

**[Draft] Management Plan for the Banded Killifish
(*Fundulus diaphanus*) in Newfoundland**

Fisheries and Oceans Canada
Government of Canada

And

Wildlife Division
Department of Environment and Conservation
Government of Newfoundland and Labrador

Draft: July, 2006

RECOMMENDED CITATION:

Osborne D. R. and J Brazil. 2006. [Draft] Management Plan for the Banded Killifish (*Fundulus diaphanus*) in Newfoundland. Fisheries and Oceans Canada, and Newfoundland and Labrador Department of Environment and Conservation. 16pp.

DECLARATION

This proposed management plan for banded killifish in Newfoundland has been prepared in cooperation with jurisdictions responsible for the species, as described in Appendix 1. Fisheries and Oceans Canada has reviewed and accepts this document as its management plan for banded killifish as required by the *Species at Risk Act*.

Success in the management of this species depends on the commitment and cooperation of the various constituencies that will be involved in implementing the directions set out in this plan and will not be achieved by Fisheries and Oceans Canada, the Newfoundland and Labrador Department of Environment and Conservation, or any other jurisdiction alone. In the spirit of the National Accord for the Protection of Species at Risk, both the federal and provincial governments invite all Canadians to join them in supporting and implementing this plan for the benefit of banded killifish and Canadian society as a whole. Both the Canadian and Newfoundland and Labrador Governments will support implementation of this strategy to the extent possible, given available resources and their overall responsibility for species at risk conservation. The Minister of Fisheries and Oceans will report on progress within five years.

RESPONSIBLE JURISDICTIONS

The responsible jurisdictions for banded killifish in Newfoundland are Fisheries and Oceans Canada, and the Newfoundland and Labrador Department of Environment and Conservation. Conservation and management measures for the species will be delivered through the cooperative efforts of both jurisdictions.

AUTHORS

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ACKNOWLEDGMENTS

Fisheries and Oceans Canada (DFO) and the Provincial Department of Environment and Conservation are grateful to those who have reviewed drafts of this document and have provided comments. This includes those from various DFO sectors, including Science (K. Clark, C. Bourgeois), Fisheries and Aquaculture Management (H. Bishop), Oceans and Habitat Management (S. Kuehnemund, D. Yetman, C. Grant, T. Fleet, D. Sooley, J. O'Rourke, L. Park) and Communications (W. Garrett, J. Woodford, E. Pittman). From the Province reviewers included Rob Perry (Environment and Conservation), Brian Carter (Department of Natural Resources) and Bas English (Department of Natural Resources).

The authors would also like to thank M. van Zyll de Jong and J. Chippett who had developed an earlier draft version of a banded killifish management plan for Newfoundland.

COSEWIC ASSESSMENT SUMMARY (COSEWIC, 2003)

Assessment Summary	May 2003
Common Name	Banded Killifish (Newfoundland Population)
Scientific Name	<i>Fundulus diaphanous</i>
Status	Special Concern
Reason for Designation	The population is separated from other major populations due to barriers to movement, i.e. 200 km of ocean. Newfoundland populations have a very limited area of occupancy. The possibility of range expansion is limited by steep gradients and impassible rapids and/or falls. Habitat degradation resulting from proposed logging would negatively impact populations in some areas.
Occurrence in Canada	Newfoundland
Status History	Last assessment based on an update status report

EXECUTIVE SUMMARY

The Newfoundland population of banded killifish (*Fundulus diaphanous*) has been listed as a species of Special Concern under the federal *Species at Risk Act* (SARA) and as a Vulnerable species under the *Newfoundland and Labrador Endangered Species Act* (NL ESA). While there is no evidence to suggest that this species' range or population numbers have decreased on the Island of Newfoundland, the banded killifish's limited area of occupancy, clustered distribution pattern and inability for range expansion makes the species particularly sensitive to catastrophic events or localized perturbations.

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) has identified potential impacts from forestry activities in the Indian Bay watershed and barriers to migration as the primary threats and limiting factors for this species in Newfoundland. Additional potential threats include development activities such as road development, mineral exploration and urban/cabin development. Additional issues, such as water temperature and availability of suitable habitat, are not considered limiting factors throughout most of the region.

The goal of this management plan is to maintain existing killifish population levels and distribution, and protect habitat within watersheds in which the species is found. This will be accomplished through surveys and monitoring on an opportunistic basis, development of site specific best management practices to protect habitat, and increased public awareness and stewardship. As banded killifish have been identified as bycatch in the American eel (*Anguilla rostrata*) fishery, these levels will be quantified to determine the level of impact. Conservation and management measures for banded killifish in Newfoundland will be delivered through the cooperative efforts of Fisheries and Oceans Canada (DFO) and the Newfoundland and Labrador Department of Environment and Conservation.

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1.0 INTRODUCTION

The status of the Newfoundland population of banded killifish, *Fundulus diaphanous* (Lesueur 1817), was first considered by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in 1989. Newfoundland populations were considered to be biogeographically isolated from mainland populations and were assigned a designation of Special Concern due to the limited area of occupancy, limitation on potential for range expansion, and potential threats from logging and other activities leading to habitat degradation (Chippett, 2003). A COSEWIC Assessment and Updated Status Report in 2003 maintained the Special Concern designation for the Newfoundland population of banded killifish (COSEWIC, 2003). This species is currently included in Schedule 1 of the federal *Species at Risk Act* (SARA), which was proclaimed on June 5, 2003. The banded killifish is the only Newfoundland freshwater fish included on the List of Wildlife Species at Risk.

The banded killifish was designated as Vulnerable by the Province of Newfoundland and Labrador through its *Endangered Species List Regulations* under the *Endangered Species Act of Newfoundland and Labrador* (NL ESA), effective July 30, 2002.

The development of this management plan is required under both federal and provincial legislation, and represents a collaborative effort between Fisheries and Oceans Canada (DFO) and the Newfoundland and Labrador Department of Environment and Conservation. This document is designed to provide a brief overview of species biology, discuss identified limiting factors and threats, and outline a specific conservation plan that includes goals, objectives and management actions.

2.0 BACKGROUND

2.1 Species Biology

The banded killifish is a member of the family Fundulidae, which contains 5 genera and approximately 48 species (Nelson, 1994). Of these, only *Fundulus diaphanous* and *F. heteroclitus* (i.e. mummichog) are native to Newfoundland (Scott and Crossman, 1964, 1973; Houston, 1990). The banded killifish is divided into two subspecies; *Fundulus diaphanous diaphanous* (Lesueur), the eastern banded killifish, and *F. diaphanous menona* (Jordan and Copeland), the western banded killifish (Chippett, 2003), the former of which is found in Newfoundland.

Banded killifish are distributed throughout eastern North America (Fig. 1), extending as far south as South Carolina and as far north as the Maritimes provinces and Newfoundland. Its westward distribution extends through the states of New York, Pennsylvania, and to southern Canada in the Great Lakes region as far west as the Yellowstone River in eastern Montana (Scott and Crossman, 1973; Houston, 1990). The Newfoundland population represents the eastern most extent of this species' range.

There are seven documented populations of banded killifish on the island of Newfoundland (Fig. 2). The majority of these populations are clustered on the south and southwest coasts, with an outlier population in the Indian Bay watershed in the northeast (Chippett, 2003). Recent genetic investigations indicate that the Newfoundland population does not differ genetically from mainland populations (Chippett, 2004).

The banded killifish has olive coloured sides with numerous vertical bands and a contrasting dark colouration across the dorsal region (see cover illustration). These vertical bands in females usually appear black in colour, are thin and distinct, and often do not appear to span the full width of the body. Males have pale, grey bands that are less distinct and closer together. Adult banded killifish are usually small, with mean length ranging from 73.2 mm (Freshwater Pond) to 91.9 mm (Loch Leven) within Newfoundland populations sampled (Chippett, 2004). A measurement of 128 mm taken from the Indian Bay watershed is likely the largest recorded length for the species (Chippett, 2003).

Banded killifish are a euryhaline species, but usually inhabit freshwater streams and lakes (Fritz and Garside, 1974, 1975). These fish are most often observed in the shallows and quiet areas of clear lakes and ponds with a muddy or sandy substrate, high detrital content and abundant submerged aquatic vegetation (e.g. Trautman, 1957; Scott and Crossman, 1964, 1973; Houston, 1990). Qualitative examinations of lakes where this species occurs in Newfoundland are consistent with accounts describing banded killifish habitat elsewhere. A full quantitative and qualitative description of killifish habitats sampled in Newfoundland is available in Chippett (2004).

Banded killifish live to a maximum of 3-4 years of age and reach maturity at an age of 1+ years and at a length of approximately 60 mm (Carlander, 1969). These fish practice external fertilization and are plant spawners. Females lay eggs equipped with adhesive threads that adhere to aquatic vegetation once released. Banded killifish in the Indian Bay watershed were observed exhibiting spawning behaviour in late June through to the middle of August, when water temperatures reached 19-23°C (Chippett, 2003).

Banded killifish feed in all levels of the water column (Keast and Webb, 1966). Smaller individuals eat chironomid larvae, ostracods, cladocerans, copepods and small quantities of amphipods and some flying insects. Larger individuals feed on the aforementioned species, as well as Odonata and Ephemeroptera nymphs, molluscs, tubellarians and small crustaceans (Keast and Webb, 1966; Baker-Dittus, 1978). Banded killifish are a forage fish for larger species like Atlantic salmon (*Salmo salar*), brook trout (*Salvelinus fontinalis*) and American eel (*Anguilla rostrata*). Other predators include the belted kingfisher (*Megaceryle alcyon*) and common merganser (*Mergus merganser*) (White, 1953, 1957; Scott and Crossman, 1973).

2.2 Population Sizes and Trends

Banded killifish populations in Newfoundland are scattered over a wide range, but local populations are restricted to very confined regions within their respective watersheds. Populations in Newfoundland appear to be locally abundant in representative populations that were sampled (i.e. Indian Bay watershed, Loch Leven and Freshwater Pond). Although multi-year data is not available, population estimates from 1999 indicate that over 20,000 individuals exist in the Indian Bay watershed. Estimates are not available for other local populations (Chippett, 2003). Additional population information, including catch per unit effort in the three population sites, is outlined in Chippett (2004).

2.3 Threats and Limiting Factors

Documented populations of banded killifish in insular Newfoundland are fragmented with little or no interaction or migration. The nature of this distribution and lack of migration makes these populations especially vulnerable to catastrophic events or localized perturbations. There are two predominate threats/limiting factors to be considered with respect to banded killifish populations in Newfoundland; (1) potential impacts of forestry activities and other land use, and (2) barriers to migration.

COSEWIC (2003) identified potential forestry impacts as the primary anthropogenic threat to banded killifish in Newfoundland. While little in the way of forest harvesting is currently occurring on the south and southwest coasts in the areas around banded killifish populations, much of the area surrounding several lakes in the Indian Bay watershed is scheduled for clear cutting (Chippett, 2003). Such activity (including associated forest road construction), if not properly mitigated, has the potential to increase suspended sediment loads in adjacent waterbodies. Associated impacts of increased suspended sediment include reductions in invertebrate abundances, decreased feeding success for sight-feeding species, and dislocation and mortality of early life stages (Miller, 1981). Sediments can suffocate aquatic vegetation, thus decreasing primary production (Waters, 1995). Suspended sediments can also damage fish gills causing injury, mortality, and increased susceptibility to disease and predation (Gosse *et. al.*, 1998). Desgagne and Lalancette (1984) indicated that banded killifish feed based on visual perception, while Richardson (1939) stated that this species makes use of aquatic vegetation in their reproductive cycle. As such, clear cutting may have a negative impact on banded killifish populations in the Indian Bay watershed, should forestry activities result in increased sedimentation in adjacent waterbodies.

Obstacles, such as steep river gradients and physical barriers (both natural and anthropogenic), prevent inland migration and access to additional suitable habitat. Habitat, in terms of substrate type and aquatic vegetation, is thought to be abundant in Newfoundland (particularly in the central region) but may be inaccessible to this species due to these difficult migration routes. However, in some locations where banded killifish were restricted in distribution to one or two lakes (i.e., Indian Bay watershed) abundant suitable habitat in other lakes linked by easily passable brooks and streams showed no evidence of banded killifish presence. Chippett (2003) suggests that this species has had little success in dispersing throughout the watershed due to long stretches

of deep, open water where predation by larger fish species would be substantially higher than would be the case in the weedy shallows.

Although forestry has been identified by COSEWIC as the primary anthropogenic threat in Newfoundland, all land use activities have the potential to degrade killifish habitat. These include road developments (especially those that involve watercourse crossings), mineral exploration and urban/cabin development. Such activities can result in direct habitat destruction, increased sedimentation, contamination, altered water flow regimes and impediments to migration.

A potential yet unquantified threat to this species includes recreational fishing, which may impact populations through direct catches or use as bait. This threat is not considered to be significant. Killifish are also caught as bycatch in commercial American eel fisheries, particularly in southwest Newfoundland (Derek Tobin, Resource Management, Fisheries and Oceans Canada, Newfoundland and Labrador Region, Pers. Comm.). The significance of this bycatch is unknown and warrants further study.

Other suggested limiting factors, such as low water temperatures and the availability of suitable habitat (Gibson et al., 1984; Houston, 1990), are likely not limiting to banded killifish in Newfoundland. Chippett (2004) noted that suitable banded killifish habitat, in terms of both substrate type and aquatic vegetation, is readily available throughout most regions of Newfoundland. As well, spawning has been observed in the Indian Bay watershed at temperatures of 19-23°C, a range which is available throughout most of the island.

2.4 Monitoring and Research History

The only focused monitoring program for banded killifish in Newfoundland was initiated by the Newfoundland Wildlife Division in 1994, and was conducted in partnership with Memorial University and the Indian Bay Ecosystem Corporation. These efforts produced an indication of killifish presence and some critical information on habitat and distribution. In 1998, these same three organizations partners in support of a graduate research project, which applied a more intensive sampling program to provide necessary information to answer several key questions concerning the biology of all Newfoundland populations. Details regarding the methodology and results of this research are outlined in Chippett (2004).

2.5 Knowledge Gaps

While only seven populations of banded killifish have been documented in Newfoundland, recent findings suggest a more extensive distribution. Photos and samples support the presence of additional populations located in both Garnish Pond (Jerry Walsh, Chief of NAFO Compliance and Offshore Operations, Fisheries and Oceans Canada, Newfoundland and Labrador Region, Pers. Comm.) and Spanish Rooms (Laura Park, Oceans Biologist, Fisheries and Oceans Canada, Newfoundland and Labrador Region, Pers. Comm.) on the Burin Peninsula, as well as a population near the

community of York Harbour in the Bay of Islands (Laura Park, Oceans Biologist, Fisheries and Oceans Canada, Newfoundland and Labrador Region, Pers. Comm.). Other potential sites include the Main Brook area on the Great Northern Peninsula, First Pond in the Port aux Basque region and Star Lake in Central Newfoundland (Chippett, 2004). Further surveys throughout the island may reveal other previously undocumented populations. Fish surveys carried out in Notre Dame and Beothuk Provincial Parks, various sites on the Avalon Peninsula (including the Winterton and Hants Harbour areas), Mint Brook (Gambo), various lakes in Gros Morne and Terra Nova National Parks, Millertown, Main Brook and several additional lakes in the Indian Bay Watershed have failed to document additional killifish populations (Chippett, 2004).

As noted in Section 2.3, the impacts of fishing (particularly bycatch in the commercial eel fishery) on some killifish populations may be a concern. However, the significance of this threat has not been quantified.

Chippett (2003) noted anecdotal evidence which suggest that the population located in the Indian Bay watershed may be the result of an introduction by anglers using banded killifish as bait. Indeed, anglers from the Maritime Provinces using “minnows” as live bait have traditionally fished in Backup and Third Ponds, where killifish populations have been recorded. While this may be impossible to substantiate, this potential introduction may explain the presence of a disjunct population in the northeast.

3.0 MANAGEMENT

3.1 Goals and Objectives

The Newfoundland population of banded killifish has been designated as Special Concern under SARA and Vulnerable under the NL ESA due to its very limited area of occupancy, separation from other populations and limited potential for range expansion. In spite of seven documented populations, the area of occurrence of these populations is less than 200 km² (Chippett, 2003). Such localized populations are vulnerable to catastrophic events or localized perturbations. However, three populations surveyed (Indian Bay, Loch Leven and Freshwater Pond) indicate that the species is locally abundant (Chippett, 2003).

Given that this species has been listed by both federal and provincial legislations due to limited natural distribution patterns rather than documented population decrease, the primary goal for the management of the Newfoundland population of banded killifish is:

- **Maintain existing killifish population levels and distribution, and protect habitat within watersheds in which this species is found.**

The specific objectives of this management plan include:

- 1) **Surveys and population monitoring;**

- 2) **Development of site specific best management practices to ensure habitat protection;**
- 3) **Determination of impacts of fishing on killifish populations; and**
- 4) **Increase public awareness and stewardship.**

3.2 Management Actions

3.2.1 Surveys and population monitoring

Known populations of banded killifish will be monitored on an opportunistic basis over time to better determine long term trends. A standardized, practical and cost effective monitoring protocol will be developed by the Newfoundland and Labrador Wildlife Division (with the cooperation of DFO where applicable) that will be utilized by management agencies and others to track populations.

Surveys to identify additional populations of banded killifish will be conducted opportunistically as part of other aquatic species survey and monitoring work. Researchers and field staff will be encouraged to look for and report banded killifish whenever possible.

Data collected on banded killifish, particularly distribution and population information, will be shared among jurisdictions (i.e. DFO, Department of Environment and Conservation) for their specific management purposes. Locational data will be housed within the Atlantic Canada Conservation Data Centre.

3.2.2 Development of site specific best management practices

The federal *Fisheries Act* provides for the protection of banded killifish habitat through Section 35 (1), which states “*No person shall carry on any work or undertaking that results in the harmful alteration, disruption or destruction of fish habitat*”. Fish habitat is defined by Section 34 (1) as “*spawning grounds and nursery, rearing, food supply and migration areas on which fish depend directly or indirectly in order to carry out their life processes*”. Similarly, Section 28 of the NL ESA allows the minister to set aside and specify prohibited activities within an area of land defined as recovery habitat (i.e. Section 2 (j) - *habitat that is necessary for the recovery of a species*) or critical habitat (i.e. Section 2 (c) - *habitat that is critical to the survival of a species*) for a vulnerable species.

The full utilization of such legislative prohibitions for the protection of this species requires the delineation of known banded killifish habitat in Newfoundland. Indeed, Section 28 (2) of the NL ESA specifies that “*the boundaries of the area shall be set out in*

the order by publishing a description of the area". To be fully effective, population distribution information must be distributed to the appropriate jurisdictional authorities (i.e. DFO Habitat Management, DFO Fisheries Management, Provincial Department of Environment and Conservation, Provincial Department of Natural Resources) to ensure killifish habitat needs are addressed through appropriate land use planning and project referral review mechanisms. As such, a fact sheet (discussed further in Section 3.2.4) and detailed locations of populations will be distributed to key DFO staff (both at regional headquarters and area offices), appropriate Department of Natural Resources (DNR) staff as well as industry (i.e. forest companies) representatives responsible for land use planning in killifish locales.

Killifish management concerns will be addressed on a case by case basis. Once development or harvesting activities are identified within a watershed known to contain this species, jurisdictions will be responsible for identifying killifish concerns and informing the proponent. The jurisdiction will then work with the proponent to develop site specific best management practices to ensure that the viability of the population in question is maintained. Gosse *et. al.* (1998) provides a summary of potential best management practices that may be implemented to protect banded killifish habitat.

In the case of the Indian Bay watershed, where forest harvesting activities are of greater concern than in other population locations, DFO representatives on the planning team will ensure best management practices (i.e. appropriate buffer zones) are in the Sustainable Forest Management Plans prepared by landholders with tenure in the watershed. As the Indian Bay watershed is also a public protected water supply area, buffer zones widths and pesticide use are subject to more stringent policy guidelines (i.e. Policy for Land and Water Related Developments in Protected Public Water Supply Area) as compared to other forested lands. For example, the buffers identified in Gosse *et. al.* (1998) is the minimum allowed by DNR. The buffer regime in place in the Indian Bay watershed is much wider than this, with a DNR no-harvest buffer of 100m on most ponds.

3.2.3 Determination of impacts of fishing on killifish populations

As noted in Sections 2.3 and 2.5, anecdotal information indicates that killifish bycatch in the commercial eel fishery may be a concern within certain populations, particularly in the southwest region of the island. However, the significance of this bycatch has yet to be quantified.

Working in partnership with commercial eel fishers, and potentially Aboriginal organizations, DFO will initiate a project to quantify killifish bycatch in both fyke nets and baited pots. The results of this research will be shared with licenced eel fishers and incorporated into the management of the eel fishery where appropriate.

3.2.4 Increase public awareness and stewardship

Increased public awareness of the banded killifish will play a vital role in the conservation of this species. Public education programs administered through the Communications Branch of DFO, the Newfoundland and Labrador Department of Environment and Conservation, and their partners can be utilized to improve the profile of banded killifish throughout the region.

As part of an increased public awareness and stewardship plan, DFO will develop a communications strategy to address outreach needs for banded killifish in Newfoundland. This strategy will outline educational product needs, distribution and outreach plans, and a proactive media approach. As banded killifish are a little known species in Newfoundland, a fact sheet will also be developed and circulated widely throughout the region. The target audience will include the forest industry, recreational and commercial fishers, students, Aboriginal groups, relevant municipalities, economic development boards, land use planners, and both federal and provincial natural resources enforcement personnel. The fact sheet will include information on species biology, currently levels of risk, distribution and conservation measures. Where appropriate, banded killifish will be the focus of DFO outreach activities (i.e. school visits, workshops) that occur in locations where this species occurs.

DFO has developed a series of illustrated “Species Identification Cards” that enhance awareness of SARA species in the fishing and/or tourism industries, and the general public. Originally, this series included nine marine animals and three marine finfish. The content of the cards consists of scientifically accurate illustrations and some facts about the biology, food, SARA status and other information. Printed on waterproof plastic, these bookmark-sized cards (7.5” x 2.5”) are durable in wet environments. In 2005, a banded killifish card was added to the series. Future distribution of these cards will target those stakeholders (i.e. forest industry, eel fishers, recreational fishers, etc.) whose actions have the potential to impact banded killifish populations.

In 2005/06, the banded killifish was one of several species at risk which were used to inspire high school art students through DFO’s School Art Program. This activity, which encourages local students to promote aquatic conservation and species at risk issues through visual art, resulted in the creation of killifish focused artwork. Future initiatives through the School Art Program will continue to generate killifish inspired art as a mean to promote public awareness and stewardship of the species.

4.0 EVALUATION

The success of the management actions will be reviewed annually, while the goals, objective outlined herein will be reviewed within five years of the Management Plan’s acceptance by the Minister of Fisheries and Oceans Canada. The following performance measures will be used to assess the effectiveness of the objectives and management actions:

- Where opportunities have been present, have surveys and monitoring of banded killifish been completed?
- Has information regarding the biology, threats and locations of populations been shared with those responsible for land use planning and project referral reviews?
- Has banded killifish concerns been incorporated into land use planning and the project referral review process?
- Has information regarding the impact of bycatch in American eel fisheries been quantified and considered in eel fisheries management?
- Has a communications strategy been developed and implemented?

5.0 SUMMARY TABLE

Priority	Obj. No.	Broad Approach/ Strategy	Threat/Limiting Factor Addressed	Specific Steps/Actions	Deliverables
High	2	Threat assessment and mediation	Forestry, other land use/development	<ul style="list-style-type: none"> • Circulate killifish information and detailed population locations to jurisdictional authorities and land managers. • Develop site specific best management practices as necessary. 	<ul style="list-style-type: none"> • Improved understanding of killifish conservation issues among land managers. • Incorporation of site specific best management practices into planning and developments with potential interaction with killifish and their habitat.
High	4	Outreach	N/A	<ul style="list-style-type: none"> • Circulate killifish ID cards. • Develop fact sheet. • Promotion of killifish conservation during outreach events. 	<ul style="list-style-type: none"> • Increased public awareness of killifish and conservation concerns throughout Newfoundland.
Mod.	1	Monitoring	Forestry, other land use/development	<ul style="list-style-type: none"> • Development and opportunistic implementation of monitoring protocols. 	<ul style="list-style-type: none"> • Tracking of population changes over time and in relation to land use.
Mod.	1	Survey	Limited distribution	<ul style="list-style-type: none"> • Opportunistic surveys to identify additional killifish populations. 	<ul style="list-style-type: none"> • Updated distribution information.
Mod.	3	Threat assessment and mediation	Bycatch	<ul style="list-style-type: none"> • Quantify the bycatch of killifish within the commercial eel fishery. 	<ul style="list-style-type: none"> • A clearer understanding of the impacts of bycatch on killifish populations and incorporation of mitigation actions into fisheries management where appropriate.

6.0 IMPLEMENTATION SCHEDULE

Action	Obj. No.	Lead	Other	Year 1	Year 2	Year 3	Year 4	Year 5
Population monitoring	1	NLWD	DFO	To be determined				
Surveys	1	NLWD	DFO	To be carried out opportunistically				
Best Management Practices	2	DFO	NLWD DNR	Where and when appropriate				
Circulation of planning info to jurisdictions and land managers	2	DFO	NLWD DNR	Where and when appropriate				
Quantification of bycatch in eel fishery	3	DFO			X			
Fact Sheet	4	DFO	NLWD		X			
Species ID cards	4	DFO		Where and when appropriate				

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APPENDIX I RECORD OF COOPERATION AND CONSULTATION

The management plan for banded killifish in Newfoundland was developed through the cooperative efforts for Fisheries and Oceans Canada, and the Newfoundland and Labrador Department of Environment and Conservation to meet both federal and provincial legislative requirements.

While data specific to this species in Newfoundland is limited, this plan was reviewed by representatives of various jurisdictions and interest groups with extensive knowledge of fish and fish habitat conservation. Drafts of the document have been reviewed by various DFO sectors in the Newfoundland and Labrador Region, as well as staff from the Department of Environment and Conservation and the Department of Natural Resources.

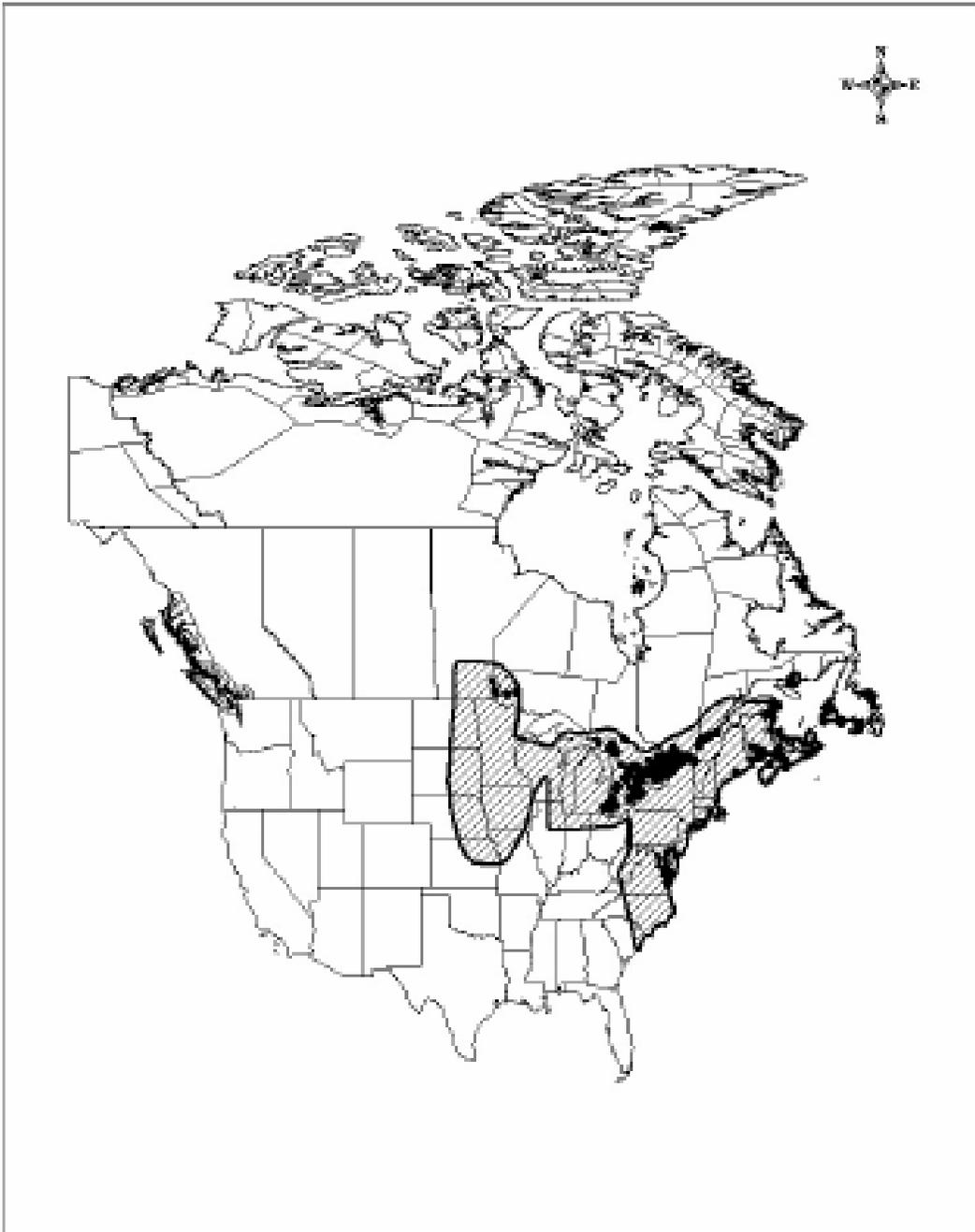


Figure 1, North American distribution of banded killifish (range taken from Scott and Crossman (1973) and Gilbert and Shute (1980); actual population records from ROM data; Newfoundland additions from Chippett (2004)).

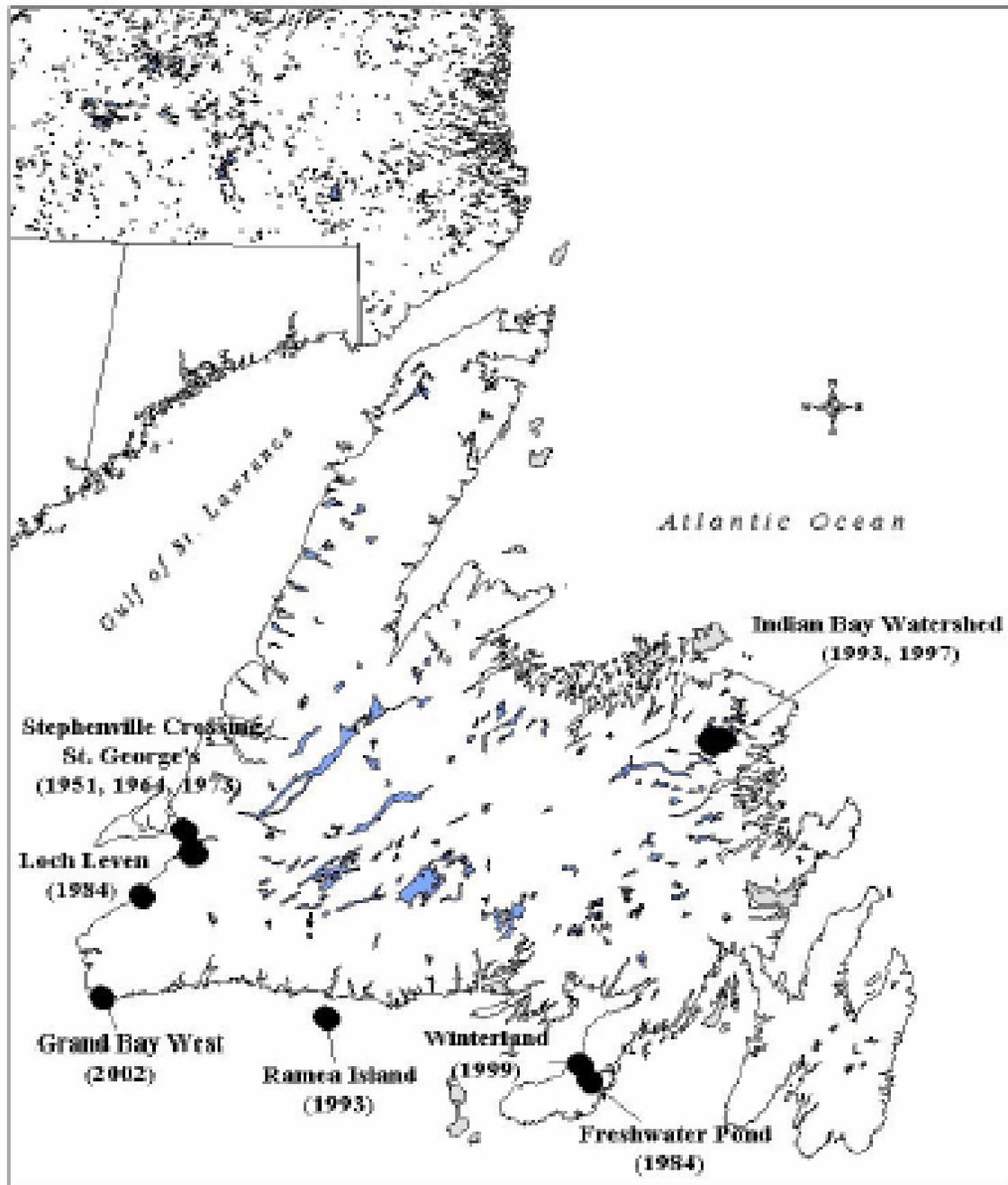


Figure 2, Newfoundland distribution of banded killifish (year of record in parentheses) (Chippett, 2004)