

IV.4 Fish and Wildlife Component

The original problem (pre 1990) with fish and wildlife included: an irreversible loss of 65 % of original fish and wildlife habitat due to shoreline restructuring and filling; impaired diversity and abundance of fish and wildlife communities; and fish and birds that exhibited tumours, lesions and deformities, indicating possible exposure to carcinogenic and teratogenic chemicals. Two goals in the 1992 RAP were to create an edible reproducing warm-water fishery, and a healthy, self-sustaining resident and migratory wildlife population. An ambitious plan (Figure 39) targeted at habitat restoration was prepared to re-establish 372 ha of fish and wildlife habitat at nine sites around the Harbour.

Figure 39. Proposed Fish & Wildlife Habitat Restoration Project Enhancement Targets

LOCATION	FISH HABITAT (ha)	WILDLIFE HABITAT (ha)	LITTORAL EDGE (km)	TRAILS (km)
Cootes Paradise *	250.0 **	250.0 **	2.0	2.00
Grindstone Creek *	20.0 **	20.0 **	2.0	1.50
Pier 28 (Fishermen's Pier)	6.0	1.0	1.4	0.22
Northeastern Shoreline *	18.4	8.0	2.3	0.36
LaSalle Park *	11.9	6.0	1.4	1.00
North Shore	18.0	.3	2.5	0
Bayfront and Pier 4 Parks *	22.1	2.0	2.1	2.10
Bayfront to Desjardins *	26.0	9.0	2.6	2.00
Windermere Basin and Red Hill Marsh		3.0		0.50
TOTAL	372.4	299.3	16.3	9.68

* Sites where habitat restoration projects have been completed or are ongoing between 1994 and 2001

** Note that the fish and wildlife habitat measurements for Cootes Paradise and Grindstone Creek represent the marsh environment and are not separate areas.

Source: Fish & Wildlife Habitat Restoration Project

By 2001, 337 ha of habitat (including 20 ha emergent vegetation and 180 ha submergent vegetation in Cootes Paradise) were restored at six sites around the Harbour (Figure IV.4.a). Improvements in water quality and habitat resulted in: 170 ha of aquatic plants returning to the littoral zone of the Harbour; an increase from 10 native plant species in Cootes Paradise to 18 species; increased waterfowl diversity and abundance in the Cootes Paradise Marsh; and the return of some amphibians such as bullfrog and spotted salamander previously extirpated from the Cootes Paradise Marsh. Carp populations were reduced in Cootes Paradise by approximately 90 %. Secure habitat for 670 nesting pairs of Caspian and common terns, herring gulls, and double-crested cormorants was created in the Harbour. There was still little overall change in the fish community composition, but dramatic changes can be seen at restoration sites.

Current water level regulation of Lake Ontario continues to be at odds with marsh restoration. A five year study initiated in 2001 by the International Joint Commission (IJC) will evaluate the impact of various water level regulation regimes with respect to the environment and other uses common to the Lake Ontario – St. Lawrence River System. The results of this study and any

modification to the water regulation of Lake Ontario will in part determine the make up of the Cootes Paradise Marsh plant community.

Emerging issues for fish and wildlife include:

- eutrophication in West Pond and associated algae mats in Cootes Paradise;
- continued invasions by exotic species with unknown impacts on fish and wildlife populations;
- ongoing management of nuisance species;
- exploring potential to increase (exceed) original habitat targets at Windermere Basin, Fisherman's Pier, Red Hill Creek estuary, and Chedoke Creek estuary;
- explore expanding wildlife targets to include wildlife other than colonial nesting birds;
- concern that the success of public access may overwhelm restoration sites; and
- influence of Lake Ontario water level regulation on restoration progress

IV.4.1 Fish & Wildlife Habitat Restoration Project

Recommendation No. FW – 1

(1992 Rec. 12)

Continue to implement the Fish and Wildlife Habitat Restoration Project and maintain the existing projects. Where possible and appropriate, provide public access to the projects and other green spaces.

Responsible Agencies

DFO, City of Hamilton, City of Burlington, Regional Municipality of Halton, Hamilton Port Authority, RBG, McMaster University, EC, Conservation Halton, Hamilton Conservation Authority, OMNR

Short Term Target

FW – 1.1 (2005) Maintain the existing projects and continue to advance projects at Fisherman's Pier, Windermere Basin, North Shore, and mouth of Grindstone Creek.

Long Term Targets

FW – 1.2 (2015) Provide 500 ha of emergent and submergent aquatic plants in Hamilton Harbour, Cootes Paradise, Grindstone Creek delta, and Grindstone Creek marshes in accordance with the Fish and Wildlife Habitat Restoration Project (360 ha FWHRP sites + 140 ha littoral zone).

FW – 1.3 (2015) Provide 15 km of littoral shore.

FW – 1.4 (2015) Provide 300 ha of wildlife habitat.

FW – 1.5 (2015) Provide 3 ha of colonial nesting bird habitat.



Status

The Fish & Wildlife Habitat Restoration Project (FWHRP) has been in existence since 1991 and was initiated to fulfil one of the remedial actions to restore the quality of Hamilton Harbour. The focus started with a plan to rehabilitate nine project sites as shown on the map in Figure 40. Fisheries and Oceans Canada (DFO) chairs the Steering Committee (see Recommendation FW – 2). Conservation Halton has provided a senior staff member as the Project Manager since 1991.

The following is a list of some of the remediation efforts that have been accomplished through this project including major landowners and the years of construction:

- Pike Spawning Marsh – RBG (1993-1994)
- Carp Barrier/Fishway in Cootes Paradise – City of Hamilton and RBG (1994-1995)
- LaSalle Park – Hamilton Port Authority (HPA) and City of Burlington (1995)
- Northeastern Shoreline – HPA and EC (1995-1996)
- Hickory Valley Herpetile Ponds – RBG (1995)
- Chedoke Creek Restoration – City of Hamilton (1995-1996)
- Grindstone Creek Waterfront Trail - RBG (1994-1995)
- Hamiltonian Pier – HPA (1997-1998)
- Lower Grindstone Creek Restoration – RBG (1999 – 2002)
- West Harbour Waterfront Trail – City of Hamilton (1999-2000)
- Hidden Valley Park – City of Burlington (2001-2002)

Details on these projects and others are available in the year end progress report produced by the FWHRP and on the RBG web site (<http://www.rbg.ca>). The results of these projects are continually tracked and information dating back to 1992 is included in each year end report.

Nine fact sheets were produced during 1998 on various fish and wildlife projects around the Harbour by the FWHRP, RBG, and the City of Hamilton. The fact sheets were reprinted to replenish stock available for distribution in 2001. The detail on the fact sheets is also available on the RBG web site.

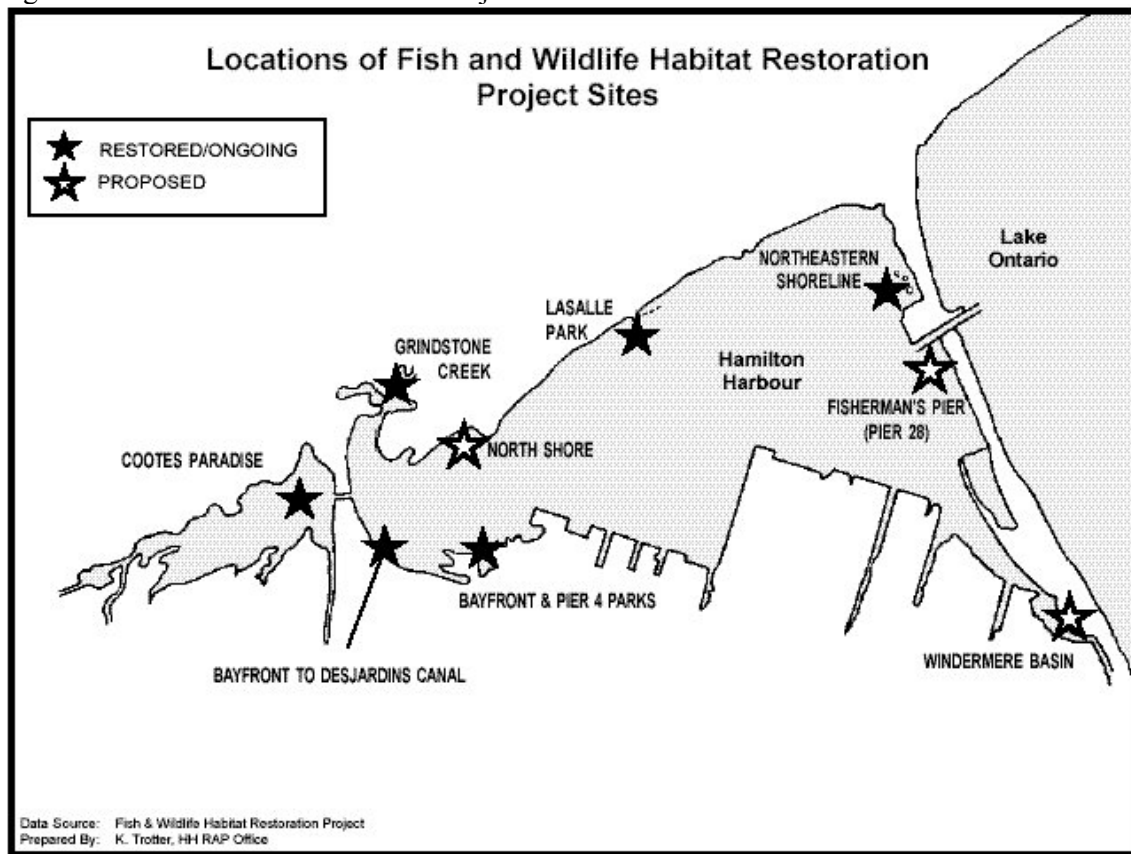
In 1998, the FWHRP was the only Canadian recipient of the prestigious “Excellence on the Waterfront” award. This is awarded for the top environmental rehabilitation waterfront project in an international juried competition by the Waterfront Centre in Washington D.C.

The inclusion of island habitats at Fisherman’s Pier (Pier 28) may be part of the concept plan when the Hamilton Port Authority and the FWHRP define project elements. This project was actually under negotiation with the Hamilton Harbour Commissioners in 1997, but governance issues precluded the project from proceeding at that time.

The Hamilton Conservation Authority is undertaking a Lower Spencer and Ancaster Creek Fisheries Rehabilitation Project in 2002 to deal with issues such as channelization and reconnecting the creek and flood plain for pike spawning.

There are future opportunities to improve habitat and/or public access at Windermere Basin, Grindstone Creek mouth, and the North Shore.

Figure 40. Locations of the FWHRP Project Sites



Date: August 20, 2002

IV.4.2 Fish & Wildlife Habitat Restoration Project Steering Committee

Recommendation No. FW – 2

(1992 Rec. 22)

Maintain a Fish and Wildlife Habitat Steering Committee to continue the implementation of the Fish and Wildlife Restoration Projects within the Hamilton Harbour, Cootes Paradise and creek estuaries.

Responsible Agencies

EC, DFO, OMNR, City of Burlington, City of Hamilton, Conservation Halton, Hamilton Conservation Authority, Hamilton Port Authority, RBG, BARC

Status

The role of the Fish & Wildlife Habitat Restoration Project Steering Committee is to oversee the activities within the project, to link with agency programs and RAP directions, and to provide advice and recommendations. Members of this committee include representatives from: DFO, EC – CWS, OMNR, City of Burlington, City of Hamilton, Conservation Halton, Hamilton

Conservation Authority, Hamilton Port Authority, RBG, BARC, and the Hamilton Harbour RAP Office.

IV.4.3 Coordination of Waterfront and Watershed Projects

Recommendation No. FW – 3

(1992 Rec. 13)

Encourage coordination in the accomplishment of all waterfront and related watershed projects.

Responsible Agencies

All agencies

Status

Coordination to accomplish all of the waterfront and watershed projects envisioned for the restoration of Hamilton Harbour is a key part of the stakeholder approach used by this RAP.

The progress of the FWHRP efforts described in Recommendation FW – 1 has involved coordination ranging from the sharing of expertise on planning committees to funding arrangements for implementation. Many of the implementation actions discussed throughout this report incorporate coordination between RAP stakeholders.

The Hamilton Industrial Environmental Association (HIEA), of which some of the RAP stakeholders are members, is a group of industries in the Hamilton area working together with area residents to improve the local environment. One of their projects is a greenbelting initiative in and around Hamilton's industrial core.

IV.4.4 Ecosystems of Lower Reaches of Harbour Tributaries

Recommendation No. FW – 4

(1992 Rec. 10)

That efforts be undertaken to restore the ecosystems of the lower reaches of the Hamilton Harbour tributaries by:

- *appropriate management of Lake Ontario water levels*
- *improving stream morphology and hydrology*
- *enhancing fish and wildlife habitat*
- *restoring flood plain habitat and providing access for fish and wildlife*
- *improving water quality by removing stresses resulting from discharges from WWTPs, CSOs, and watersheds*

Responsible Agencies

DFO, RBG, EC, OMOE, OMNR, Conservation Halton, Hamilton Conservation Authority, City of Hamilton, City of Burlington, Regional Municipality of Halton

Short Term Target

FW – 4.1 (2005) Develop habitat targets (riparian and stream morphology) for lower tributaries of Spencer Creek, Chedoke Creek, Red Hill, and Indian Creek.

Long Term Targets

FW – 4.2 (2015) Recover 40 ha of wetland habitat in Grindstone Creek.

FW – 4.3 (2015) Implement recovery for Spencer Creek, Chedoke Creek, Red Hill, and Indian Creek to meet defined habitat targets.

Status

The tributaries that flow into Hamilton Harbour include: Grindstone Creek, Spencer Creek, Borer's Creek, Indian Creek, Falcon Creek, Chedoke Creek, Red Hill Creek, and the Hagar/Rambo Creek diversion. Watershed studies have been prepared for Grindstone Creek, Red Hill Creek and Spencer Creek, with studies underway in 2001 for Indian and Falcon Creeks. The City of Burlington has completed a baseline hydrology and hydraulics study for Indian and Falcon Creeks.

DFO will consult with RBG and the Conservation Authorities to develop habitat targets for the lower tributaries, and fishery targets for a restored Cootes Paradise Marsh. DFO will be involved in authorizing habitat restoration projects in area tributaries. Habitat targets must be linked to fishery targets to justify the need for remedial actions and should not proceed independently. DFO will work through the Fish & Wildlife Habitat Restoration Project (FWHRP) to implement the habitat recovery in the tributaries.

In the lower reaches of Grindstone Creek the RBG has enhanced the pike spawning habitat (Ponds 1-4 and Lower Grindstone Berms around Ponds 2-4), and completed the Christmas tree enclosures designed to exclude carp, recover emergent vegetation, and redefine the creek channel in the estuary. The installation of a carp barrier (similar to the Cootes Paradise Fishway) was eliminated from consideration. Through work of the City of Burlington, restoration of stream morphology and fish habitat at Hidden Valley Park began in 2001, with scheduled completion in 2002. The Hidden Valley Park Stream Restoration Project involves part of the lower reaches of Grindstone Creek, which provide cold water fish habitat. Improvements to fish habitat included the construction of a stable pool and riffle pattern to reduce erosion of the stream banks and the removal of existing barriers to fish passage.

RBG and Hamilton Conservation Authority developed a habitat and stream morphology plan for the lower reaches of Spencer Creek with implications for the improvement of the west end of Cootes Paradise. Preliminary plans exist to recover the lower reaches of Spencer Creek. Applications to Environment Canada's Great Lakes Sustainability Fund (GLSF) to start this implementation project were made for the 2002-2003 fiscal year.

There are no firm plans yet to restore habitat in Red Hill Creek, Indian Creek, Falcon Creek, or Chedoke Creek. Timing for projects in these areas depends upon the availability of funding. Work in Red Hill Creek will depend on the Red Hill Expressway, which is proposing to alter the course of the creek and its surrounding ecosystem. In the lower reaches of Chedoke Creek, the City of Hamilton has completed riparian habitat enhancement on the west bank with future work required on east bank and upstream.



IV.4.5 Nuisance Species Management

Recommendation No. FW – 5

(2001Rec. M)

That coordinated interagency management strategies be developed and implemented to reduce the negative effects of over populations of some nuisance species on fish and wildlife habitat, and on the diversity and balance of fish and wildlife communities in Hamilton Harbour and Cootes Paradise. The management strategy should include species such as: ring-billed gulls, Canada geese, double-crested cormorants, mute swans, round goby, carp, purple loosestrife and manna grass. There is a need for integrated committees to develop comprehensive strategies.

Responsible Agencies

EC - CWS, DFO, OMNR, RBG, Hamilton Port Authority, City of Hamilton, City of Burlington, McMaster University

Short Term Targets

- FW – 5.1 **(2005)** Develop a management strategy with species targets for Canada geese, mute swans, round gobies and other species as they arrive.
- FW – 5.2 **(2005)** Maintain carp in Cootes Paradise at less than 40kg/ha .

Long Term Targets

- FW – 5.3 **(2015)** Reduce ring-billed gulls numbers to 5000 pairs.
- FW – 5.4 **(2015)** Reduce double-crested cormorants numbers to 200 pairs.

Status

The Colonial Waterbird Committee has evolved in 2002 into the Wildlife Management Advisory Committee. The new mandate expanded to encompass a larger area and to include a larger number of species (animals and plants). As many of the problems are regional, members from outside of Hamilton Harbour are part of this group. The multi-stakeholder process is looking at a number of “nuisance” species including: ring-billed gulls, double-crested cormorants, Canada geese, carp, round goby, and purple loosestrife.

The previous Colonial Waterbird Committee developed a management strategy for ring-billed gulls that saw the Canadian Wildlife Service (CWS), the Hamilton Port Authority (HPA), and the City of Hamilton collaborating in management actions to discourage ring-billed gulls from occupying habitat at the Northeast Shoreline, Windermere Basin, and on Pier 26. There has been a marked reduction in ring-billed gulls from just fewer than 40,000 pairs in 1990 to a plateau of around 23,500 pairs from 1999-2001 as shown in Figure 41. It should be noted that the 1990 count was the last time a systematic count of this population was done. It is essential that the management of ring-billed gulls be an integral part of the planning for Windermere Basin, now that the City of Hamilton is the responsible owner of the property. The ability to reduce the current population to the target of 5000 ring-billed gulls will not be possible without major and intrusive management procedures such as a greater use of raptors and more intensive egg collections (Morris, 2001).

Figure 41. Ring-billed Gull and Double-Crested Cormorant Nesting Numbers Within Hamilton Harbour

Year Sampled	Ring-billed gulls	Double-crested cormorant
1987	21207	51
1988	N	157
1989	N	140
1990	39621	250
1991	N	416
1992	N	592
1993	N	685
1994	N	451
1995	N	588
1996	N	819
1997	N	496
1998	16575	867
1999	23590	1107
2000	23884	1143
2001	21000 - 24000	1196
RAP Target	5000	200

N = nesting but not sampled

Source: Canadian Wildlife Service, March 2002

The double-crested cormorant was a species that implementers wanted to increase when the Hamilton Harbour RAP started. Their numbers were low (51 pairs in 1987), probably due in part to the effect of DDT on their eggs. A target of 200 pairs was proposed in 1992; however, as of 2001 there were 1196 pairs counted by staff at CWS, as seen in Figure 41. The cormorants have clearly overshot the original target and have become a nuisance species. Their excrement kills the mature trees they nest in, creating barren stands of tree limbs now visible on Hickory Island in Cootes Paradise and at Carroll's Point on the Northwest Shore of the Harbour. A management strategy is needed for this once sought after species. The OMNR is the responsible agency for cormorant management. The increase in cormorant populations is however a Great Lakes wide phenomenon.

Each year CWS considers the applications for permits to allow reduction of goose and swan numbers. The RBG has implemented a control program involving the oiling of eggs to reduce the impact of Canada geese (1993) and mute swans (1999) on Cootes Paradise. Egg oiling suffocates the developing chick and prevents it from hatching, whereas removal may encourage the parents to lay more eggs. Figure 42 and Figure 43 present data on the number of nests and total eggs oiled for Canada geese and mute swans respectively. A major factor in the control of Canada geese and mute swans throughout the Harbour and Cootes Paradise will be using education about the problems created by feeding birds to persuade the public to change behaviour.

RBG is controlling carp populations in Cootes Paradise at the Fishway, and in Sunfish Pond and lower Grindstone Creek with the Christmas Tree Barriers as described in other recommendations (FW – 4 and FW – 10).

Figure 42. Non-Migratory Canada Goose Control Program at RBG (1993-2001)

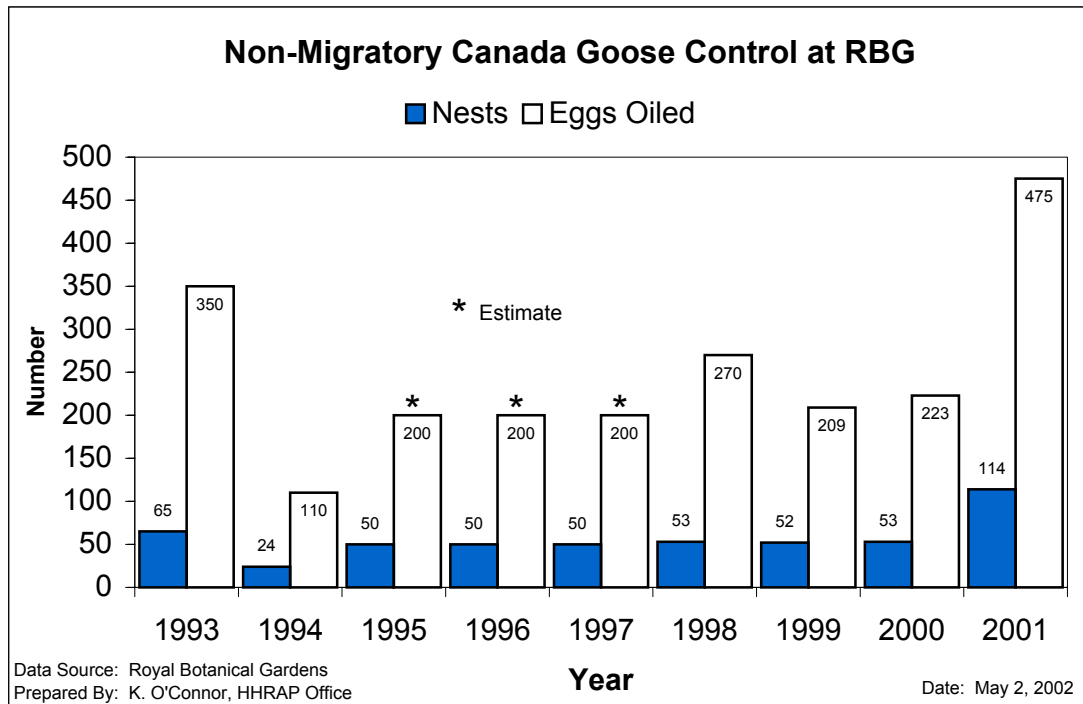
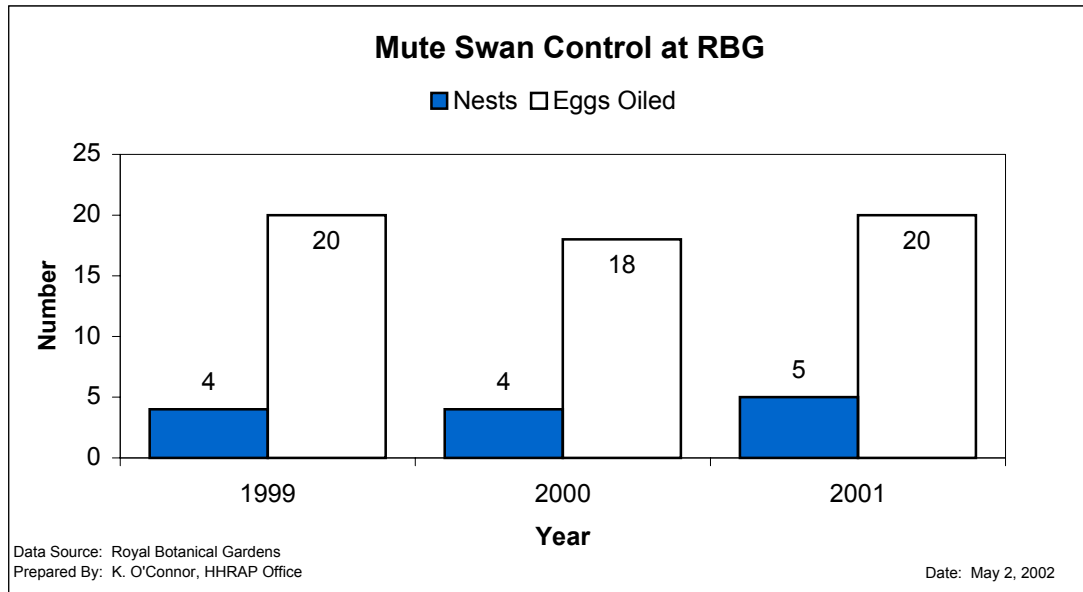
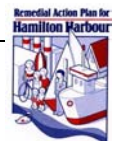


Figure 43. Mute Swan Control Program at RBG (1999-2001)



Round goby was first recorded in Hamilton Harbour in 1999. DFO and OMNR need to determine the impact of the round goby on fish populations in Hamilton Harbour. RBG surveyed the fish community in Hamilton Harbour in 2001 and is to provide estimates of round goby



numbers to DFO. A DFO survey of the Harbour fish community will be undertaken in 2002 and part of that will be an examination of the impact of the round goby.

RBG successfully implemented control of purple loosestrife using two species of beetles in Cootes Paradise and Mercers Glen.

IV.4.6 Biological Effects due to Exposure of Contaminants

Recommendation No. FW – 6

(1992 Rec. 18)

The levels of toxic substances in the water, sediment, and food chain be reduced as much as possible to allow for the presence and natural reproduction of the most sensitive native species of aquatic and terrestrial life.

That a battery of indicators be developed for fish and wildlife populations inhabiting the harbour to identify the level of biological effects attributable to exposure to environmental contaminants identified in Hamilton Harbour.

Responsible Agencies

DFO, OMOE, EC – CWS, OMNR, Universities

Long Term Targets

- FW – 6.1 **(2015)** Incidence rates of fish tumours or other deformities should not exceed rates at unimpacted control sites that are locally relevant.
- FW – 6.2 **(2015)** Collect survey data to confirm the absence of neoplastic or preneoplastic liver tumours in bullheads or suckers.
- FW – 6.3 **(2015)** Incidence rates of deformities or reproductive problems in sentinel wildlife species should not exceed background levels in control populations.

Status

There have been various techniques to assess the health of fish and wildlife in Hamilton Harbour and a number of physiological, histological and biochemical ‘health’ measures have been attempted. To date there are data on:

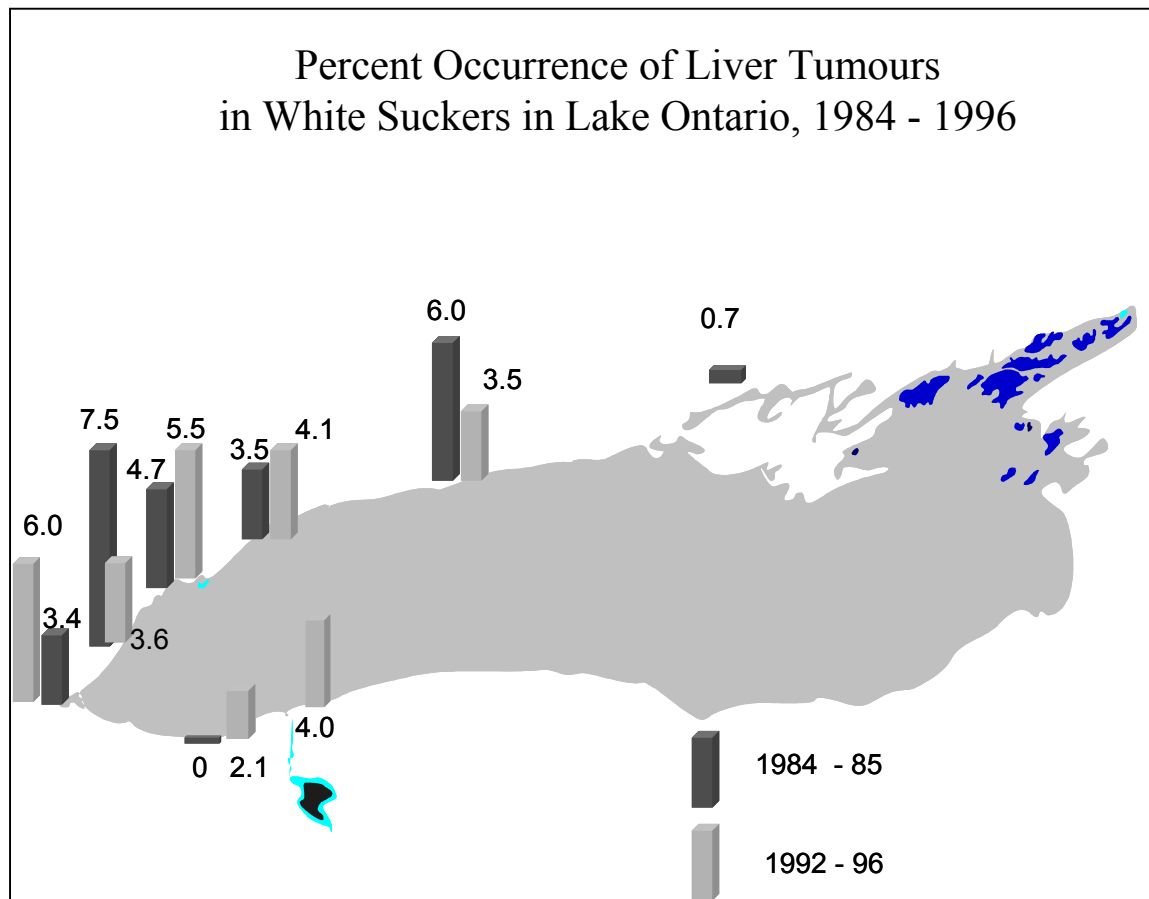
- Liver and epithelial tumours on white sucker and brown bullhead (DFO)
- MFO (mixed function oxidase) levels in Harbour fish
- ALAD (amino levulinic acid dehydratase) levels in Harbour fish (an indicator of lead exposure)
- Developmental abnormalities in colonial nesting birds (CWS)
- Biochemical indicators of genetic mutation in birds (McMaster)
- Developmental abnormalities in snapping turtles (CWS)
- PCB levels in forage fish in Red Hill Creek (OMOE)
- Determination of effects of EDCs (endocrine disrupting compounds) on fish health (NWRI)

DFO and RBG have been monitoring the status of fish populations in the Harbour and Cootes Paradise, but no studies have been done specifically to assess natural reproduction of sensitive species.

DFO is planning to review the tumour prevalence data for Hamilton Harbour and determine if the occurrence of liver tumours and epithelial tumours in brown bullhead and white sucker in the Harbour exceeds the prevalence at unimpacted control sites. DFO completed a study indicating that contaminants in Hamilton Harbour sediment can induce tumours in rainbow trout. These studies linked tumour induction to PAHs. The last tumour survey in Hamilton Harbour was completed in 1996 (Figure 44), but incidental observations of epithelial tumours have been made annually at the Fishway. DFO recommends waiting approximately ten years to repeat the tumour survey; the next tumour survey is scheduled in 2006. DFO started a “Contaminant Trend Monitoring Study of the Harbour Fish Community” in 2001, which looks at several trophic levels using a whole fish analysis.

CWS has been monitoring contaminant levels and reproductive levels in herring gulls and snapping turtles in Hamilton Harbour and Cootes Paradise and have developed and implemented a battery of biological responses. Figures showing levels of dioxin and PCBs in herring gull eggs are presented in Recommendation RM – 2. There are no immediate plans to monitor wildlife for deformities but the Fish & Wildlife Habitat Restoration Project could undertake a survey if funds were available. CWS has background data on deformities in snapping turtles from Cootes Paradise.

Figure 44. Liver Tumours in White Suckers in Lake Ontario, 1984 - 1996



Source: V. Cairns, DFO

Date: August 22, 2002

IV.4.7 Indicator of Wildlife Health

Recommendation No. FW – 7

(1992 Rec. 19)

That indicators of wildlife health and efficacy of remediation efforts to control contaminants be determined by developing contaminant concentration objectives for indicator wildlife species (including food web impacts).

Responsible Agencies

OMOE, OMNR, EC – CWS, McMaster University

Short Term Target

FW – 7.1 (2003) Conduct a literature review and propose contaminant concentration objectives/levels for indicator wildlife species at various trophic levels where none exist.



Long Term Target

FW – 7.2 (2015) Apply objectives from literature review.

Status

CWS is proposing to conduct a literature review of contaminant concentrations and effects in colonial waterbirds and snapping turtles and, where sufficient data exist, set contaminant concentration/level objectives. This will be done in conjunction with CWS's health effects monitoring (see Recommendation RM – 2).

IV.4.8 Habitat Protection from Overuse by Public**Recommendation No. FW – 8**

(2001 Rec. N)

That a management plan be developed for restored fish and wildlife habitats to protect them from overuse by the public interested in fishing, ecotourism, wildlife viewing, hiking and education.

Responsible Agencies

RBG, DFO, OMNR, EC - CWS, Hamilton Port Authority, City of Burlington, City of Hamilton, BARC

Short Term Target

FW – 8.1 (2005) Develop a management plan for restored fish and wildlife habitats to protect them from overuse by the public interested in fishing, ecotourism, wildlife viewing, hiking and education.

Status

The popularity of the restoration project sites has created an interesting dilemma, the need to strike a balance between allowing the public access to view restoration efforts and protecting projects from destruction due to overuse by the public. Public access has been incorporated at most of the fish and wildlife habitat restoration projects to permit limited access on trails and boardwalks. The Fish & Wildlife Habitat Restoration Project Steering Committee will work with RBG and the property owners for the various restored sites to develop a management plan that would protect them from overuse.

Fishers have been observed fishing illegally within the 75 yds of the Cootes Paradise Fishway, which is a legally protected zone. There is circumstantial evidence that poachers are destroying many of the large top predator fish species that are congregating in the Desjardins Canal. This issue could be incorporated into a fisheries study of the Desjardins Canal and fish movement through the Fishway proposed under Recommendation FW – 10. “No fishing” signs have been posted at the Fishway to indicate the 75 yd protected zone. Some enforcement has been done by OMNR and DFO, but this has not succeeded in reducing illegal fishing. The creation of a “no fishing zone” for the entire Desjardins Canal on the Harbour side and other voluntary fish sanctuaries in the area are perhaps the most practical solutions.

IV.4.9 Restoration of Aquatic Vegetation in Cootes Paradise

Recommendation No. FW – 9

(1992 Rec. 9)

That efforts be undertaken to restore abundance and diversity of submerged and emergent vegetation in Cootes Paradise by:

- *controlling carp populations*
- *introducing top predators to restructure the fish community and increase top-down control of lower trophic levels*
- *enhancing water quality to remove stresses from sewage treatment plants, CSOs, and tributaries*
- *promoting appropriate management of Lake Ontario water levels*

Responsible Agencies

DFO, RBG, EC, OMOE, OMNR, Hamilton Conservation Authority, City of Hamilton, McMaster University

Short Term Targets

- FW – 9.1 **(2005)** Maintain less than 40 kg/ha of carp biomass in Cootes Paradise.
- FW – 9.2 **(2005)** Develop a long term target for phosphorus in Cootes Paradise, which is scientifically defensible and would achieve the long term light penetration and chlorophyll targets.

Long Term Targets

- FW – 9.3 **(2015)** Achieve 240 ha of submerged and emergent vegetation in Cootes Paradise.
- FW – 9.4 **(2015)** Achieve a plant diversity based on historical diversity of 18 species of submergent and 25 species of emergent vegetation in Cootes Paradise.
- FW – 9.5 **(2015)** Achieve a target of 25 mg/l suspended sediments in Cootes Paradise. Compliance with environmental conditions with respect to suspended sediments should be measured once weekly throughout June – August.

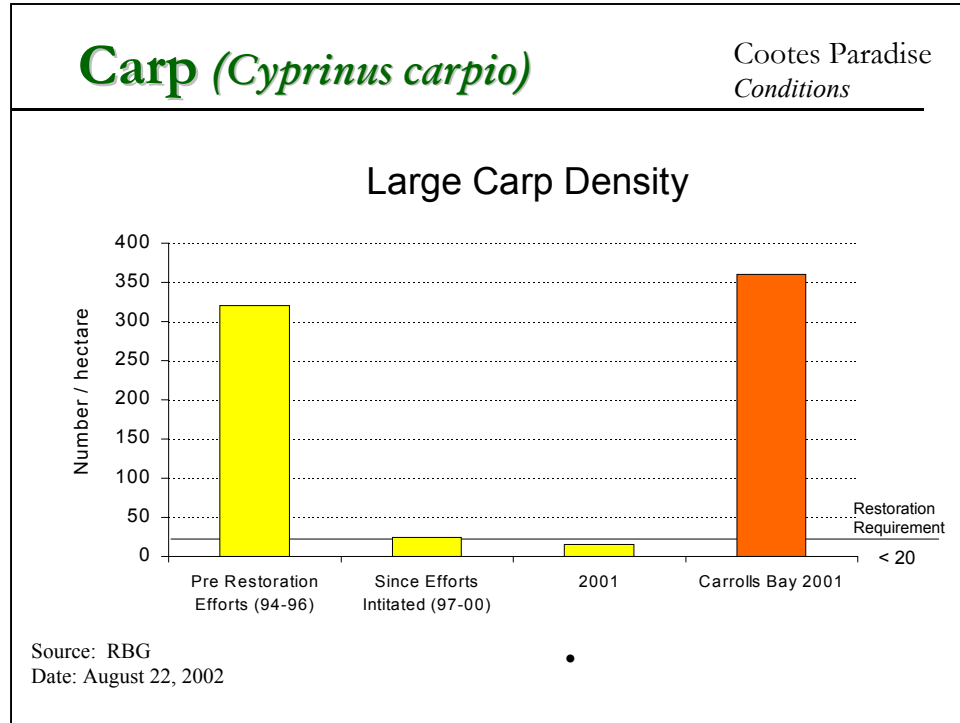
Status

The control of carp activity in Cootes Paradise was the first limiting factor addressed in order for emergent and submergent vegetation to recover in the marsh. Carp reduce light penetration by stirring up sediment and they physically damage plants during feeding and courtship/spawning activity. Since the Cootes Paradise Fishway was constructed in 1995 by the Fish and Wildlife Habitat Restoration Project (operated since 1996 by RBG), the carp populations in Cootes Paradise have been substantially reduced (Figure 45).

The introduction of specific top order predatory fish to accelerate a permanent restructuring the fish community was used in Cootes Paradise. Walleye were introduced through stocking in 1997 and 1998 into Hamilton Harbour and Cootes Paradise; however there has been no evidence of walleye recovery. In addition, muskellunge re-introductions are currently being contemplated in a further attempt to advance this natural predator-influenced carp control strategy. Successful restoration of the pike spawning marsh in Grindstone Creek has increased the number of adult pike entering Cootes Paradise in the spring without stocking. DFO funded a MSc graduate

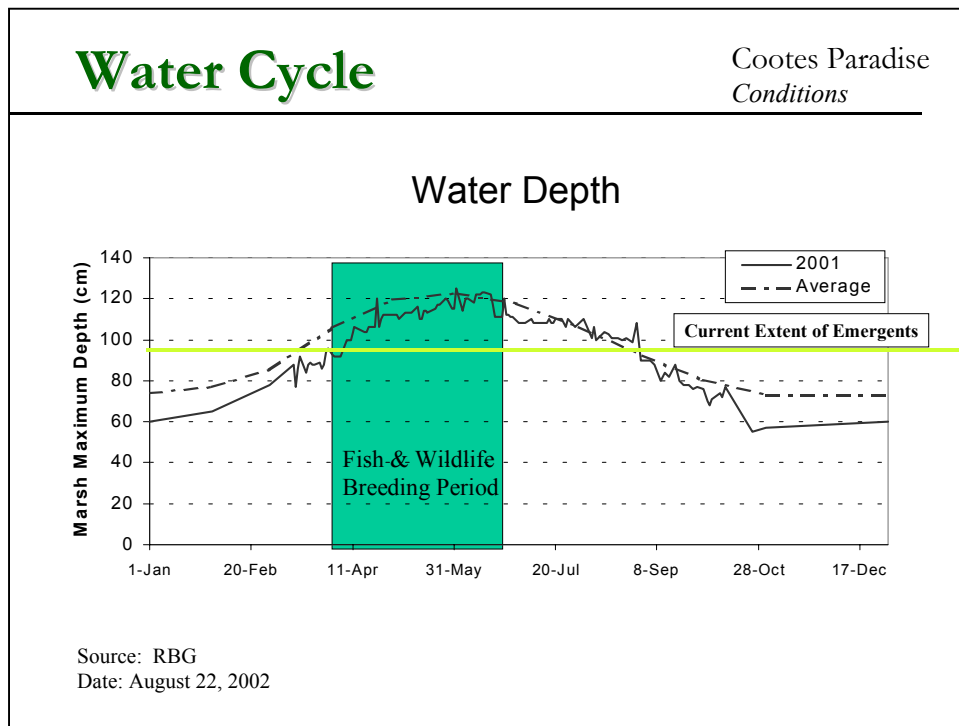
student at the University of Toronto to examine the fish community data in Cootes Paradise to determine if the fish community is responding as predicted to remedial actions.

Figure 45. Large Carp Density in Cootes Paradise



Regulation of water levels in Lake Ontario currently keeps levels high, but this floods the Cootes Paradise Marsh before emergent vegetation gets established (Figure 46). Three consecutive years of consistent low water level during the spring growing season might be all that is needed to establish the plants. A cycle of flooding in the marsh is also important to control vegetation from overtaking the entire marsh and removing any open water areas. The International Lake Ontario – St. Lawrence River Study is attempting to find an acceptable solution to this issue. A management plan for water levels for Cootes Paradise has been developed for submission to the IJC group.

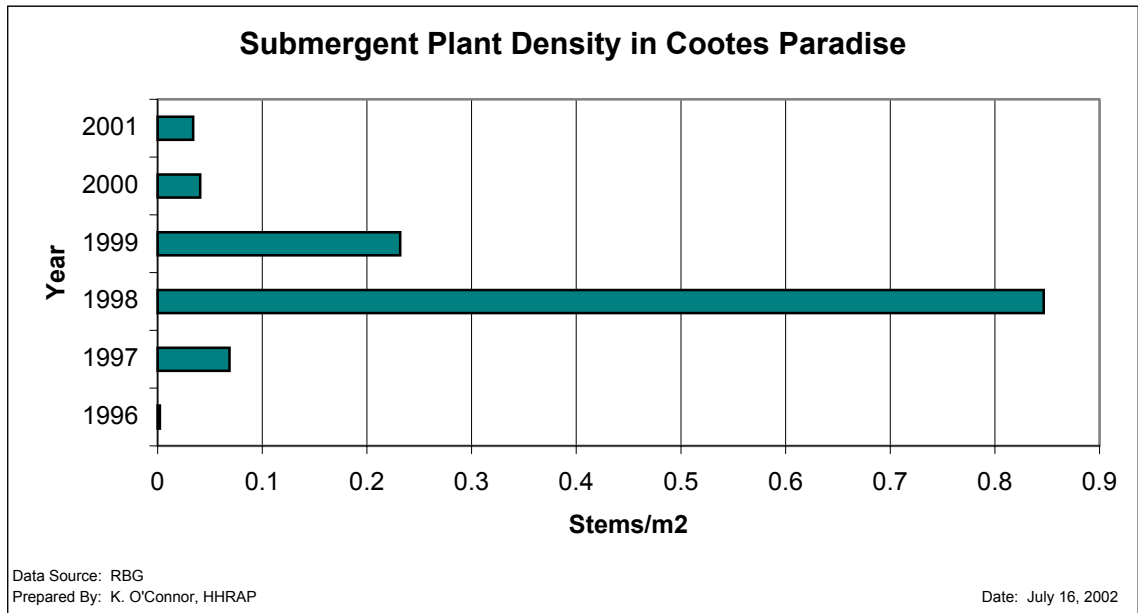
Figure 46. Water Cycle in the Cootes Paradise Marsh



The installation of the Chedoke Creek Combined Sewer Overflow (CSO) tank in 1997 reduced the volume of untreated wastewater entering the marsh. The reduction of nutrient inputs reduces algal growth, which improves water clarity and allows vegetation to recover. An Environmental Assessment and public consultation are being undertaken by the City of Hamilton to identify and implement solutions for reducing the impact of the remaining CSOs draining into Cootes Paradise. Additionally, upgrades and the optimization of the King St (Dundas) WWTP, which started in 2001, is part of the overall effort to address the high nutrient environment that hampers vegetative recovery.

The RBG, through Project Paradise, have been monitoring the restoration of aquatic vegetation in Cootes Paradise since 1994. The emergent aquatic plants community in Cootes Paradise are stable or slowing expanding. Densities (stems/m²) of submergent aquatic plants in Cootes Paradise presented in Figure 47 show an increase from 1996 to the peak in 1998 and a decline continuing into 2001. A large bloom of zooplankton in 1988 clearing the water column, may explain the peak in aquatic vegetation that year. High water levels in 1999 followed by extremely low water levels combined with high phosphorus levels in 2000 are thought to have influenced the decline in aquatic vegetation those years. “In terms of marsh ecology, a healthy submergent bed in a eutrophic wetland measures five to 40 stems/m² depending on specific conditions such as water depth, wind exposure and sediment quality. The hypothetical potential for Cootes Paradise in the shallow more protected areas is up to four or more stems/m².” (p. 23, RBG 2001 Field Season Review). The restoration work in the Cootes Paradise Marsh is ongoing, but progress is limited by water quality, nutrient levels, and Lake Ontario water levels fluctuation.

Figure 47. Stem Density of Submergent Plants in the Cootes Paradise Marsh



IV.4.10 Carp Control in Cootes Paradise

Recommendation No. FW – 10

(1992 Rec. 11)

That in order to eliminate the destructive effects of the existing large numbers of large carp on wildlife and fish habitat, carp control in Cootes Paradise continue to be implemented. Research is needed to determine whether the carp are interfering with the movement of other fish species in the Desjardins Canal.

Responsible Agencies

DFO, RBG, OMNR

Short Term Target

FW – 10.1 (2005) Undertake research to determine whether the carp are interfering with the movement of other fish species in the Desjardins Canal.

Status

Carp have been excluded from Cootes Paradise through the construction of the Fishway barrier where the Desjardins Canal enters the marsh. This project, which was built by the FWHRP, was completed in 1995 and was fully operational for the 1996 field season. It is managed by the RBG. Methods to move other desired fish species into and out of Cootes Paradise have been accomplished through the manual sorting of large fish and the passive movement of small fish (less than 2 inches wide) through the underwater grates. However, during certain time periods, a

large number of carp congregate in the Desjardins Canal on the Harbour side of the Fishway. Their presence may be interfering with passage of other fish species into Cootes Paradise. The FWHRP, with RBG, will develop a research project for 2003 to determine if carp are in fact preventing other species from moving into Cootes Paradise.

IV.4.11 Restructuring of Fish Community

Recommendation No. FW – 11

(1992 Rec. 14)

Implement a program to restructure the fish community by:

- *Increasing the total biomass of top predator fish and increasing top down control of lower trophic levels*
- *Evaluating the success of habitat restoration projects designed specifically for top predator species.*
- *Evaluating the success of purposeful introductions of top predators such as walleye, bass and pike.*
- *Enforcing fishing regulations to protect recovering top predator species from overexploitation.*
- *Creating a “no fishing zone” within the Desjardins Canal.*
- *Supporting the voluntary fish sanctuaries developed by the RBG.*

Responsible Agencies

OMNR, DFO, RBG

Long Term Targets

- FW – 11.1 (2015) Shift from a fish community indicative of eutrophic environments, such as white perch, alewife, bullheads, and carp to a self sustaining community more representative of a mesotrophic environment, containing pike, bass, yellow perch, and sunfish.
- FW – 11.2 (2015) Attain a littoral fish biomass of 200 - 250 kg/ha.
- FW – 11.3 (2015) Increase the species richness from 4 species to 6-7 species per transect.
- FW – 11.4 (2015) Increase the native species biomass from 37% to 80-90% of the total biomass.
- FW – 11.5 (2015) Reduce the spatial variability in fish biomass within the Harbour.

FW – 11.6 (2015) Attain the proposed nearshore fish community of Hamilton Harbour:

<u>Category</u>	<u>Littoral Biomass</u>
Piscivores (pike)	40 – 60 kg/ha
Specialists (insectivores)	70 – 100 kg/ha
Generalists (omnivores)	30 – 90 kg/ha

FW – 11.7 (2015) Attain an Index of Biotic Integrity (IBI) of 55-60 for Hamilton Harbour.

Status

The primary objective is to create a self-sustaining warmwater fish community representing appropriate trophic levels as indicated in the fish targets for Hamilton Harbour. The long-term goals are to rehabilitate both the warmwater and the coldwater fish communities in Hamilton Harbour. DFO monitors the fish community in the Harbour once every three years and assists RBG to monitor the fish community in Cootes Paradise. DFO monitors: to determine progress towards RAP goals, to assess effectiveness of remedial actions, and to identify opportunities for rehabilitating the fish community. DFO will collect data on the fish community, habitat availability, and need for habitat enhancement/restoration and or fish introductions. The next scheduled monitoring for Hamilton Harbour is set for the 2002 field season.

Management strategies to restructure the fish community have been implemented by:

- Restoring pike spawning habitat in the lower Grindstone Creek (Pond 4). This project has successfully resulted in more pike spawning in the Creek and more adult pike entering Cootes Paradise Marsh in the spring.
- Increasing littoral spawning and nursery habitat in Hamilton Harbour by increasing habitat complexity and providing suitable spawning substrate (Figure 48).
- Recovering submerged vegetation in Cootes Paradise to provide nursery habitat for larval and young fish.
- Introducing young of the year walleye into Hamilton Harbour and Cootes Paradise (by local fishing clubs and the OMNR).

Figure 48. Littoral Fish Community Targets for Hamilton Harbour

CATEGORY	2001 NUMBERS	TARGET NUMBERS
Biomass	300 kg/ha	200-250 kg/ha
Native piscivores	9% of biomass	20-25% of biomass
Spatial variability of biomass	coefficient of variation of 120%	coefficient of variation 70-80%
Native species	37% of biomass	80-90% of biomass
Species richness	4 species/transect	6-7 species/transect

Source: Fish & Wildlife Habitat Restoration Project



DFO recommends that the RAP Forum adopt the 'Index of Biotic Integrity' (IBI) as a second and more comprehensive indicator of fish community health in Hamilton Harbour. The original fish community targets were based on fish community metrics such as total biomass (weight of fish per unit area), and trophic composition of the fish community (relative proportion of predators, prey, specialist species and generalist species). These are still valid indicators of community health, but they do not include the three important influencing variables of water quality, exotic species, and fish habitat. In addition, it is difficult to integrate the various metrics into a single number that the RAP can use to track responses of the fish community to remedial actions.

Minns et al. (1994) adapted Karr's stream Index of Biotic Integrity and applied it to the littoral areas of the Great Lakes. The IBI measures 12 individual metrics of three broad types (i) species composition, (ii) trophic composition, and (iii) abundance and condition (Figure 49). The IBI integrates the 12 metrics and presents the results as a single number between 0 and 100. The IBI is correlated to environmental quality and low IBI's represent degraded areas. Minns et al. (1994) tested the IBI over a gradient of environmental conditions in Severn Sound, the Bay of Quinte, and Hamilton Harbour. Based on this analysis Smokorowski et al. (1998), recommended a conservative IBI target of 50-60 (the IBI target of 50-60 is an adjusted IBI which takes into consideration the effects of numbers and biomass of offshore fish that influence the nearshore fish community data), which fell within the range of scores observed at the reference areas at the three AOCs. Analysis of IBI values from 1990 to 1997 indicate that the IBI for the Hamilton Harbour fish community improved from 18 in 1990 to 28 in 1997, but is still considerably less than the 50-60 target.

Figure 49. Metrics used to calculate the Index of Biotic Integrity and the direction of IBI response as the metric increases

CATEGORIES	METRIC	IBI RESPONSE
Species Composition	native species richness	+
	centrarchid species richness	+
	intolerant species richness	+
	native cyprinid species richness	+
Trophic Composition	% piscivore biomass	+
	% generalist biomass	-
	% specialist biomass	+
Abundance and Condition	number of native individuals	+
	biomass of native species (kg)	+
	% number of non-indigenous sp.	-
	% biomass of non-indigenous sp.	-

Source: V. Cairns, DFO

IV.4.12 “No Net Loss” of Fish Habitats

Recommendation No. FW – 12

(1992 Rec. 16)

That regulatory agencies apply the Fisheries Act to ensure the policy of “no net loss” of all fish habitats in Hamilton Harbour, Cootes Paradise and watershed tributaries.

Responsible Agencies

DFO, OMNR, Conservation Halton, Hamilton Conservation Authority

Ongoing Target

FW – 12.1 To enforce the policy of "no net loss" of fish habitat in the Harbour and Cootes Paradise.

Status

DFO Fish Habitat Management is enforcing the No Net Loss Policy and *Section 35 of the Fisheries Act* for all fish habitat restoration projects in the harbour. DFO in conjunction with the Conservation Authorities enforce habitat sections of the Fisheries Act with respect to all development applications in the Hamilton Harbour and its watershed.

A draft Fish Habitat Management Plan was prepared for Hamilton Harbour by DFO in 1996, but was never finalized. Recent developments regarding land use and ownership in the Harbour are consistent with the recommendations in the draft plan and are overtaking the need to complete the plan.

IV.4.13 Nesting Habitat Creation for Colonial Waterbirds

Recommendation No. FW – 13

(1992 Rec. 23)

That habitat be maintained or created as necessary in the Harbour, or in Lake Ontario immediately adjacent to the Harbour, to support nesting populations of colonial waterbirds at selected areas, and that habitat projects be reviewed by the Fish and Wildlife committee to ensure they support the objectives of the FWHRP.

Responsible Agencies

EC - CWS, OMNR, McMaster University

Status

Habitats for colonial waterbirds have been created in Windermere Basin (common tern spur dike) and at the Northeast Shoreline of the Harbour where three islands were created and designed to accommodate Caspian and common terns, herring gulls, black-crowned night herons, and double-crested cormorants. Further habitat enhancement plans for colonial waterbirds should be incorporated within the 2001/2002 City of Hamilton Windermere Basin Master Planning Process and future plans for Fisherman’s Pier.

CWS manages nesting habitat for Caspian and common terns on the islands created on the Northeast Shoreline to ensure that ring-billed gulls do not occupy the entire available nesting

habitat. Ring-billed gulls migrate back to the area earlier than the terns. This gives an advantage to the ring-billed gulls for establishing nests. Management methods include plastic tarping of nesting areas in the early spring until the terns return, followed by gull egg removal, and the deployment of a tethered raptor to scare away the gulls. Decisions are made annually on the need for CWS to continue to work the HPA and the City of Hamilton to hire raptor specialists to deter nesting by ring-billed gulls in the east Harbour region.