill net (4.5 and 2.5 inch mesh) produced the following results: 8 splake, 1 lake trout and 27 white suckers. The splake ranged in size from 1.6 kg to 4.5 kg and from 48 – 74.8 cm in length.

From this assessment it is recommended that Big Mair Lake remain on the splake stocking program. The splake are doing extremely well in the lake. What little creel returns we have from the lake show that there is above average returns of the stocked splake. There should be an attempt at getting more creel information from the lake to determine whether there are any small fish being caught.

NATIONAL FRESHWATER FISHING HALL OF FAME. 2000. Official world and USA state freshwater angling records. Hayward, Wisconsin. 77 p.

The freshwater fishing hall of fame is a non-profit museum – educational organization which maintains records and recognizes world record sized fish of 56 different species including splake. The largest splake on record is a 20 pound 11 ounce (9.38 kg) fish which was angled from Georgian Bay, Ontario, on May 17, 1987. Other Ontario splake which are recorded include a 10 pound 9 ounce (4.79 kg) fish which was angled from the Bighead River in September 1988 and a 4 pound (1.81 kg) fish which was angled from Doc Grieg Lake in May, 1993.

NOVAK, J. P. 1974. The 1974 planting of splake marked with oxytetracycline-hydrochloride in South Bay. File Report, Fisheries Research Section, Ontario Ministry of Natural Resources, south Bay, Ontario. 8 p.

ONTARIO MINISTRY OF NATURAL RESOURCES. 1977. Report of the Lake Huron Fisheries Assessment Unit to the Lake Huron Committee, Great Lakes Fishery Commission. February 22, 1977.

On the basis of the results of an experimental gill netting program carried out in past years, it would appear that splake abundance underwent little change in southern Georgian Bay between 1975 and 1976. Total catches of splake were identical (201) in the two years. Peak abundance occurred in 1974.

The 1976 planting of splake in the Meaford area of southern Georgian Bay differed in both size and number. The two lots of fish stocked averaged 14.3 fish/lb. and 4.9 fish/lb. respectively. Subsequent catch data, adjusted for the number of fish planted, of large splake to small splake was 10.8 : 1. Small splake may not be fully recruited to the gear until the fish reaches age II.

Estimates of splake survival obtained from the 1976 catch data are in agreement with estimates previously derived. Mean survival from age I – II is estimated to be 58%; from II – III 10%. Survival estimates beyond this point become questionable because of sample size.

ONTARIO MINISTRY OF NATURAL RESOURCES. 1978. Report of the Lake Huron Fisheries Assessment Unit to the Lake Huron Committee, Great Lakes Fishery Commission. March 14, 1978.

A sharp reduction (61%) occurred in the number of splake caught in experimental gill nets set in southern Georgian Bay in 1977. Much of this is believed due to the adverse effect of a furunculosis outbreak on the

survival of yearling splake. The disease caused heavy losses in the hatchery in May and early June and many of the hybrids planted were debilitated. The removal of 160 splake from the study area by commercial fishermen immediately prior to the assessment period and high winds during the assessment period also are regarded as factors in the decline.

The prior removal of splake from the area in which the test fishing was done precluded use of catch data to arrive at further survival estimates. However, the lack of older (age IV) splake in the catch is consistent with earlier results that indicated high mortality beyond age III. The data did furnish additional evidence that large size at the time of planting imparts a survival advantage to yearling splake.

Two (5.4%) of the yearlings caught in 1977 were unclipped. This is higher than the observed rate of missed fin clips among hatchery fish (0.9%) but the sample size (37 splake) is too small to say anything more.

Much of the commercial harvest of splake occurred at Burnt Island in northern Lake Huron. There, an estimated 1,201 splake were taken. These consisted of three age groups: ages I (3.2%), II (69.3%), and III (27.4%). The division of the catch between gill net and pound net fisheries was the reverse of that for lake trout – 71% of the splake having been caught in the impounding gear set nearshore.

ONTARIO MINISTRY OF NATURAL RESOURCES. 1982$_a$. Rationale for stocking F_1 splake in inland waters. Fish Culture Section, Fisheries Branch, Toronto. 8 p.

It is clearly evident from the research findings that F_1 splake are likely to outperform both brook trout and lake trout in inland lakes in terms of survival and growth, and therefore also in the provision of artificial fishing opportunities. Further, the longevity of F_1 splake as compared with brook trout provides the possibility of a trophy fishery. Thus it is recommended that F_1 splake may now be used for put-grow-take stocking in district fisheries management programs where appropriate, subject to the accepted policy and with due regard to the recommended stocking guidelines. It is also suggested that an adaptive experimental management strategy be adopted for F_1 splake including a proper assessment program which will in turn provide the information required to continually refine and improve the stocking guidelines.

ONTARIO MINISTRY OF NATURAL RESOURCES. 1982$_b$. Guidelines for stocking F_1 splake in inland waters. Fish Culture Section, Fisheries Branch, Toronto, Ontario. 3 p.

Pursuant to the F_1 splake stocking policy, guidelines are presented for stocking F_1 splake in inland waters of Ontario. For supportive information the fisheries manager is referred to the background document entitled “Rationale for stocking F_1 splake in inland waters”. Guidelines include stocking rates, use of fall fingerlings versus spring yearlings, optimal temperature conditions, food supply and forage considerations and competition with other resident species.

ONTARIO MINISTRY OF NATURAL RESOURCES. 1990. Splake stocking. *In* Eastern Ontario’s Fish Stocking Program, Eastern Ontario Fisheries Update, Eastern Region, Kemptville, Ontario. 4 p.

Over one hundred thousand splake are normally planted each year in 40 – 50 inland lakes throughout eastern Ontario (111,900 F_1 splake were stocked in 1989). The splake, a hybrid resulting from a lake trout-brook trout cross, grows quickly and is used to provide fishing opportunities in many former lake trout waters.

ONTARIO MINISTRY OF NATURAL RESOURCES. 1996. Lake trout rehabilitation plan for Lake Huron (Canadian jurisdiction). Report 96-02, Lake Huron Management Unit, Owen Sound, Ontario.

Great Lakes agencies have actively sought to re-establish lake trout populations by stocking, lamprey control, fisheries regulations and, more recently, habitat restoration. Efforts to restore lake trout in Lake Huron began in the early 1950s. Initial plantings survived poorly past age IV due to repeated attacks by sea lamprey. It became apparent that sea lamprey control was essential for rehabilitation, although early expectations for control were pessimistic.

By the late 1950s, attention turned to developing an early maturing trout by crossing female lake trout with male brook trout. The resulting hybrid was known as the splake. F_1 (first generation) splake were the first hybrids selected for planting in 1966. Further genetic selection created the "highly select" splake variety that was subsequently planted. High mortalities and lack of evidence of natural reproduction prompted the infusion of more lake trout genes in the hybrid through backcrossing. The backcross, a cross between pure lake trout and the splake, is approximately 80% lake trout. The backcross retains some of the early maturing characteristics originally obtained through the hybridization process. Planting of backcross first began in northern Georgian Bay (Heywood Island) in 1978 and was extended to southern Georgian Bay in 1979.

ONTARIO MINISTRY OF NATURAL RESOURCES. 1999. Stocks catalogue. Fish Culture Section, Fish and Wildlife Branch, Peterborough, Ontario.

In former years, F_1 splake, an inter-specific hybrid of brook trout x lake trout, were stocked in most regions of Ontario. These fish were produced using Lake Manitou female lake trout crossed with Hills Lake male brook trout. The Ministry's lake trout backcross program, which was developed in the late 1970s and early 1980s, required large number of Lake Manitou lake trout eggs. Egg collections for the F_1 splake program would have placed additional stress on the Lake Manitou stock which was unacceptable. Consequently, lake trout eggs for the F_1 splake program have been collected from other captive lake trout broodstocks (Killala Lake, Mishibishu Lake and Slate Islands). Selection of the two F_1 splake stocks (i.e., HL x KL; LN x ST) was based on (i) availability of parent captive stocks in the fish culture system; (ii) suitable egg size; and (iii) hatchery logistics.

Based on information currently available, the three F_1 splake stocks presently found in the provincial fish hatchery system should be used to provide put-grow-and-take fishing opportunities as follows:

> **Killala Lake x Hills Lake and Mishibishu Lake x Hills Lake –** Killala and Mishibishu lake trout both originate from soft water lakes and most F_1 splake lakes are soft water lakes. These stocks grow well in the hatchery environment (e.g., HL x KL range from 7 – 12 gm as fall fingerlings and 22 – 40 gm as yearlings; HL x ML average 27 gm as fall fingerlings and 55 gm as spring yearlings). It is recommended that these two stocks be used in northeastern and southcentral Ontario.
>
> **Lake Nipigon x Slate Islands –** These stocks originate from the Dorion fish culture station. It is recommended that this stock be used in northwestern Ontario. Growth rates of this stock are extremely slow (e.g., 10 – 15 gm as fall fingerlings; 18 gm as spring yearlings). If this stock is not providing a satisfactory level of performance it may be necessary to transfer KL x HL eggs to Dorion for culture and ultimate release into northwestern Ontario waters.

Although the F_1 splake is a fertile hybrid, it is to be used only to provide hatchery-dependent, put-grow-and-take fishing opportunities in lakes where naturally reproducing stocks of lake trout or brook trout are not present and cannot be re-established.

ONTARIO MINISTRY OF NATURAL RESOURCES. 2000. Best management practices for fish stocking inland waters of the Northeastern Region. Unpublished guidelines, South Porcupine, Ontario. 14 p.

These best management practices for fish stocking have been developed as a starting point for making sound stocking decisions. Stocking decisions made outside these best management practices should reflect either new science, recommendations from stocking assessment and/or local knowledge which is defensible.

The best management practices for splake stocking may be summarized as follows:

- Splake should be stocked at the frequency of once every 1 – 3 years.
- For brook trout "type" lakes splake should be stocked at the maximum rate of 4.5 kg per ha < 6 m in depth or 25 – 50% of this when based on lake surface area. For lake trout "type" lakes the rate should be half of that determined for brook trout "type" waters.
- Lakes should only be stocked where there are no native brook trout or lake trout present.
- Splake should not be stocked into lakes where brook trout or lake trout are also being stocked.
- Managers should avoid stocking lakes where other self-sustaining sport fish populations (e.g., smallmouth bass) exist.
- Waters stocked with splake must have suitable habitat available in both the summer (i.e., > 5 ppm dissolved oxygen) and late winter (i.e., 50% of lake volume having > 4 ppm dissolved oxygen).
- When stocking splake in lakes with complex fish communities, including perch, herring, and northern pike, stocking should be considered as experimental management. Assessment to evaluate returns of stocked fish is necessary.

ONTARIO MINISTRY OF NATURAL RESOURCES. Undated. Splake. *In* Fishing in the Parry Sound District. Parry Sound, Ontario.

After the collapse of the lake trout population in the upper Great Lakes, the Department of Lands and Forests embarked on a trout rehabilitation program during the late 1950s. The species chosen for the job was the splake, a cross between the lake trout and the brook trout. What was desired was a fish with the early maturing characteristics of the brook trout and the deep swimming ability of the lake trout. The early maturing characteristic was to ensure the fish had a better probability of spawning at least once before they were subjected to sea lamprey predation and the deep swimming characteristic was to provide a predator fish which would fill the deep swimming and piscivorous role of the native lake trout.

The "Big Sound" of Georgian Bay near Parry Sound was first planted in 1972 with 14,400 yearlings and 3,038 two-year-old splake. Splake were again planted in 1975 (98,500 yearlings) and in 1976 (99,000 yearlings). The plantings were divided equally and placed at Mowat Island (inside the "Big Sound") and Davy Island (just west of Killbear Park).

Assessment work conducted in the "Big Sound" during August of 1977 and subsequent assessment on the former lake trout spawning shoals indicate the survival of the early plantings of these genetically, highly selected fish, was poor.

Beginning in 1978, the Ministry of Natural Resources began planting fish in the North Channel of Lake Huron which had much more lake trout character than its predecessor. This fish has become known as the backcross splake and genetically is three-fourths lake trout and one-fourth brook trout. Since 1978, the largest plantings have been made in the Owen Sound, Wiarton and Collingwood areas of southern Georgian Bay. The success of the plantings of backcross splake is past history. Assessment of these

plantings in 1979 and the large catches in 1980 and 1981 by both anglers and commercial have indicated that both the survival and growth of these fish has been spectacular.

As part of the overall program to rehabilitate the trout fishery in Georgian Bay, 95,500 backcross splake (large fingerlings) were planted in the "Big Sound" off Parry Sound in October of 1981 and an additional 97,000 yearlings were planted in May of 1982. It is further planned to plant a minimum of 70,000 yearling backcross splake in the "Big Sound" annually. Parry Sound district fisheries personnel are very optimistic that, by 1984, the Parry Sound residents and visitors alike will have a trout fishery worth bragging about.

ONTARIO MINISTRIES OF NATURAL RESOURCES AND THE ENVIRONMENT. 1992. Inland lake trout management in southeastern Ontario. Queen's Printer for Ontario, Kemptville, Ontario. 160 p.

In addition to lake trout, the Ministry of Natural Resources stocks splake, rainbow trout and brook trout in inland waters to supply fishing opportunities on a put-grow-and-take basis. The F_1 splake stocking program commenced in 1983 with the release of approximately 6,000 fish in five lakes. Currently 25 – 30 southeastern Ontario inland lakes are stocked with 100,000 splake annually. F_1 splake will continue to have a major role to play in lake trout management by supplying alternative fishing opportunities.

Splake are intermediate in their preferred temperatures: preferred temperatures for lake trout and brook trout can be considered as 10º C and 16ºC respectively. Splake have a temperature preference of approximately 12º C.

The proposed stocking program for splake includes converting lakes difficult to manage as put-grow-take lake trout fisheries. In addition, splake will be introduced into entirely new lakes having less than favourable conditions for lake trout but suitable conditions for splake as well as converting some put-grow-and-take brook trout and rainbow trout fisheries. With a longer open season and higher catch and possession limits, it is hoped that splake will divert pressure away from lake trout fisheries.

ORENDORFF, J. A. and N. C. FRASER. 1984. Stocking of salmonids in inland lakes: A summary for Algonquin Region, 1974 – 1983. Fish Culture Section, Ontario Ministry of Natural Resources, Toronto, Ontario. 43 p.

This document summarizes fish stocking information for the Algonquin Region for the period of 1974 – 1983. Brook trout stocking events occurred most often followed by lake trout, rainbow trout and F_1 splake, respectively. In terms of total numbers stocked, lake trout outnumbered brook trout followed by rainbow trout and F_1 splake. On average, splake were planted at a density of 110 fish/ha. In terms of mean density by weight F_1 splake were planted at a rate of 2.2 kg/ha. The mean lake area and mean depth for lake stocked with splake was 88 ha and 7.5 m respectively. Almost 52% of F_1 splake plantings occurred between April and June while the remainder (48%) occurred in September and October.

PAYNE, N. R. 1975. Splake – The "made-to-measure" fish. The Griffon, Ontario Ministry of Natural Resources, Owen Sound, Ontario 1 : 1 – 2.

PAYNE, N. R. 1977. Splake assessment. Lake Huron Fisheries Assessment Unit, Ontario Ministry of Natural Resources, Owen Sound, Ontario.

This report summarizes the results of the splake assessment program carried out in the Cape Rich area of southern Georgian Bay in 1977. The timing of the project was August 13 – September 1. Fishing effort remained unchanged (54,864 m) but some modifications were made to the gear used.

Seventy-eight (78) splake were taken. This represents the smallest total catch of the hybrid since 1971 and a reduction of 61% from 1976. This decline occurred despite indications that the new mesh twine was more efficient.

Comparatively few yearling splake from the 1977 planting were captured. The yearlings planted in the Meaford area in the spring of 1977 were of large average size (5.2/lb.) and therefore should have shown up in substantial numbers. Their failure to do so is a strong indication that the furunculosis outbreak which accounted for high losses (20.3%) of yearlings at the Chatsworth Fish Culture Station in May and June also significantly reduced survival in the lake.

PAYNE, N. R. Undated. Criteria for the selection of splake planting sites. Unpublished manuscript, Lake Huron Fisheries Assessment Unit, Ontario Ministry of Natural Resources, Owen Sound, Ontario. 4 p.

Splake are being planted in Lake Huron with the object of establishing the hybrid in a self-sustaining state in habitat previously occupied by lake trout and, by doing so, to restore lost fishing opportunities. Criteria for the selection of planting sites may be grouped under three general categories:

1. Conditions necessary for the survival and reproduction of splake
- suitable spawning substrate available.
- summer habitat based on an area with water temperatures at bottom below 15º C and above 8º C.
- evidence of low lamprey wounding rates.
- no known problem with contaminants.
- amount of fishing and the degree it can be controlled.

2. User criteria.
- demand for a fishery and alternate opportunities available.
- access to fishery and local services available.
- conflicting uses of water (e.g., commercial vs. sport fishing).
- protection for adverse weather (e.g., wind).

3. Logistical considerations.
- distance from fish culture station.
- distance over water from nearest suitable port to release site.
- availability of vessels for planting.

PEARSON, B. E. 1952. The behaviour of a sample of hybrid trout (*Salvelinus fontinalis* x *Cristivomer namaycush*) in a vertical temperature gradient. Manuscript Report, Ontario Fisheries Research Laboratory, University of Toronto, Toronto, Ontario.

This study, conducted at the Laboratory for Experimental Limnology at Maple, Ontario, involved a comparison of lake trout, brook trout and hybrids. The temperature preferendum of the hybrids was found to be 12º C.

PECK, J. W. 1990. Contribution of hatchery trout and salmon to a Lake Superior sport fishery. p. 196 *In* Proceedings of the 52nd Midwest Fish and Wildlife Conference, Minneapolis, Minnesota. (Abstract Only)

The recent organization by anglers who fish Michigan waters of Lake Superior has resulted in increased demand for enhancement of sport fish populations through plants of hatchery fish. Information on catch and return to the creel were lacking for most species of hatchery trout and salmon planted in these waters. The purpose of this study was to determine the percentage of contribution to total catch and the percentage of total number planted that were caught by anglers (return to the creel) for strains of rainbow trout (*Oncorhynchus mykiss*), age groups of splake (*Salvelinus fontinalis* x *S. namaycush*), brown trout (*Salmo trutta*) and yearling coho salmon (*Oncorhynchus kisutch*) planted in Lake Superior and tributaries at Marquette, Michigan during 1983 – 1987.

To obtain these data I used an on-site creel survey with stratified random instantaneous counts of anglers and angler groups at two Lake Superior sites and portion of three tributaries. Hatchery trout and salmon contributed a minor portion of the sport fish catch at Marquette. Yearling splake provided a 13% return to the creel compared to less than 2% for fall fingerling splake and plants of other trout and coho salmon. Straying by the more migratory species and mortality affecting numerically small plants are believed to be the main factors contributing to the poor return to the creel.

PETERSON, R. H., A. M. SUTTERLIN and J. L. METCALFE. 1979. Temperature preference of several species of *Salmo* and *Salvelinus* and some of their hybrids. Journal of the Fisheries Research Board of Canada 36 : 1137 – 1140

Temperature preference of newly feeding fry of two species of *Salmo*, three species of *Salvelinus* and seven hybrids were determined in a horizontal gradient. Fry of species in the genus *Salmo* and intergeneric hybrids with female parent in *Salmo* selected significantly higher temperatures (13.0º – 15.0º C) than did fry of species and hybrids of the genus *Salvelinus* (9.0º – 11.5º C). No significant differences were obtained among species and hybrids within either of the two groups described above. Preferred temperatures of fingerlings (after 3 months of feeding) of two species and two hybrids within *Salvelinus* were determined in a vertical temperature gradient. Brook trout preferred 17.5º C and lake trout 10.8º C. The two hybrids (brook trout x lake trout and lake trout x brook trout) preferred intermediate temperatures (14.7º and 14.4º C). Rainbow trout fingerlings selected 14.7º C.

POTTER, B. A. 1995. F_1 Splake-bass interactions. File memo, Aquatic Ecosystems Branch, Ontario Ministry of Natural Resources, Toronto, Ontario. 2 p.

There is not a lot of information specifically regarding the impacts of stocking F_1 splake on other species including smallmouth bass. Research in Algonquin Park indicated the diet of splake differed among lakes but fish (mainly yellow perch) and crayfish predominated in the diet of larger F_1 splake. Zooplankton (primarily Cladocera) were common in the diet of smaller splake. Smallmouth bass tend to feed on insects, crayfish and fish with the two latter organisms making up the bulk of the diet. Yellow perch appears to be a commonly consumed fish by bass.

PUNT, K. 1997. Joyce's Lake 1997 splake assessment. File Report, Ontario Ministry of Natural Resources, Pembroke, Ontario. 5 p.

A netting exercise took place on August 25 – 26, 1997 to determine the success of the splake introduction into Joyce's Lake which began in May of 1994. It was recommended by staff during the Environmental Assessment process that after the fourth year of fish planting, a thorough assessment of the splake be

carried out. On August 25, two standard monofilament gill nets were set for approximately one hour so not to have a dramatic impact on the fish present. A small two-panel gill net was left overnight to determine if all age classes were present. A net was also set in the lake for one hour on August 26 to sample more fish.

A total of 6 splake and 4 common white suckers were caught in the one hour net sets. Five splake had a left pectoral (LP) clip and one had no clip. The LP clip is from the 1995 stocking and the unclipped fish is from the initial stocking in 1994. The overnight set produced a total of 8 splake with a composition of 5 LP clips, 2 unclipped fish, and one right pectoral (RP) clip (from the 1996 stocking). No fish from the 1997 splake stocking were caught. The one hour set on August 26 produced one LP clipped splake and one common white sucker. Stomach contents were analyzed for seven splake. The diet consisted mainly of fish.

Overall, the splake seem to be surviving and have good growth. This may be due to a trophic surge caused by the introduction. Only time will tell whether the fishery will continue to do well. The splake are utilizing the coarse fish present in the waterbody. All year classes seem to be present except for 1997. It may be due to the size of these fish and were missed in the nets.

QUÉBEC MINISTÈRE DU LOISIR, DE LA CHASSE ET DE LA PÊCHE. 1988. Technical guidelines for introducing and restocking splake. *In* Stocking guidelines for fish species other than anadromous Atlantic salmon. Direction de la gestion des especes et des habitats, Québec City. PQ. 79 p.

All stocking of splake must be carried out according to the criteria described in the technical files using the put-grow-and-take technique:

- Stocking splake in waters where populations of brook charr, lake charr and freshwater fed charr exist is not recommended.
- Stocking should be carried out with yearlings . The maximum quantity is 25,000 fish per project. Stocking rates should be determined according to the following chart:

	Ecological Region			
	Sedimentary Suitable Habitat Area		Precambrian Shield Suitable Habitat Area	
Fish Community in Recipient Lake	< 400 ha	> 400 ha	< 400 ha	> 400 ha
Salmonids, minnows, suckers	50/ha	25/ha	40/ha	20/ha
Warmwater species	35/ha	20/ha	25/ha	15/ha

- Stocking frequency should be every other year.
- Stocking should be carried out in the spring preferably when the recipient water temperatures are between 4º C and 10º C (but never higher than 16º C).
- Fish should be distributed uniformly over the deep water zone of the lake.
- The success of stocking must be assessed no later than two or three years after stocking.

RUMSEY, C. and T. LAMARRE. 1994. A preliminary report on the effects of F_1 splake plantings on a stunted yellow perch population in a small Precambrian Shield lake. Unpublished report, Sir Sandford Fleming College, Lindsay, Ontario. 7 p.

East Lake, Harcourt Township in Haliburton County, is a 30 ha Precambrian Shield lake. Historically, the lake provided anglers with an outstanding fishery for brook charr (*Salvelinus fontinalis*). The fishery was largely a result of natural reproduction in the lake in spite of the fact that the charr lived sympatrically with yellow perch (*Perca flavescens*). With the advent of summer cottage development in the 1960s the fishery

went into permanent decline. In 1972, in addition to planting brook charr, Harcourt Park Inc. began annual stockings of rainbow trout (*Onchynchus mykiss*) in an attempt to improve the fishery. This practice continues today and the rainbow provide a significant contribution to the creel.

Since yellow perch commonly impact on brook charr populations, perch control was attempted by introducing F_1 splake (*Salvelinus fontinalis* x *S. namaycush*) in 1989 (500 yearlings) and 1991 (750 yearlings). Splake are known to feed on yellow perch in many situations.

Stock assessments indicate that the perch population has declined by over 40% between 1990 and 1992. It appears that splake may be the controlling factor since splake in East Lake are much more likely to contain perch in their diet than are stocked rainbow trout or brook charr.

We hypothesize that yellow perch will be controlled by this method and that brook charr survival and growth will be enhanced. Additional plantings of splake, continued perch assessments, salmonid diet analysis and growth studies will allow us to more positively evaluate our efforts.

SATTERFIELD, J. R., Jr. and K. D. KOUPAL. 1994. Splake as a control agent for brook trout in small impoundments. p. 431 – 436 *In* H. L. Schramm and R. G. Piper [eds.] Uses and Effects of Cultured Fishes in Aquatic Ecosystems. American Fisheries Society Symposium 15.

During 1988 – 1992, fingerlings (70 – 120 mm total length) of splake, the hybrid of male brook trout (*Salvelinus fontinalis*) and female lake trout (*S. namaycush*) were stocked annually into three 3.5 – 40.5 ha Colorado impoundments at a density of 100 per hectare to improve population structure of existing brook trout populations. After 5 years of splake stocking, brook trout in all three impoundments exhibited significant improvements in population structure. Density of stock-length (> 125 mm total length) brook trout, as measured by gill net catch per unit effort (CPUE), declined in all waters from a pre-splake introduction average of 42 fish per net night to 23 fish. Conversely, brook trout proportional stock density (PSD) increased over the five years of splake stocking from an average of 4 (range 1 – 7) to an average of 69 (range 44 – 89). After five years of stocking, gill net CPUE for stock length (> 150 mm total length) splake averaged 21 fish per net night in the three impoundments. Splake fingerlings reached 300 mm in three growing seasons (1991) and 350 mm in four growing seasons (1992) in all waters. Brook trout PSD and splake PSD were positively related suggesting that splake populations with a substantial proportion of quality length fish (> 250 mm total length) can affect brook trout population structure. Thus, besides providing angling opportunities for an additional game fish, splake stocking may also be an effective means of reducing brook trout density and improving average size of brook trout. However, if splake populations are established in small waters containing brook trout, anglers may have to accept lower brook trout catch rates.

SCOTT, W. B. 1956. Wendigo : The hybrid trout. Division of Zoology and Paleontology, Royal Ontario Museum, Toronto, Ontario.

Much attention has been focused recently on a relative newcomer to the ranks of Canadian game fishes. The hybrid trout, or more correctly, hybrid char, is variously known as the splake (speckled trout x lake trout), the moulac in Québec (truite mouchetee x lake trout), or the wendigo (decided in a contest sponsored by the Carling Conservation Club). Whatever we choose to call it, the hybrid trout has been developed by fertilizing lake trout eggs with speckled trout milt.

In a letter dated June 8, 1917 (now in the files of the Royal Ontario Museum), professor E. E. Prince, Dominion Commissioner of Fisheries, Ottawa, wrote to a government official as follows: “The crossing of the two species (brook trout and salmon trout) at the Port Arthur hatchery is interesting but cannot really have any very beneficial results.” The Port Arthur hatchery referred to is believed to be the federal

hatchery, established in 1912 and turned over to Ontario provincial authorities in 1926. A hasty review of the federal fishery reports for the years 1915 – 1917 yielded no further information and it is assumed that the experiment was abandoned.

The revival of interest in this hybrid trout is due mainly to the work of J. E. Stenton, park warden at Banff National Park who crossed the two species in 1946, successfully repeated the cross in 1947 and has continued to breed the hybrid.

Wendigos have now been planted in many lakes in Canada and the United States. In Ontario, the Department of Lands and Forests have planted from 1,500 to 15,000 in several lakes. Manitoba and Québec have each planted the hybrids experimentally. In Alberta, the Canadian Wildlife Service has planted extensively in lakes in Banff and Jasper National Parks. In the United States, wendigos have been planted in New York State, New Hampshire, Wyoming, California and possibly in other states.

SEQUIN, L. R. 1954. The splake. p. 21 – 22 *In* Ephemerides of the Québec Biological Bureau, Game and Fisheries Department of Québec.

In 1953 anglers caught 300 F_1 and F_2 hybrids raised in a hatchery from the eastern townships of Québec.

SEQUIN, L. R. 1956. Habits and rearing methods of Québec trout. Booklet of the Game and Fisheries Department, Province of Québec.

Seven hundred splake fingerlings were planted in Lake Lyster, Québec.

SLASTENKO, E. P. 1954. The relative growth of hybrid charr (*Salvelinus namaycush* x *S. fontinalis*). Journal of the Fisheries Research Board of Canada 11(5) : 652 – 659.

One thousand eggs of the lake trout (*Cristivomer namaycush*) which had been fertilized with the milt of the eastern brook trout (*Salvelinus fontinalis*) were received at the Laboratory for Experimental Limnology at Maple, Ontario, from Banff National Park. Samples of about ten individuals were taken every one or two weeks for approximately one year when a total of 392 individuals were sampled. Measurements were made on a number of parameters including standard length, head length, eye diameter, pectoral and ventral lengths, anal height, dorsal to caudal distance, snout to dorsal distance, body depth, body width and weight.

Hybrid char were intermediate between the two parental species in respect to relative growth of some characters; in others they approximated one or other of the parent species. However, it was not possible to make comparisons with parent species material of the same stock as the hybrids' parents and reared under the same conditions.

SNUCINS, E. J. 1992. Relative survival of hatchery reared lake trout, brook trout and F_1 splake stocked in low pH lakes. North American Journal of Fisheries Management 12(3) : 460 – 464.

A matched planting experiment was conducted to determine the most suitable salmonid genotype for stocking in former lake trout lakes that currently are too acidic to support lake trout reproduction. Hatchery reared lake trout (*Salvelinus namaycush*), brook trout (*Salvelinus fontinalis*), and F_1 splake (*S. namaycush* x *S. fontinalis*) were planted in May 1989 at age 18 – 19 months in four lakes with pH values of 4.9 – 5.4. Relative survival of the three genotypes was assessed during a four day holding period immediately after stocking and by gillnetting during the summer of 1990. During the four day holding

period, survival of lake trout (23%) was significantly lower than that of brook trout (98%) and splake (92%). Gillnetting recovery rates were 0 – 0.9% for lake trout, 0 – 1.8% for brook trout and 1.1 – 15.0% for splake. The results of this study suggest that splake are the most suitable of these three salmonid taxa for stocking on a put-grow-take basis in lakes of pH 4.9 – 5.4.

SOWARDS, C. L. 1959. Experiments in hybridizing several species of trout. Progressive Fish Culturist 21(4) : 147 – 150.

This report is a summary of the experiments conducted on the hybridization of trout in Wyoming between 1952 and 1957. The experiments are reported primarily because of the high degree of success obtained in the F_1 and F_2 generations of a cross between a female brook trout (*Salvelinus fontinalis*) and a male lake trout (*Salvelinus namaycush*).

The progeny resulting from the original cross was called brookinaw. When this name was applied, the author was unaware that Stenton was applying the name "splake" to a cross of lake trout and brook trout. However, Stenton applied this name to the offspring of a female lake trout crossed with a male brook trout so the name "brookinaw" has been retained and is used herein to identify the reciprocal cross – female brook trout and male lake trout.

The F_1 generation of brookinaw was obtained by crossing a brook trout female and a lake trout male. The hatching success was 73% with good survival. Hatching success for two lots of the F_2 generation averaged 68%. Hatching success of a backcross with a brook trout male was 94.1% and that or a backcross with a brook trout female was 82.2%. A cross between a brookinaw female and a brown trout male yielded a hatching success of 4.8%; a cross between a brown trout female and a brookinaw male yielded a hatch of 32.2%. The hatching success of a cross between a lake trout female and a brook trout male was 38.5%.

When sexually mature, the brookinaw was a handsome fish. It had a vermiculated olive-green back, metallic blue-gray sides and a yellowish-orange belly. The males and females were noticeably different. The males were more brightly colored and usually had deeper bodies. The males more nearly resembled a brook trout and the females a lake trout. A kipe (hooked jaw) was noted in some fish but was always small.

SPANGLER, G. R. and A. H. BERST. 1976. Performance of lake trout (*Salvelinus namaycush*) backcrosses, F_1 splake (*S. fontinalis* x *S. namaycush*) and lake trout in Lake Huron. Journal of the Fisheries Research Board of Canada 33 : 2402 – 2407.

This paper presents the results of plantings in Lake Huron waters of lake trout (*Salvelinus namaycush*), F_1 splake (*S. fontinalis* x *S. namaycush*) and the progeny of the backcross between splake males and lake trout females. The planted fish were piscivorous throughout age groups II – V with rainbow smelt (*Osmerus mordax*), sticklebacks (*Pungitius sp.*) and alewives (*Alosa pseudoharengus*) the dominant food organisms.. Hybrid stocks grew more rapidly but attained a somewhat smaller asymptotic length than did lake trout. The F_1 hybrids were the earliest to mature with 34% of the males and 4% of the females spawning at age II. Earliest maturity occurred in the backcrosses at age III in contrast to lake trout which matured predominantly at ages VI and VII. The backcrosses demonstrated a slightly broader thermal and bathymetric distribution during summer than did lake trout while the F_1 hybrids tended to concentrate in the thermocline. Total annual mortality rates (attributed mostly to predation by sea lampreys (*Petromyzon marinus*) ranged from 62 to 95% for all of the planted stocks.

SPANGLER, G. R. and A. H. BERST. 1978. Questions and answers on splake. Ontario Fish and Wildlife Review 17(2) : 3 – 8.

Splake have been produced since the 1870s by various fish culturists in North America. Interest in the hybrid was renewed in the early 1950s as a result of the disastrous decline in lake trout populations caused by the sea lamprey. An international program was devised to control sea lamprey populations in the upper Great Lakes and then to restore the complex of self-reproducing lake trout stocks or to establish a suitable substitute for them. The Great Lakes Fishery Commission's special committee on lake trout rehabilitation recommended in 1958 that Ontario's splake work be accelerated to provide "an early maturing, fast-growing trout able to inhabit the strata formerly occupied by the native trout."

Research to develop an early maturing lake trout by hybridization with brook trout and by selection of each generation began in 1957. By 1966, the selection program had provided the initial brood stocks to production hatcheries. The first progeny of these were planted in Lake Huron in 1969 and plantings have continued annually.

Geneticists refer to the progeny of the first cross as the F_1 generation. The hybrids are fertile so an F_1 male may be crossed to an F_1 female to produce the second generation known as F_2 splake. This process may be repeated indefinitely giving rise to F_3, F_4, F_5 splake and all possible combinations of crosses such as F_2 x F_5. It is also possible to breed splake back to either parent species. Progeny of these crosses are called "backcrosses". Geneticists now know that the splake is a stable hybrid which will not revert to the parental species.

Selective breeding of splake has been successful in two important respects. First, they mature at age 3 or younger like the speckled trout; this is four to five years earlier than lake trout. Second, they occupy deep water; the latter characteristic is similar to that of lake trout which differ from brook trout in their ability to retain swimbladder gas.

It is now known what the maximum size or age will be for the various strains of splake, but F_1 splake and selected splake are known to have survived in natural waters beyond age 7. The largest F_1 reported from Ontario waters is a 7.5 kg (16 3/4 pounds) specimen from northern Lake Huron. A 4.8 kg (10 3/4 pounds) selected splake was taken in 1974 from southern Lake Huron.

Dual plantings of splake and brook trout in Algonquin Provincial Park have shown that F_1 splake yield a greater return to the creel than brook trout in some lake which have traditionally been managed for brook trout. Matched plantings of F_1 hybrids, lake trout backcrosses, brook trout backcrosses and trout parental species in lakes of northeastern Ontario have clearly shown both greater survival and greater yield of the various hybrids compared to the parental species.

First generation (F_1) splake are known to have established self-sustaining populations in Agnes Lake, Alberta, which was stocked in 1951. The original hybrids planted in this lake were produced by crossing female brook trout and male lake trout. The reciprocal cross (i.e., female lake trout x male brook trout) has also been used to establish a self-sustaining population of splake in Lake 17 near Espanola, Ontario.

STAUFFER, T. M. and W. C. WAGNER. 1979. Fish predation on lake trout eggs and fry in the Great Lakes, 1973 – 1978. Fisheries Research Report No. 1864, Michigan Department of Natural Resources, Ann Arbor, Michigan.

During lake trout spawning predation on eggs was very light. In contrast to predation on naturally deposited eggs, predation on artificially deposited eggs was severe, at least during the 24-hour period after deposition. Predation on fry was practically nil while they were on a spawning reef and while they migrated away from the reef during May – July. Predators on lake trout eggs and fry included lake trout, longnose suckers, lake chub, white suckers, lake whitefish, burbot, sculpins, yellow perch, round whitefish, trout-perch, coho salmon and rainbow smelt.

One splake, 62 cm in length, was examined from Williams Reef. Four lake trout eggs were found in the stomach of this fish.

STENTON, J. E. 1950. Artificial hybridization of eastern brook trout and lake trout. Canadian Fish Culturist 6 : 20 – 22.

In the fall of 1946, a successful attempt was made to cross eastern brook trout (*Salvelinus fontinalis*) and the lake trout (*Cristivomer namaycush*). In this first attempt a female brook trout and a male lake trout were used; these eggs hatched successfully but it was noted that a few specimens had deformed caudal fins and all of them died. The balance, unfortunately, were all lost when chlorine was introduced into the Banff water supply.

In the fall of 1947, another attempt, on a larger scale, was made to hybridize the species. In this second trial the species concerned were crossed both ways, that is, a female lake trout to a male brook trout and vice versa. The stripping was carried out by the dry method and fertilization was successful in both cases. The lake trout used in this experiment were netted from Lake Minnewanka and the eastern brook trout were taken from the Third Vermilion lake and transported to Lake Minnewanka, a distance of 11 miles.

The lake trout – brook trout hybrids reached the eyed stage on December 18, 57 days after being placed in the tunnel; hatching was completed at the Banff hatchery by March 21, 151 days from the time of fertilization. The water temperature averaged 39º F during the period. The brook trout – lake trout hybrids hatched approximately 10 days earlier and the straight brook trout at about the same time. All of the brook trout – lake trout hybrids died but a number of the lake trout – brook trout hybrids are progressing satisfactorily at the Banff hatchery.

In general appearance, the hybrids favour the lake trout but the vermiculations of the brook trout are evident on closer examination and a row of pale yellow spots is apparent just above the lateral line. The back is a pale green colour and the under section is white with no apparent colour markings.

These species were crossed again in the fall of 1947 and showed much the same conditions as earlier work with a good percentage of the lake trout (female) and the brook trout (male) hatching normally. On the other hand, where the sexes were reversed a fairly large number hatched with a deformed caudal fin. All died. The balance are doing nicely at the Banff hatchery. In the case of the deformed caudal fins it is estimated that the cross resulted in a much larger embryo and the brook trout egg sac not large enough to permit normal development of this appendage.

STENTON, J. E. 1952. Additional information on eastern brook trout – lake trout hybrids. Canadian Fish Culturist 13 : 1 – 7.

Reciprocal crosses were made in 1948. There was a high percentage of survival both ways but there was a large number of deformed fish with crosses of lake trout males and brook trout females. Adult hybrids have been observed digging redds in hatchery ponds in the fall of 1950 and 1951.

STRAIGHT, W. J. 1969. Depth distribution of splake of known ability to retain swimbladder gas. M. Sc. Thesis, York University, Toronto, Ontario.

In the spring of 1967 and 1968, 6,059 F_2 splake (*S. fontinalis* x *S. namaycush*) were grouped into five classes based on their ability to retain swimbladder gas, and planted into Alluring Lake in Algonquin Provincial Park, to determine (i) if highly selected hybrids (good gas retainers) could swim as deep as lake trout; (ii) if they would simulate a lake trout distribution pattern in the same lake; and (iii) if splake of varying ability to retain swimbladder gas would segregate into different zones.

Gill netting in July, August and September, 1968, showed that good gas retainers caught in July (N=102) did swim as deep (30.5 m) as lake trout (N=79) and approximated the distribution pattern of lake trout being found in significant numbers from 3.1 – 30.5 m. In August – September these hybrids were found in peak density in the region of the thermocline yet were still significantly deeper than splake of lesser ability to retain gas. An increase in growth, a decrease in the total number of empty stomachs from 70% to 28%, and a lower frequency of empty stomachs in the region of the thermocline in August – September suggests the concentration of splake in this region was largely a feeding response.

The remaining group of splake showed no significant difference in their patterns of depth distribution occurring at all periods with peak concentration in the region of the thermocline.

Good gas retainers showed a tendency to occur in 5 – 6º C water while the remaining four groups were concentrated in water from 7 – 12º C, intermediate to that for lake trout (5 – 6º C) and brook trout (12 – 20º C) in Alluring Lake.

Perch and chub were the major food items of both lake trout and splake larger than 15 cm while Diptera and zooplankton were the important stomach contents of trout 10 – 15 cm in length.

STRICKLAND, D. 1985. Special splake fisheries. *In* Fishing in Algonquin Provincial Park, The Friends of Algonquin Park and the Ontario Ministry of Natural Resources, Whitney, Ontario.

Although trout stocking in Algonquin Park has generally given dismal results, there are circumstances which can make for success and make stocking a justifiable procedure in the Highway 60 corridor. In suitable and highly accessible lakes with no significant remaining native stock or brook trout populations the creation of special splake fisheries can be justified.

The splake is a man-created hybrid between our two native trout resulting from the fertilization of lake trout eggs with brook trout sperm. The hybrid combines many of the qualities of its parents – including the brook trout's fast growth and the lake trout's large size.

Planted splake have done better than planted brook trout in even smaller sometimes boggy bodies of water and occasionally have had truly spectacular successes in deeper, colder lakes of moderate size. In Jack Lake, for example, 65% of the splake planted in 1954 were recovered by fishermen and an additional 10% were taken in researchers' nets. The growth of the fish was truly remarkable. Yearlings (planted at about 10 centimeters long) had reached lengths of 30 centimeters by October of the same year, averaging 4 centimeters longer than native brook trout and 13 – 25 centimeters longer than lake trout of the same age. After four years, the planted splake were over 50 centimeters long and weighed close to two kilograms.

Splake resemble brook trout by inhabiting the transition layer between the warm upper lake and cold lower lake in summer but they also have a strong schooling tendency providing the fisherman with short burst of excellent fishing. Spawning by splake (again with characteristics of both parents) was observed for the first time in nature in Jack Lake but there have been no recoveries of second generation fish to this date.

Because of their intermediate nature, many anglers many not realize they have caught a hybrid trout unless they know what to look for. The spots are usually pinkish, although many fish have little or no colour, and the tail is generally intermediate between the deeply forked tail of the lake trout and the square tail of the brook trout. The only positive way to tell is to open up the fish and examine the worm-like projections on the front part of the stomach. These are called pyloric caeca and function in digestion. Lake trout have 100 – 190 of them and brook trout have 20 – 50, and splake usually have 70 – 80. A character such as this is much more reliable than external appearance. It is important to identify your catch correctly in lakes

known to contain splake because the catch limit for splake is less than it is for brook trout and you are responsible for knowing which you have.

SWANSON, M. E. 1979. Survival, growth and food of rainbow trout and splake trout in ponds on the Canadian prairies. M. Sc. Thesis, University of Idaho, Moscow, Idaho. 30 p.

TAIT, J. S. 1970. A method of selecting trout hybrids (*Salvelinus fontinalis* x *S. namaycush*) for ability to retain swimbladder gas. Journal of the Fisheries Research Board of Canada 27 : 39 – 45.

A method was developed for selecting hybrid trout for deep-swimming ability for use in a breeding program to combine in one strain the early maturing character of brook trout (*Salvelinus fontinalis*) with the deep swimming ability of lake trout (*S. namaycush*). The method involves testing hybrids in pressure tanks and selecting individuals that, like lake trout, retain most of their swimbladder gas during the test period. For a sample of F_2 hybrids the range of pressures at which the fish floated when anaesthetized was almost entirely between the medians for samples of the two parent species. Successive tests of marked individuals showed good repeatability of flotation measurements. The method is concluded to be reliable for large scale selection of fish with ability to retain swimbladder gas.

THOMAS, B. 1995. 1995 splake stocking assessment on Upper Raven Lake. File Report, Ontario Ministry of Natural Resources, Minden, Ontario. 3 p.

Upper Raven Lake is a small, coldwater lake that has historically supported small populations of lake trout (*Salvelinus namaycush*) and brook trout (*S. fontinalis*). The physical characteristics of the lake severely limit it potential to support a viable lake trout fishery with the key restrictions being the small surface area and limited habitat availability during late summer. As with the lake trout, brook trout are also severely limited from suitable spawning facilities and the well established population of yellow perch (*Perca flavescens*). A total of 1,600 splake were stocked in the spring of 1994. Assessment gill netting was conducted between July 25 – 27, 1995. Twenty-six net sets, utilizing random mesh sizes, were made. The catch was comprised on 2 splake, 8 white sucker and 141 yellow perch. The absence of lake trout in the catch confirms the low abundance from earlier sampling. The capture of only two splake also suggests a low abundance. Yellow perch were the most abundant species captured during the assessment. It appears that the initial stocking of splake in Upper Raven Lake was unsuccessful in creating a put-grow-take fishery. A number of factors may have contributed to this failure. These include: (a) high post-stocking mortality due to the cumulative stresses associated with the transportation and handling of hatchery-reared fish; (b) disease?; (c) lack of sufficient usable habitat; and (d) competition with yellow perch and subsequent loss of food availability. None of the potential problems listed are sufficient reason to abandon this program after one failure. It is recommended that larger (e.g., 50 grams) yearling splake be stocked, that stocking be conducted later in the spring to reduce the window between ice-out and the beginning of spring/summer forage production.

WARD, N. 2000. A review of fish stocking assessment in the Kenora District. File Report, Ontario Ministry of Natural Resources, Kenora, Ontario. 7 p.

Kenora District has a long history of stocking fish. Records since 1946 indicate that at least 117 waterbodies have been stocked with either brook trout, lake trout, rainbow trout, walleye, smallmouth bass, musky, whitefish, black crappie, rock bass and splake.

From 1985 to 1988, splake were introduced into Dogtooth Lake in an attempt to provide a fishery that would substitute for Dogtooth's extinct lake trout population. Splake stocking began for Arpin Lake in 1990 when rainbow trout transport costs from Sault Ste. Marie (Tarentorus fish culture station) became prohibitive and an environmental assessment for stocking fish into new waters was completed. Arpin Lake has been stocked on a regular basis with approximately 3,000 splake since that time.

Assessment of returns from planted fish consisted of some gillnetting and the occasional "note to file" indicating a large fish or number of fish having been caught from one of the stocked lakes. The only information for a stocked splake lake is the record of 33 angler hours of effort which was expended in March of 1987 with no fish being angled.

WILEY, R. W. 1995. A common sense protocol for the use of hatchery-reared trout. American Fisheries Society Symposium 15 : 465 – 471.

Fish hatcheries are vital to fisheries management, maintenance of high quality angling and restoration of endangered fishes. However, people tend to expect too much from hatcheries and rely on stocking to provide more fish than lakes and streams can sustain. In the Rocky Mountains, salmonids were imported for rearing in hatcheries and stocking to supplement native fish for sport angling, commercial use, and food. Fish were stocked in any water that looked suitable. No one understood that natural waters have productive limits, introduced fishes might extirpate native fishes, and fish stocks might be adapted to specific stream and lake conditions. People believed that rearing and stocking fish was necessary to continued good angling. Without evidence to the contrary, fisheries biologists and fish culturists thought one fish was just as good as another. The idea that differences in fish stocks could be hereditary, adaptive and result from local evolution was slowly recognized.

Stocking fish according to regional fish stocking protocols would improve consistency in the use of fish. Foresighted fisheries management should (1) be based on drainage surveys that document habitat conditions and natural limits or production; (2) determine genetic strengths of broodstocks and stock hatchery fish where best suited; (3) manage for native or wild fish first; (4) establish priorities for fish stocking in standing waters; and (5) understand public desires.

WILSON, D. 1987. 1986 stocking assessment on selected brook trout, rainbow trout and splake lakes within Minden district. File Report, Ontario Ministry of Natural Resources, Minden, Ontario. 7 p.

This assessment program was implemented to determine the effectiveness of past stocking efforts in 14 selected artificial rainbow trout, brook trout and splake lakes within Minden district. Gill nets, of various mesh sizes, were set in the different lakes between July 23 and September 18, 1986. In Buller Lake (Lutterworth Township) seven splake were netted. Fish originated from at least two separate stockings. Anglers report relatively poor success recently but it is recommended that splake stocking be continued and angler success be monitored. In Dutton Lake (Eyre Township) 40 splake were captured. These included fish from both the 1985 and 1986 stocking. It is recommended that splake management be continued and angler success be monitored. Twenty-two splake were netted in Little Gull Lake (Lutterworth Township). All of the fish were from the most recent stocking (3 months earlier). No larger splake from the 1984 stocking were captured. No splake were captured in Miller's (Guilford) Lake in Guilford Township despite the fact that 3,000 fish had been stocked just 3 – 4 months previously. It is recommended that splake stocking be discontinued. Only one splake was netted in Minden Lake (Minden Township) however the size of the fish and its fin clip indicate that it came downstream from Horseshoe Lake. None of the 3,000 splake stocked in 1985 were captured. It is recommended that splake stocking be discontinued and replaced by increased plantings of catchable rainbow trout. In Tedious (Long) Lake in Guilford Township two splake were caught. Anglers report relatively poor fishing success for splake except in the outlet

stream a few days after stocking. It is recommended that splake stocking be discontinued. Only one splake, planted in 1985 was netted from Tory (Lorraine) Lake in Monmouth Township. However, it is recommended that splake stocking be continued and angler success be monitored. Overall, it is recommended that future stocking assessment be conducted one year after stocking rather than 2 – 3 years after stocking events.

WILSON, W. 1988$_a$. 1988 stocking assessment netting on East Lake (Harburn Township). File Report, Ontario Ministry of Natural Resources, Minden, Ontario. 2 p.

East Lake was planted with 3,500 yearling splake, averaging 23.9 grams in size, in 1987. Overnight gill netting was conducted on August 15 – 16, 1988. Six splake, all bearing a right ventral (RV) fin clip and originating from the 1987 stocking, were captured. The splake averaged between 100 – 200 grams in weight. The splake catch represented a CUE of 1.6 fish per 1000 net meter hours. Splake appear to be surviving but are small in size probably as a result of competition with yellow perch and white suckers. As splake increase in size it is hoped that they will switch to perch and greatly increase their growth rate and reduce the perch population. It is recommended that efforts to stock splake be continued in order to provide angling opportunities and reduce angling pressure on brook trout.

WILSON, W. 1988$_b$. 1988 stocking assessment netting on Guilford (Miller's) Lake. File Report, Ontario Ministry of Natural Resources, Minden, Ontario. 2 p.

Guilford (Miller's) Lake was stocked with splake in 1986 (3,000 unclipped fish averaging 12.4 grams) and again in 1988 (3,000 unclipped fish averaging 35.7 grams). Two gill nets were set overnight at depths ranging from 5 – 10 metres on August 15 – 16, 1988. Thirteen splake, ranging from 50 – 100 grams in weight, were captured. All fish were from the 1988 stocking. The splake netting CUE was 4.2 splake per 1000 net metre hours. The splake stocked in 1988 appear to be doing well and it is recommended that stocking be continued. Additional netting may be required to determine the fate of fish stocked in 1986. Anglers should be encouraged to utilize the current fishery.

WILSON, W. 1988$_c$. 1988 Algonquin Region splake stocking assessment questionnaire results. File Report, Ontario Ministry of Natural Resources, Minden, Ontario. 11 p.

A splake stocking questionnaire was circulated to Ministry of Natural Resources staff in all six Algonquin Region districts and Frost Centre fisheries management staff in August of 1988. The purpose of the questionnaire was to obtain an overview of the current splake stocking program within the Algonquin Region.

There are approximately 101 lakes which are currently stocked with splake in the Algonquin Region. Splake fisheries were rated as good to excellent in 40%, poor to nil in 18% and either too early to tell or uncertain in 42% of lakes. Generally, lakes with well oxygenated hypolimnions and smaller lakes (< 50 ha) supported the best fisheries.

The results from five districts indicated that some 66% of the splake caught by index netting were associated with the thermocline (10 – 18º C), 28% were caught below the thermocline (< 10º C) and few splake (6%) were found above the thermocline. An attempt was made to rate splake as a sport fish by MNR staff and local anglers. The overall splake stocking program was considered to be a success up to this point with a 70% good to excellent rating, 12% poor and 8% uncertain.

Future splake direction and management needs which were identified included the development of a public information program, the establishment of a coordinated stocking assessment approach, the collection of

creel information on splake fisheries, and further investigation to determine optimal stocking sizes, densities and frequency.

WILTON, M. L. 1971. An objective assessment of the splake as a management tool for Ontario's inland waters. p. 1 – 8 *In* Ontario Department of Lands and Forests Resource Management Report No. 106, Toronto, Ontario.

This report consists of a review of pertinent literature, a summary of discussions with field workers, and, finally, conclusions and recommendations relating to the future of splake in inland waters. The following summarizes the facts learned about the splake and its preferred environment during this study:

- Splake prefer barren, clear water of medium-sized lakes ranging from 50 – 200 acres in size with maximum depths of 40 – 80 feet.
- Splake are usually found in the thermocline during the summer stratification period as they prefer a temperature in the vicinity of 54º F.
- The hybrid has a more rapid growth rate than either parent and a longer life span than the brook trout.
- Splake feed heavily on crustaceans and insects during early life and gradually become more piscivorous as size increases.
- Splake have a strong tendency to school which often gives rise to short periods of intensive angling success.
- Splake are excellent fighters with flesh which is pink through orange in color and is highly regarded for its eating qualities.
- Unlike many hybrids, the splake is able to reproduce and while it prefers the gravel seepage shoals usually used by brook trout for lake spawning, in the absence of these it will use the boulder shoals favoured by lake trout.
- Splake are usually mature in their third year of life and their spawning period falls closer to that of the brook trout in late October or early November.

WISCONSIN DEPARTMENT OF NATURAL RESOURCES. 1999. An evaluation of stocking strategies in Wisconsin with an analysis of projected stocking needs. Report prepared for the Joint Legislative Audit Committee, Madison, Wisconsin. 37 p.

This report specifically addresses the long range stocking goals for the Department of Natural Resources and projected long term propagation needs using the best available scientific information. The plan promotes the most effective use of stocking in the overall management of Wisconsin's fisheries using a goal-oriented, species and water specific approach that minimizes impacts to existing self-sustained populations.

It is proposed that 120,000 yearling splake be stocked into Lake Superior and 40,000 yearling splake be stocked into Lake Michigan in 1999 – 2000. All fish will originate from domestic brood stock. It is proposed that 4,000 splake be allocated for stocking inland waters in 1999 – 2000.

WRIGHT, B. H. and R. D. SOPUCK. 1979. A history of fish stocking in northern Manitoba. Fisheries Research Report 79-6, Manitoba Department of Mines, Natural Resources and Environment, Winnipeg, Manitoba.70 p.

The past several decades have seen thousands of fry, fingerlings, yearlings or eggs planted into northern Manitoba waters to provide better sport fishing. This report has been prepared to assemble information to accommodate requests by anglers and field staff alike.

Records indicate that splake have been planted in seven lakes. In Little Cliff Lake the stocking of 8,000 yearling splake in 1973 was unsuccessful due to the presence of pike in the lake. Similarly, one planting of splake (4,000 yearlings) in Manistikwan Lake did not provide any returns to the local fishery. Conversely, annual stocking of splake in Mid Lake have proven to be quite successful, especially in the fall, when 6 – 8 pound splake are angled and limits are filled. Splake averaged 5 – 6 years of age. Plantings of splake in Upper Ospwagan Lake produced catches of 8 lb. fish.

Acknowledgements

I am indebted to MNR field staff who provided file reports and unpublished data on splake stocking activities. I am also grateful to Tim Simonson, Wisconsin Department of Natural Resources, Todd Grischke, Michigan Department of Natural Resources, and Serge Gonthier, Ministère Environnement et Faune Québec, for providing splake stocking guidelines utilized in their respective jurisdictions.

Ola McNeil and Wendylee Stott provided historic splake stocking information. MNR library staff Margaret Wells and Elizabeth Gustafsson, are thanked for their assistance in searching for published materials. Terra Lasenby provided an editorial review of the original draft. Jeanette Arminio is gratefully acknowledged for her assistance in formatting this publication.

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Food Habits of Stocked Fish (cont'd)

APPENDIX 1. Splake stocking in Ontario waters, 1950 – 1999.

Year	Eyed Eggs	Fry	Fingerlings	Yearlings	Adults	Unknown	Total
1950	0	0	0	0	0	0	0
1951	0	0	0	0	0	0	0
1952	0	0	0	0	0	0	0
1953	0	0	24,500	0	0	0	24,500
1954	0	0	0	17,200	2,190	0	19,390
1955	0	0	0	10,450	0	0	10,450
1956	0	0	0	8,115	0	0	8,115
1957	0	0	16,370	16,300	0	0	32,670
1958	0	0	0	207,710	0	0	207,710
1959	0	0	0	135,047	1,204	0	136,251
1960	0	0	0	13,151	0	0	13,151
1961	0	0	0	97,068	5,640	0	102,708
1962	0	0	0	111,792	0	0	111,792
1963	0	0	0	114,100	2,400	0	116,500
1964	0	0	0	87,650	11,645	0	99,295
1965	0	0	0	21,200	15,700	0	36,900
1966	0	0	0	69,000	44	0	69,044
1967	20,000	0	1,180	118,547	10,243	0	149,970
1968	0	0	2,000	36,226	984	0	39,210
1969	0	0	0	64,102	431	0	64,533
1970	0	0	0	256,586	40	0	256,626
1971	0	0	180,950	285,040	0	0	465,900
1972	0	93,000	0	235,975	34,513	0	363,488
1973	0	0	312,720	410,659	2,290	0	725,669
1974	0	0	24,700	303,954	1,574	0	330,228
1975	0	0	0	0	0	556,000	556,000
1976	0	0	0	682,519	5,040	0	687,559
1977	0	0	308,722	535,053	954	0	844,729
1978	377,220	0	0	0	0	187,826	565,046
1979	0	0	0	0	0	800,489	800,489
1980	76,200	0	0	0	0	770,486	846,686
1981	0	0	0	0	0	683,862	683,862
1982	0	0	0	0	0	927,292	927,292
1983	180,000	0	0	0	0	103,517	283,517
1984	0	0	52,000	147,111	5,734	0	204,845
1985	0	0	34,000	251,455	823	0	286,728
1986	0	0	26,900	324,659	6,826	0	358,385
1987	0	0	50,500	339,449	5,095	3,000	398,044
1988	0	0	0	437,282	2,527	0	439,809
1989	0	0	15,000	560,259	648	0	575,907
1990	0	880,000	124,000	567,242	273	0	1,571,515
1991	83,524	400,000	229,000	711,327	465	0	1,424,316
1992	0	147,730	148,000	608,489	1,144	0	905,363
1993	0	45,000	0	306,212	0	6,000	357,212
1994	0	0	90,000	385,302	0	0	475,302
1995	0	30,000	0	712,610	1,165	0	743,775
1996	0	102,500	61,000	674,216	0	0	837,716
1997	582,500	130,000	0	634,368	0	0	1,346,868
1998	0	30,000	30,000	558,068	0	0	618,068
1999	0	17,637	30,000	749,952	0	0	797,589

Note: Fry includes fish 1 – 2 months of age; fingerlings are fish 3 – 9 months of age, and yearlings are fish 10 – 19 months of age. The adult category includes older juvenile (i.e., sub-adult) and mature adult fish. Lake trout backcross are not included in the table.

APPENDIX 2. A summary of netting projects on Ontario inland lakes to evaluate splake stocking activities.

Waterbody	Date	Netting Technique	Caught	# Splake CUE	Splake Catch	% Splake in Comments	Reference
Anson Lake (Hindon Twp.)	Summer 1990	• Thirteen gill net sets perpendicular to shoreline (975 net meter hours).	21	2.15 splake per 100 net meter hours	81%	• Splake introduced in 1985. Lake stocked on an alternate year basis. • 3,500 splake stocked in 1989	Haxton (1991)
Bear Lake (Dickens Twp.)	Summer 1987	• Nine overnight gill net sets.	23	2.56 fish per net night	–	• 2,000 splake stocked in 1986.	Liskauskas and Quinn (1991)
Big East Lake (Hindon Twp.)	July 1987	• Gill nets set overnight (4,212 net meter hours).	6	0.14 fish per net meter hour	8.0%	• Splake were stocked in 1987. • 66 white suckers, 1 yellow perch and 2 dace were also captured.	Haxton (1987)
Big Mair Lake (North Canonto Township)	1990	• One overnight gill net (1200' in length) set.	8	–	22.2%	• 1 lake trout and 27 white suckers also captured.	Myers and McCambridge) (1990
Bivouac Lake (Eyre Twp.)	Summer 1990	• Nine gill net sets perpendicular to shoreline (675 net meter hours effort).	20	3.11 splake per 100 net meter hours	100.0%	• 3,000 splake introduced to lake in 1988.	Haxton (1991)
Black Lake (Lutterworth Twp.)	July 1987	• Gill nets set overnight (5,872.4 net meter hours effort).	0	0.00 splake per 100 net meter hours	0.0%	• Splake were stocked in 1986. • 33 smelt, 3 yellow perch, 1 smallmouth bass, 1 white sucker and 1 burbot were also captured.	Haxton (1987)
	Summer 1990	• Forty gill net sets perpendicular to shoreline (3000 net meter hours effort).	0	0.00 splake per 100 net meter hours	0.0%	• 1 lake trout, 4 yellow perch and 4 white suckers also captured. • Recommendation to discontinue splake stocking in lake.	Haxton (1991)

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Waterbody	Date	Netting Technique	Caught	# Splake CUE	Splake Catch	% Splake in Comments	Reference
Blue Lake (Barrie Township)	October 1991	• One overnight gill net (800' in length) set.	32	–	27.6%	• 2 – 3,000 splake stocked annually for the past four years. • 70 white suckers, 6 largemouth bass and 8 smallmouth bass also captured.	Anonymous (1991_b)
Brewer Lake Twp.)	Summer 1987	• Nine overnight gill net sets.	29	3.22 fish per net night	–	• 4,000 splake stocked in 1986.	Liskauskas and (Sproule Quinn (1991)
	Summer 1989	• Six overnight gill net sets.	28	4.67 fish per net night	–	• 4,000 splake stocked in 1988.	Liskauskas and Quinn (1991)
Brooks Lake (Abinger Township)	June 1987	• One overnight gill net (1200' in length) set (23.3 net hours of effort).	47	–	39.2%	• Lake stocked annually with 750 – 1,000 yearling splake • 5 brook trout, 55 white sucker, 2 brown bullhead, 7 golden shiner and 4 creek chub also captured.	Lawrence (1987)
Bruce Lake (Peck Twp.)	Summer 1989	• Six overnight gill net sets.	31	5.17 fish per net night	–	• 2,500 splake stocked in 1988.	Liskauskas and Quinn (1991)
Buller Lake (Lutterworth Twp.)	Summer 1986	• Four net nights of effort using "lake survey" gill nets.	7	–	13.0%	• Lake herring, largemouth bass, smallmouth bass, rock bass and white suckers also captured.	Wilson (1987)
Cardinal Lake (Twp. #238)	1992	• 600 meters of gill net set for a period of six hours.	1	–	4.5%	• Splake had been stocked in 1990 and 1992. • 20 lake herring and 1 yellow perch also captured.	MNR unpublished data
Costello Lake (Sproule Twp.)	Summer 1988	• Nine overnight gill net sets.	24	2.67 fish per net night	–	• 3,000 splake had been stocked in 1987.	Liskauskas and Quinn (1991)

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Waterbody	Date	Netting Technique	Caught	# Splake CUE	Splake Catch	% Splake in Comments	Reference
Depot Lake (Eyre Twp.)	June 1987	• Gill nets set overnight (7,257.9 net meter hours effort).	1	0.0001 fish per net meter night	1.3%	• Splake stocked in 1986. • 5 brook trout and 71 white suckers were also captured.	Haxton (1987)
Dutton Lake (Eyre Twp.)	Summer 1986	• Four net nights of effort using "lake survey" gill nets.	40	–	10.1%	• 167 white suckers and 188 yellow perch also caught.	Wilson (1987)
East Lake (Harburn Twp.)	August 1988	• Two gill nets set overnight.	6	–	0.8%	• 3,500 splake stocked in 1987. • 2 brook trout, 576 yellow perch, 156 white sucker, 3 pumpkinseed and 3 golden shiners also captured.	Wilson (1988)
East Galipo (Eyre Township)	Summer 1990	• Four net sets perpendicular to shoreline(300 net meter hours effort).	20	6.67 fish per 100 net meter hours	87%	• Splake introduced in 1986 and stocked in alternate years – 2500 splake stocked in 1988. • 2 brook trout and 1 white sucker also captured.	Haxton (1991)
East Trump Lake (Pearce Township)	July 1993	• Two 400' sections of gill nets set for 4 two hour intervals.	2	–	50.0%	• 2 white suckers also captured.	MNR unpublished data
Egg Lake (South Canonto Township)	September 1986	• Four gill nets set overnight (87.7 hours of netting effort).	5	1.25 splake per net night	5.4%	• 15,000 yearling splake stocked in spring 1986. • 13 rock bass, 3 pumpkinseed and 71 golden shiners also captured.	Anonymous (1986_a)
Foote Lake (Bethune Township)	Spring 1987	• Overnight gill netting.	0	–	–	• 3,000 splake stocked in 1986.	Deyne and Arnett (Undated)
Fork Lake (Sproule Twp.)	Summer 1989	• Six overnight gill net sets.	22	3.67 fish per net night	–	• 2,000 splake stocked in 1988.	Liskauskas and Quinn (1991)

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Waterbody	Date	Netting Technique	# Splake Caught	Splake CUE	% Splake in Catch	Comments	Reference
Fox Lake (Ashby Township)	July 1986	• Two gill nets set overnight (44 net hours).	0	0.00 fish per net night	0.0%	• 2 lake trout, 216 yellow perch, 4 white suckers, 1 creek chub and 1 common shiner also captured.	Anonymous (1986_f)
Gooderham Lake (Glamorgan Twp.)	July 1987	• Gill nets set overnight. (6941.3 net meter hours effort)	0	0.00 fish per net meter hours	0.0%	• Splake stocked in 1986. • 22 white sucker and 2 rock bass also captured.	Haxton (1987)
	Summer 1990	• Forty gill net sets perpendicular to shoreline (3,000 net meter hours effort).	0	0.00 fish per 100 net meter hours	0.0%	• Splake were introduced in 1986 and stocked in alternate years; 3,000 splake stocked in 1988. • 31 white suckers and 2 smallmouth bass were captured.	Haxton (1991)
Grandview Lake (McLean Township)	Spring 1987	• Overnight gill netting.	0	–	–	• 2,300 splake stocked in 1986.	Deyne and Arnett (Undated)
Granite Lake (South Canonto Township)	September 1986	• Four overnight gill nets (86.8 net hours of effort).	3	0.75 splake per net night	3.4%	• 1 – 3,000 splake are stocked . annually • 35 perch, 49 white sucker and 2 pumpkinseed also caught.	Anonymous (1986_c)
	May 1989	• Four gill nets set for approximately 3 hours each.	4	–	3.4%	• 53 white sucker and 60 yellow perch also captured.	Anonymous (1989_c)
Grant Lake (Cannisbay Twp.)	Summer 1989	• Six overnight gill net sets.	67	11.17 fish per net night	–	• 500 splake stocked in 1988.	Liskauskas and Quinn (1991)
Grindstone Lake (Miller Township)	October 1985	• Two gill nets set overnight.	4	2.0 fish per net night	40.0%	• 3 white suckers, 1 smallmouth bass, 1 pumpkinseed and 1 lake	Anonymous (1985_b)

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Waterbody	Date	Netting Technique	# Splake Caught	Splake CUE	% Splake in Catch	Comments	Reference
						whitefish also captured.	
Grindstone Lake (cont'd)	June 1987	• One overnight gill net set. (23.4 net hours).	5	5.0 splake per net night	7.5%	• 3 smallmouth bass, 55 lake herring, 3 yellow perch and 1 white sucker also captured. • Lake stocked annually with 3 – 6,000 splake.	Anonymous (1987_a)
	September 1991	• One overnight gill net (1,200' in length) set (22 net hours).	3	–	5.5%	• 25 lake herring, 15 white suckers, 8 smallmouth bass and 4 largemouth bass also captured.	Anonymous (1991_a)
Harvey Lake (McClintock Twp.)	Spring 1987	• Overnight gill netting.	0	–	–	• 1,500 splake stocked in 1986; 3,000 in 1987. • Splake introduction considered a failure.	Deyne and Arnett (Undated)
Hilliard Lake (Cannisbay Twp.)	Summer 1989	• Six overnight gill net sets.	75	12.5 fish per net night	–	• 4,100 splake stocked in 1988.	Liskauskas and Quinn (1991)
Horne Lake (Gunterman Twp.)	Fall 1989	• Overnight gill netting.	38	6.3 fish per 100' gill net	–	• Splake stocked in 1988 and 1989.	Anonymous (1989_a)
	Summer 1990	• Overnight gill netting.	24	–	21.8%	• 4,000 splake stocked in 1990. • 8 white suckers, 75 rock bass and 3 pumpkinseed also captured.	Anonymous (1990_b)
Horseshoe Lake (Minden Township)	July 1987	• Gill nets set overnight (4,619.2 net meter hours effort).	0	0.00 fish per net meter hour	0.0%	• Splake stocked in 1986. • 1 lake trout, 13 lake whitefish, 10 smallmouth bass, 21 white suckers, 18 yellow perch, 2 rock bass, 7 burbot, 6 smelt and 2 lake herring also captured.	Haxton (1987)
Jack Lake (Cannisbay Twp.)	Summer 1988	• Nine overnight gill net sets.	17	1.89 fish per net night	–	• 2,000 splake stocked in 1987.	Liskauskas and Quinn (1991)

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Waterbody	Date	Netting Technique	# Splake Caught	Splake CUE	% Splake in Catch	Comments	Reference
Joyce's Lake (Lyndoch Twp.)	August 1997	• Three panels of gill net set; 2 for one hour and one was left overnight.	14	–	36.8%	• Splake were introduced in 1994. • White suckers, yellow perch, largemouth bass and northern pike were also captured.	Punt (1997)
Labine Lake (South Canonto Township)	September 1986	• Three gill nets set overnight.	1	0.33 splake per net night	6.3%	• 3 pumpkinseed and 12 white sucker also captured. • Recommend that lake be reclaimed.	Anonymous (1986_e)
Limit Lake (Lake Township)	August 1988	• One gill net (1200' in length) set overnight (23 net hours).	16	16.0 splake per net night	1.6%	• 1,500 splake stocked annually for the past three years. • 215 brown bullheads, 35 pumpkinseeds and 750 rock bass also captured.	Anonymous (1988_a)
Little Glamor Lake (Monmouth Twp.)	June 1991	• Gill netting (893.3 net meter hours effort).	0	0.00 fish per net meter hour	0.0%	• 4,000 splake planted in 1989 and 4,800 stocked in 1991. • 37 white suckers, 25 yellow perch and 2 smallmouth bass also captured.	MNR unpublished data
Little Gull Lake (Lutterworth Twp.)	Summer 1986	• Four net nights of effort using "lake survey" gill nets.	22	–	–	• Splake stocked in 1987 and 1988. • All splake netted were from the May 1986 stocking.	Wilson (1986)
Little Long Lake (Effingham Township)	July 1988	• One overnight gill net (1200' in length) set (22.5 net hours).	23	23.0 splake per net night	63.9%	• 12 white suckers and 1 pumpkinseed also captured.	Anonymous (1988_c)
Little Merrill Lake (Effingham Township)	1986	• Gill netting.	1	–	–	• 1 smallmouth bass and several other coarse fish also captured.	Anonymous (1986_g)

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Waterbody	Date	Netting Technique	# Splake Caught	Splake CUE	% Splake in Catch	Comments	Reference
Little Merrill Lake (cont'd)	1993_b	• Gill netting	18	–	90.0%	• 1 lake trout and 1 smallmouth bass also captured.	Anonymous (1993_b)
Little Yirkie Lake (Denbigh Township)	July 1987	• One overnight gill net set (1200' net, 23.8 net hours of effort)	1	1.0 splake per net night	0.4%	• 21 yellow perch and 204 white sucker also captured.	Anonymous (1987_b)
	July 1991	• One overnight gill net (800' in length) set.	5	5.0 splake per net night	23.7%	• 1,000 yearling splake stocked in both 1990 and 1991. • 40 yellow perch and 145 white suckers also captured.	McCambridge (1991)
Machesney Lake (Effingham Township)	August 1994	• Gill netting.	10	–	24.4%	• 24 white sucker also captured.	Anonymous (1994)
Major Lake (Murchison Twp.)	Summer 1988	• Nine overnight gill net sets.	28	3.11 fish per net night	–	• 2,500 splake stocked in 1987.	Liskauskas and Quinn (1991)
McCausland Lake (Barrie Township)	June 1988	• Gill netting.	10	–	6.7%	• Splake and lake trout stocked in spring 1988. • 7 lake trout, 1 smallmouth bass, 64 yellow perch, 63 white suckers and 5 golden shiners also captured.	Anonymous (1988_b)
Mill Lake (McDougall Twp.)	September 1987	• Eight overnight gill net sets.	0	–	0.0%	• 9 lake trout, 17 lake whitefish, 42 lake herring, 6 smelt, 8 walleye, 1 northern pike and 5 white suckers also captured.	McIntyre and Henry (1988)
Miller's Lake (Guilford Township)	Summer 1986	• Four net nights of effort with "lake survey" gill nets.	0	–	6.7%	• 3,000 splake stocked in May 1986. • Yellow perch very abundant.	Wilson (1987)

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Waterbody	Date	Netting Technique	# Splake Caught	Splake CUE	% Splake in Catch	Comments	Reference
Miller's Lake (cont'd)	1987	• 7,706 net meter hours of gill netting effort.	6	–	–	• 49 yellow perch, 33 white suckers and 2 rock bass caught.	Wilson (1988)
	August 1988	• Two overnight gill net sets.	13	–	61.9%	• Splake stocked in 1988. • 7 yellow perch and 1 pumpkinseed also captured.	Wilson (1988)
Minden Lake (Minden Twp.)	Summer 1986	• Four net nights of effort using "lake survey" gill nets.	1	–	–	• 3,000 splake stocked in the spring of 1985.	Wilson (1987)
Nugget Lake (Eyre Twp.)	May 1989	• Gill netting (10,401.3 net meter hours effort).	4	0.04 fish per net meter hour	80.0%	• 2,000 splake stocked in 1989. 1 unidentified cyprinid also captured.	MNR unpublished data
Ouse Lake (Peck Twp.)	Summer 1987	• Nine overnight gill net sets.	41	4.56 fish per net night	–	• 1,000 splake stocked in 1986.	Liskauskas and Quinn (1991)
Peck Lake (Peck Twp.)	Summer 1987	• Nine overnight gill net sets.	33	3.66 fish per net night	–	• 800 splake stocked in 1986.	Liskauskas and Quinn (1991)
Pine Lake (Guilford Twp.)	July 1989	• Gill netting (23,088.6 net meter hours effort).	7	0.03 fish per net meter hour	0.3%	• 5,300 splake stocked in 1989. • 2,249 yellow perch, 162 unidentified cyprinids, 39 smelt, 12 lake herring, 1 lake whitefish, 1 white sucker, 1 muskellunge also captured.	MNR unpublished data
Plump Lake (Scarfe Twp.)	October 1989	• Six gill nets set.	1	–	–	• Splake stocked in 1986, 1987 and 1989. • Smallmouth bass, rock bass and burbot also captured.	Anonymous (1989_b)

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Waterbody	Date	Netting Technique	# Splake Caught	Splake CUE	% Splake in Catch	Comments	Reference
Rankin Lake (Foley Twp.)	August 1987	• Four lake survey gill nets each set for two nights (8 net nights total effort).	2	–	3.4%	• Splake stocked in 1983, 1984 and 1985. • Other species captured were smallmouth bass, largemouth bass, white suckers, rock bass and smelt.	Hill and McIntyre (1988)
Ross Lake (Harburn Twp.)	July 1987	• Gill nets set overnight (3,516.1 net meter hours effort)	5	0.14 fish per net meter hour	0.5%	• Splake stocked in 1986. • 178 rock bass and 4 yellow perch also captured.	Haxton (1987)
Round Lake (Cavendish Twp.)	July 1987	• Gill nets set overnight (6,419.4 net meter hours of effort).	5	0.0008 fish per net meter hour	33.3%	• Splake stocked in 1987. • 9 yellow perch and 1 white sucker also captured.	Haxton (1987)
Round Lake (North Burgess Twp.)	September 1992	• Two overnight gill net sets.	2	–	5.9%	• 500 splake stocked for the past three (1990 – 1992) years. • Smallmouth bass, largemouth bass, pumpkinseed, yellow perch, rock bass and bluegill also captured.	McNaughton (1992)
Round Lake (Otto, Marquis, Boston and Pacaud Townships)	September 1999	• 30 two hour sets in hypolimnion.	8	0.27 splake per net set	18.2%	• 1 whitefish, 27 herring, 1 white sucker, 1 spottail shiner, 2 trout-perch, 3 burbot and 1 walleye also caught.	Davis
		• 12 two hours sets in thermocline.	5	0.42 splake per net set	11.4%	• 2 herring, 2 smelt, 3 northern pike, 6 white sucker, 5 spottail shiner, 9 trout-perch, 2 yellow perch and 10 walleye also captured.	Davis (2000)
Rustyshoe Lake (Glamorgan Twp.)	July 1987	• Gill nets set overnight (5,608.6 net meter hours effort).	6	0.11 fish per net meter hour	100.0%	• Splake stocked in 1986.	Haxton (1991)
Scaup Lake (Rogers Twp.)	August 1990	• One 2 hour gill net set.	3	–	50.0%	• 3 brook trout also captured.	Anonymous (1990_a)

Appendix 2 continued on next page

Waterbody	Date	Netting Technique	# Splake Caught	Splake CUE	% Splake in Catch	Comments	Reference
Schamerhorn Lake (Perry Township)	October 1983	• One 4' trapnet set at two locations in the lake.	0	–	0.0%	• 1,575 yearling splake had been stocked in May 1983.	Anonymous (1985)
	July 1985	• Two "lake survey" gill nets set for three nights (6 net nights of effort).	2	–	66.7%	• 3,000 yearling splake stocked in May 1985. • 1 lake trout also captured.	Anonymous (1985)
Spring Lake (Ashby Township)	July 1991	• Three gill nets set.	15	–	8.7%	• 140 white suckers, 14 rock bass and 3 pumpkinseed also captured.	Anonymous (1991_c)
Sproule Lake (Sproule Twp.)	Summer 1989	• Six overnight gill net sets.	58	9.67 fish per net night	–	• 3,800 splake stocked in 1988.	Liskauskas and Quinn (1991)
Sunday Lake (Sproule Twp.)	Summer 1988	• Nine overnight gill net sets.	18	2.0 fish per net night	–	• 4,000 splake stocked in 1987.	Liskauskas and Quinn (1991)
Tedious Lake (Guilford Twp.)	Summer 1987	• Overnight gill netting.	2	–	100.0%	• No other fish species captured. • Recommend the discontinuation of splake stocking.	Wilson (1987)
Tory Lake (Monmouth Twp.)	Summer 1987	• Overnight gill netting.	1	–	25.0%	• Splake stocked in 1985. • 1 brook trout and 2 lake trout also caught.	Wilson (1987)
Trump West Lake (Pearce Twp.)	August 1993	• Four 2 hour gill net sets.	2	–	6.1%	• 11 white suckers and 20 yellow perch also captured.	Anonymous (1993)
Tyne Lake (Ballantyne Twp.)	Spring 1987	• Overnight gill netting.	2	0.033 fish per 100 meter hours	–	• 1,400 splake stocked in 1986.	Deyne and Arnett (Undated)
Upper Raven Lake (Proudfoot Twp.)	July 1995	• Two sections of gill net based on the Algonquin protocol.	2	0.077 fish/61 m net	1.3%	• 8 white suckers and 141 yellow perch also captured.	Thomas (1995)

Appendix 2 continued on next page

Waterbody	Date	Netting Technique	# Splake Caught	Splake CUE	% Splake in Catch	Comments	Reference
West Galipo Lake (Eyre Twp.)	Summer 1990	• Nineteen net sets perpendicular to shoreline (1,425 net meter hours effort).	5	0.35 fish per net meter hour	45.0%	• 3,00 splake stocked in 1988 and 1,200 in 1990.	Haxton (1991)
Widgeon Lake (Joly Twp.)	Spring 1987	• Overnight gill netting.	8	0.048 fish per 100 m hours	–	• 1,500 splake stocked in 1986.	Deyne and Arnett (Undated)
Widgeon Lake (Township #238)	1992	• Gill netting for 6.25 hours.	3	–	37.5%	• Splake stocked in 1989 and 1991. • 5 longnose suckers also captured.	MNR unpublished data
Wildcat Lake (Eyre Twp.)	June 1987	• Gill nets set overnight (3,990.6 net meter hours effort).	29	0.73 fish per net meter hours	–	–	Haxton (1987)
Wolf Lake (Havelock Twp.)	June 1987	• Gill nets set overnight (2623.3 net meter hours effort).	4	0.002 fish per net meter hour	14.8%	• Splake stocked in 1986. • 7 lake trout, 1 smallmouth bass, 4 rock bass and 11 white sucker were also captured.	Haxton (1987)

APPENDIX 3. Contribution of stocked splake to the recreational fisheries of selected North American lakes.

Waterbody	Year/Season	% Return (from # stocked)	Splake CUE	% of Total Catch	Reference
Battery Lake (Ontario)	1984 – 1992 (W)	–	0.052	–	MNR unpublished data
	1984 – 1992 (S)	–	0.074	–	MNR unpublished data
Big Mair Lake (Ontario)	1986	–	0.115	–	Anonymous (1992_a)
	1987	–	0.538	–	Anonymous (1992_a)
Egg Lake (Ontario)	1985	–	0.038	–	Anonymous (1986_b)
	1986	–	0.053	–	Anonymous (1986_b)
Glasgow Glen Pond (Ontario)	1967 – 1972	10.0%	0.330 (0.120 – 0.460)	25.2%	Berst and McCombie (1975)
Granite Lake (Ontario)	1985 (S)	–	0.062	–	Anonymous (1985c)
Grindstone Lake (Ontario)	1985 (S)	–	0.000	–	Anonymous (1985c)
Indian Lake (Ontario)	1989 (W)	–	0.230	–	Hart (1989)
Jack Lake (Ontario)	1960s	78.6%	–	–	Budd (1969)
Joyce's Lake (Ontario)	1997 – 2000 (W)	–	0.082	–	MNR unpublished data
	1997 – 2000 (S)	–	0.120	–	MNR unpublished data
Lake Superior (Michigan)	1983 – 1987	13.0% (yearlings) < 2% (fingerlings)	–	–	Peck (1990)
Lower Beverley Lake (Ontario)	1989 (W)	–	0.010	–	Hart (1989)
Otter Lake (Ontario)	1989 (W)	–	0.010	–	Hart (1989)
Parvin Lake (Colorado)	1959	19.8%	–	–	Leik (1959_c)
Providence Bay (L. Huron)	Late 1960s	9.6%	–	–	Berst and Spangler (1970)

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Waterbody	Year/Season	% Return (from # stocked)	Splake CUE	% of Total Catch	Reference
Redrock Lake (Ontario)	1954 – 1957	0.7%	–	–	Fisher (1986)
South Bay (Lake Huron)	Late 1960s	8.4%	–	–	Berst and Spangler (1970)
Spring Lake (Ontario)	1985 (S)	–	0.080	–	Anonymous (1985_c)
	1986	–	0.270	–	Anonymous (1985_d)
26 southeastern Ontario lakes	1989 (W)	–	0.128 (Division 9)	–	Hoyle (1989)
			0.442 (Division 29)	–	

S – Summer; W – Winter

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