AN EXAMINATION OF THE DISTRIBUTION, HABITAT AND GENETIC AND PHYSICAL CHARACTERISTICS OF FUNDULUS DIAPHANUS, THE BANDED KILLIFISH, IN NEWFOUNDLAND AND LABRADOR

JAMIE D. CHIPPETT

AN EXAMINATION OF THE DISTRIBUTION, HABITAT AND GENETIC AND PHYSICAL CHARACTERISTICS OF *FUNDULUS DIAPHANUS*, THE BANDED KILLIFISH, IN NEWFOUNDLAND AND LABRADOR

BY

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CHAPTER 1. INTRODUCTION AND BACKGROUND

1.1 The Family Fundulidae

The banded killifish, *Fundulus diaphanus* (Lesueur 1817), is a member of the family Fundulidae. Many killifish are slender and pike-like in shape to aid in rapid swimming (Riehl and Baensch 1991) and some species have a flattened head and terminal mouth adapted for surface feeding, hence the name topminnows (Leim and Scott 1966, Scott and Crossman 1973, Houston 1990). Three species of the genus *Fundulus*, *Fundulus diaphanus*, *F. heteroclitus*, and *F. notatus* have been recorded in Canadian waters (Houston 1990). Of these three, only *Fundulus diaphanus* and *F. heteroclitus* are found in Newfoundland (Scott and Crossman 1964; 1973, Houston 1990).

1.2 *Fundulus diaphanus* in North America

Fundulus diaphanus occurs in North America from South Carolina in the southern United States northward to the Maritime provinces and Newfoundland in Canada, and west through the states of New York, Pennsylvania, and southern Canada in the Great lakes region as far west as the Yellowstone River in eastern Montana. The species is widely distributed in the Maritimes and also in suitable habitat of the St. Lawrence River valley of Quebec and the Great Lakes watershed of southern Ontario. In the Great Lakes watershed, *F. diaphanus* is present in the extreme eastern waters of Lake Michigan but absent from Lake Superior (Scott and Crossman 1973, Houston 1990). Only two records exist for *F. diaphanus* from Manitoba, one from the Red River near

Winnipeg, the other from Crowduck Lake (50°05' N, 95°08' W) near South Arm (Stewart et al. 1985).

Fundulus diaphanus (Lesueur 1817) is divided into two subspecies; *Fundulus diaphanus diaphanus* (Lesueur), the eastern banded killifish and *F. d . menona* (Jordan and Copeland), the western banded killifish. The eastern banded killifish differs from the western subspecies in a more anterior positioning of the dorsal fin, a greater number of anterior bars in males (9-15 in *diaphanus* vs. 5-10 in *menona*) and more intense bars along the side that remain intact over the anterior back, a greater number of scale rows (45-49 in *diaphanus* vs. 40-44 in *menona*), and a combination of dorsal and anal fin rays 24 to 26 (23-24 in *menona*), as well as being much larger in size (110mm maximum *diaphanus* vs. 74mm maximum *menona*) (Trautman 1957, Hubbs and Lagler 1974). The eastern subspecies occurs in the Atlantic drainage of Canada reaching west to the eastern part of Lake Ontario and the upper portion of the St. Lawrence River where it is thought to co-occur with *F.d.menona* (Scott and Crossman 1973, Gilbert and Shute 1980, Houston 1990).

1.3 Is this a vulnerable species in Newfoundland?

Very little, other than the specified range, is known about the eastern banded killifish in Newfoundland. *Fundulus diaphanus diaphanus* in the insular waters of Newfoundland appear to exist in localized, "pocket" populations in numbers far less than populations from Nova Scotia (Scott and Crossman 1973, Gilhen 1974). However, more recent data indicates that some of the Newfoundland populations may be fairly large. The reasons suggested for the patchy distribution of *F.d.diaphanus* in Newfoundland focus on a lack of suitable habitat, a rocky coastline, rivers of steep gradients, and lower temperatures as factors that place limits on the regions that eastern banded killifish can inhabit (Gibson et al. 1984). The Newfoundland populations of *F.d.diaphanus* were designated as vulnerable by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in 1989 (Houston 1990), with vulnerable status indicating a species of special concern because of characteristics that make them particularly sensitive to human activities or natural events but not sensitive enough to place the species at a threatened or endangered designation (COSEWIC 2000). The most recent discoveries of eastern banded killifish in Newfoundland have cast doubt upon the aforementioned limiting factors (i.e. lower water temperatures, lack of suitable habitat) and have altered the population distribution as previously documented. Many records of the extremely sporadic distribution of eastern banded killifish in Newfoundland have been reported during other studies on freshwater fish such as Atlantic salmon (*Salmo salar*) and brook trout (*Salvelinus fontinalis*). As a result, it is of great importance that the complete range and distribution, degree of distinctiveness and relationship to other populations, life history characteristics, and some indication of population dynamics of *F. d. diaphanus* populations in Newfoundland be examined to determine if any additional protection is required for these populations.

1.4 Local Ecological Knowledge (LEK) and *Fundulus diaphanus* in the Indian Bay Watershed

Much of this project has been completed under the larger research initiative entitled "Coasts Under Stress" (Coasts Under Stress 2000) at Memorial University of

Newfoundland. The goal of this project is to identify the important ways in which changes in society and the environment in coastal British Columbia and Newfoundland and Labrador have affected, or will affect, the health of people, their communities, and the environment in the future. The overall effort is divided into 5 arms or major research questions. This study of the banded killifish in Newfoundland falls into Arm 1 entitled "Lay and Expert Knowledge, Policy, and Decision Making" and the specific research question: "How do different kinds of knowledge (local and scientific) on ecosystem dynamics help to influence decision making, which in turn affects human and environmental health?" Neis et al. (2001) indicate certain Coasts Under Stress projects are more focused on the concept of ecosystem health. Generally speaking, a healthy ecosystem is defined as being stable and sustainable, maintaining its organization and autonomy over time and its resilience to stress (Rapport et al. 1998). Rapport et al. (1998) report that ecosystem health can be measured using indicators of resilience, vigor and organization and describe instances in various ecosystems where stress has resulted in serious impacts including biotic impoverishment, altered biotic composition, and risks to human and animal health.

It is useful to view the interactions between traditional and local ecological knowledge (TEK/LEK) and conventional science through a conceptual diagram developed by Coasts Under Stress team members (Figure 1-1). Mailhot (1993) defines TEK as the sum of the data and ideas acquired by a human group on its environment as a result of the group's use and occupation of a region over many generations.

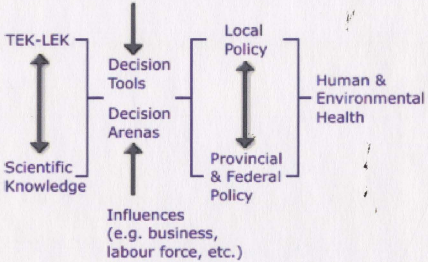

Figure 1-1: Conceptual diagram illustrating the effects of the interactions between traditional and local ecological knowledge (LEK/TEK) and scientific knowledge on overall human and environmental health (Coasts Under Stress 2000).

For the purposes of this study it is useful to examine Figure 1-1 using the example of the Indian Bay watershed and the evolution of a community watershed management group, the Indian Bay Ecosystem Corporation. The Indian Bay watershed, located on the northeast coast of Newfoundland, has traditionally been regarded as a recreational fishing paradise for anglers seeking brook trout, *Salvelinus fontinalis*, and Atlantic salmon, *Salmo salar* (Figure 1-2). In the past 15-20 years, however, local anglers have noticed that the quality of brook trout angling in the Indian Bay watershed was not near what it was in past decades. The criteria for this observation were smaller numbers of fish caught per fishing trip and also a smaller mean size. This realization led to the formation of a group that was the precursor to what today is the Indian Bay Ecosystem Corporation (IBEC). Initially, this group was involved in the removal of waste and debris from the watershed, the repair of frequently used bridges and the clearing of obstructions from streams that would otherwise impede the migration of local fish species. In this regard, LEK and IBEC were already impacting on the ecosystem health of this region (Barry Wicks, pers. comm.).

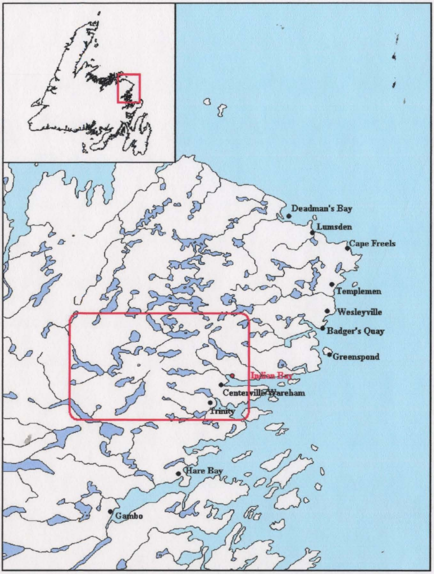

Figure 1-2: Indian Bay and other surrounding communities on the coast surrounding near the Indian Bay watershed (red rectangle) in the Bonavista North region of Newfoundland and Labrador.

Traditionally, the scientific community (scientific knowledge) and local resource harvesters (TEK-LEK) or those in close contact with a particular species (may or may not be considered a resource) rarely worked together. However, as the left-hand bidirectional arrow in Figure 1-1 illustrates, recent years have seen a change in the attitude with which local individuals and the scientific community view the possibility of the two groups working together. This interaction was the next impact in the development of IBEC. Through interaction with the then Newfoundland and Labrador provincial government Department of Forest Resources and Agrifoods: Inland Fish Section[1], a detailed research mandate was established for the Indian Bay watershed that involved generating population estimates and growth rates for brook trout in each lake in the watershed. In more recent years, IBEC has evolved a community watershed management structure that is recognized over much of Newfoundland and Labrador and in other parts of Canada. Such organizations give local stakeholders a responsibility for managing populations in a specific geographical area with the aim of conserving the resources while maintaining a quality angling experience and contributing to the local economy (Sutton 2000).

Investigations indicated that the brook trout stocks were indeed at a lower level than in previous years and alterations were needed in the management of stocks in this specific region. As a result, through consultations with the provincial government and presentation to the federal Department of Fisheries and Oceans, the per day catch limit for brook trout in the Indian Bay watershed was reduced to 6 fish/day in contrast to the 12 fish/day allowed in other watersheds throughout the province. This change, and others like the temporary closing of certain lakes to recreational angling in the Indian Bay area, indicated the eventual impact of LEK and scientific interaction on decisions that were

[1] The Inland Fish section is now located in the Department of Environment and Conservation (Feb. 2004)

ultimately enforced by government agencies. These steps occupy the central sections of Figure 1-1.

Finally, the discovery of *Fundulus diaphanus* in the Indian Bay watershed, the subject of this thesis, is closely linked to LEK, or more accurately a gap in LEK, of the individuals who were involved in IBEC in the early 1990's. In 1993, a single banded killifish was taken in the by-catch of a fyke net set in Indian Bay Big Pond as part of a brook trout study. This specimen was not recognized as being a common component of the fish community in this watershed. The specimen was preserved and forwarded to biologists with the then Department of Forest Resources and Agrifoods for identification. This was the first discovery of this species in Newfoundland since 1984. This record, and subsequent discoveries in the Indian Bay watershed provided the impetus for this work.

Although a relatively unknown constituent of the freshwater fish fauna in Newfoundland, the importance of *Fundulus diaphanus* in the areas where it occurs should not be overlooked. In these areas, the banded killifish may be an important link in the food web, most likely serving as a forage fish for larger brook trout and Atlantic salmon. In addition, as per one definition of ecosystem health, each species is important in achieving an accurate measure of biodiversity and in ensuring that as many species as possible are conserved for future generations (Neis et al. 2001). Biodiversity also provides clues about the degree of organization that exists within an ecological system and indirectly comments on trends in stability, resistance, and resilience to perturbation (Neis et al. 2001). The loss of a species such as the banded killifish would be a symptom of Rapport's ecosystem distress syndrome (1992) and would amount to a decreased measure of ecosystem health as defined earlier based on vigor, resilience, and organization. Depending on the nature of the stress involved, an unhealthy ecosystem may be unable to continue to sustain traditional levels of recreational and economic activity for example, and human health is therefore being reduced (Rapport et al. 1998).

The Newfoundland populations also offer a unique opportunity to investigate a species existing at the extreme northern and eastern limits of its range. In other areas of the world, the banded killifish and similar species are used as environmental indicators as they may be very sensitive to perturbations in water quality and clarity due to pollution, development or natural events. As such, checks in areas where banded killifish occur in Newfoundland can serve as environmental monitors for development, whether it be farming, forestry, or golf course or cottage construction. Each of these factors, however, is overshadowed by the fact that the Newfoundland populations of this species are classified as vulnerable by COSEWIC and are listed under the provincial *Species at Risk Act* in Newfoundland. The purpose of this thesis is to provide more information to help evaluate whether these assessments are adequate.

The remaining chapters provide an up-to-date description of the distribution of *Fundulus diaphanus* in Newfoundland and a qualitative summary of the habitat requirements of this species (Chapter 2), analysis of the morphometric and genetic characteristics of Newfoundland banded killifish in comparison to a reference population on the mainland (Chapter 3), and review of the COSEWIC process and summary of the latest status report prepared on this species in Newfoundland (Chapter 4). Finally, Chapter 5 is a new status report on Newfoundland banded killifish as presented to

COSEWIC in 2002. In summary, this work provides a compilation of the literature on this species, new information on distribution and range in Newfoundland, habitat and life history characteristics specific to Newfoundland banded killifish, and a discussion of the relationships between Newfoundland and mainland banded killifish populations. It describes the process followed for the review of the status of banded killifish populations in Newfoundland, with guidance and priorities for future work on this species.

CHAPTER 2. THE REVISED DISTRIBUTION OF *FUNDULUS DIAPHANUS* IN NEWFOUNDLAND: NEW RECORDS AND A RANGE EXTENSION

2.1 Introduction

The Newfoundland banded killifish is a small, minnow-like freshwater fish that previously was thought to exist in only two or three lakes on the west coast of the island (Scott and Crossman 1964, 1973). The older records on this species designate the extent of the distribution in insular Newfoundland as limited to the southwestern portion of Newfoundland while Houston (1990) describes the population discovered in 1984 in Freshwater Pond on the Burin Peninsula as well (Gibson et al. 1984). The purpose of this chapter is to review the initial discoveries of *Fundulus diaphanus* in Newfoundland, to highlight more recent, lesser known research on the distribution of banded killifish in Newfoundland, and to record populations of this species that have been confirmed or discovered during the course of this research. The contribution of the chapter to the overall study is to provide an up-to-date account of the distribution of banded killifish in Newfoundland, a qualitative overview of habitat characteristics of various population locales, and a description of selected populations including indications of population size. A range extension for the eastern limit of the banded killifish populations in Newfoundland is reported from the Indian Bay watershed population.

There have been suggestions that a lack of suitable habitat, steep gradients in Newfoundland rivers and other barriers to dispersal, as well as low water temperatures limit the occurrence of *Fundulus diaphanus* in Newfoundland (Gibson et al.1984). However, the present research indicated a larger range than previously documented and may cast some doubt upon these presumptions and will certainly revise the picture of a fragmented distribution indicated in earlier literature (Scott and Crossman 1964, 1973, Houston 1990). The qualitative review of habitat preferences will consider these factors.

The degree of fragmentation or isolation with respect to banded killifish populations in Newfoundland is of utmost importance in the future evaluation and conservation of this species in Newfoundland. There are numerous side effects associated with small, fragmented populations, including the impact on genetic variation, which must be considered along with life history and demographic information by managers and scientists in the application of appropriate conservation strategies (Sherwin and Moritz 2000). The potential effects of fragmentation on Newfoundland banded killifish populations will be discussed with an emphasis on the importance of frequent assessment of distribution for conservation purposes.

2.2 Methods

2.2.1 Literature search and interviews

An initial literature search on *Fundulus diaphanus* was performed with special attention devoted to records of this species in insular Newfoundland. Each of these records was catalogued and descriptions of the areas of Newfoundland where populations occurred were compiled. In addition, institutions including the Newfoundland Museum (St. John's, NL), the Royal Ontario Museum (ROM, Toronto, ON), the Canadian Museum of Nature (CMN, Ottawa, ON) and the Smithsonian Institution (USNM, Washington, DC) were contacted for records of occurrence and other data on this species in Newfoundland, Canada, and North America. Fisheries biologists with the Newfoundland and Labrador provincial government (then Department of Forest

Resources and Agrifoods: Wildlife – Inland Fish Section) and the Department of Fisheries and Oceans branch in St. John's, Newfoundland and Labrador were consulted for specific data on the banded killifish in Newfoundland.

Local people in the areas where banded killifish existed were surveyed informally for their knowledge of the presence of banded killifish, information on other populations of this fish and the presence of suitable habitat in their regions. The most substantial contribution in this area involved the participation and cooperation of the Indian Bay Ecosystem Corporation (IBEC), a not-for-profit community management group concerned with the status of a well-reputed recreational brook trout (*Salvelinus fontinalis*) fishery which had begun to show signs of declining in the Indian Bay watershed on the east coast of Newfoundland (Chapter 1). A descriptive sheet with a graphic of a killifish and a general physical description was also circulated in these areas.

2.2.2 Confirmation and determination of banded killifish hotspots

Upon obtaining literature or personal accounts pertaining to known sites of banded killifish in Newfoundland, a key focus became the description of these regions and a confirmation of lakes where *Fundulus diaphanus* were known to, or thought to, exist but had not yet been officially documented through specimen collection and/or publication. Although several new records of banded killifish populations were identified, the majority of environmental and biological data collection was performed at three major field sites: Indian Bay watershed (Bonavista Bay) (49°N, 54°W), Freshwater Pond (Burin Peninsula) (47°6′N, 55°16′W), and Loch Leven (Southwestern Newfoundland)

(48°10′N, 58°53′W) (Gibson et al. 1984). These sites were chosen as they represented populations from each of the south, west and east coasts of Newfoundland (Figure 2-1).

In the Indian Bay watershed individual employees of IBEC indicated the specific regions of lakes where banded killifish were previously caught in fyke net sets. However, the sites for visual observations, snorkeling, or exploratory fyke net sampling in other locations in the Indian Bay watershed and in other areas of Newfoundland were chosen based mainly on a superficial examination of substrate composition and submerged and emergent aquatic vegetation. Key macrophyte species associated with banded killifish were identified and used as indicators when selecting collection sites. These variables helped to direct exploratory netting in the Indian Bay area aimed at refining the extent of the watershed inhabited by banded killifish. The general qualitative discussion of these variables in this chapter provides a starting point for future exploratory studies concerning this species.

2.2.3 Sampling Protocol

Sampling for killifish was performed using a specially modified fyke net designed to target the shallow inshore areas of the ponds or lakes sampled. These traps also predominantly excluded larger species such as adult Atlantic salmon (Salmo salar) and larger brook trout resulting in decreased stress level for banded killifish when caught. The modified fyke nets were constructed of 1.9 cm stretch-mesh knitted nylon. The leader and wings measured 8.5 m and 4.2 m in length respectively and were 0.75 m deep. The actual trap portion of the net consisted of four cages. The initial cage was semicircular with a

Figure 2-1: Study sites used to assess three populations of Newfoundland banded killifish.

flat bottom-resting portion and measured 0.78 m across the bottom and 0.70 m in height. The subsequent three cages were circular and measured 0.52 m , 0.45 m, and 0.42 m in diameter respectively. The section at the end of the last cage where live fish were held measured 1.2 m in length. Fyke nets were locally designed and made by Mr. Basil Goodyear of Lumsden. Figure 2-2 shows a fyke net set in Loch Leven on the southwest coast of Newfoundland.

All fyke nets were set for approximately 24-hour periods and all fish caught were collected, identified, enumerated and in the case of banded killifish measured for total length (to nearest mm). Catch per Unit Effort (CPUE) was calculated by dividing the number of specimens caught (C = mean catch) by the number of net sets (F = mean effort) at each of the three study locations as described by the equation:

$$CPUE = \frac{\overline{C}}{\overline{F}}$$

Figure 2-2: Modified fyke net set in Loch Leven on the southwest coast of Newfoundland.

2.2.4 Mapping

Each confirmed and reported record of the banded killifish obtained was used in the mapping software package Mapinfo (version 4.5) for the construction of current distribution maps of the banded killifish in Newfoundland and Labrador.

2.2.5 Population Estimate in Indian Bay Watershed

Population estimates have not been attempted with this species previous to the current research (Houston 1990). Schnabel mark-recapture estimates were performed using anal fin clip marks in the Indian Bay watershed for a week long period in July and August 1999. The required assumptions that the population be constant, with no recruitment or mortality (Robson and Regier 1968) were met by conducting the surveys over the week long period. The equation for calculating the population number (N) was:

$$N = \frac{\sum(C_t M_t)}{R+1}$$

Where:

M_t	total marked fish at large at start of the *t*th day (or other interval)
M	$\sum M_t$, total number marked
C_t	Total samples taken on day t
R_t	number recaptures in sample C_t
R	$\sum R_t$, total recaptures during the experiment

Approximate limits of confidence were obtained by considering R as a Poisson variable and given by the formula:

$$\frac{\sum(C_t M_t)}{R + 1.92 \pm 1.96\sqrt{R+1}}$$

Additional information on Schnabel mark-recapture technique is available in Robson and Regier (1968).

2.2.6 Physical Habitat Assessment and Macrophyte Identification

Lakes that were surveyed for banded killifish were qualitatively examined for substrate composition (e.g. sand/mud/rock) and relative density (in terms of the volume of water) of emergent vegetation were recorded to enable preliminary comparisons with other literary reports. Macrophyte taxa were identified and counted in $0.25m^2$ quadrats by Dr. Sallie Sheldon of Middlebury College (Vermont) while scuba-diving in the Indian Bay watershed. Areas where banded killifish had not been sighted or caught during the research but which were observed to have dense vegetation were also surveyed for differences from areas where killifish were observed. Water temperature data was also collected at the first ring of the fyke nets with a manual thermometer.

2.3 Results

2.3.1 Summary of *Fundulus diaphanus* records for insular Newfoundland

Before this work, the banded killifish, *Fundulus diaphanus*, was known from only four localities in southwestern insular Newfoundland (ROM data; Scott and Crossman 1973) (Figure 2-3). *Fundulus diaphanus* was first reported from specimens taken in brackish water at the head of St. George's Bay, near Stephenville Crossing in 1951 (Templeman 1951). The distribution was then extended to include a freshwater lake, Loch Leven (48°10′ N, 58°53′W), 50 km to the south of Stephenville Crossing (Gibson et al. 1984) (Figure 2-3) and Ramea Island located about 7km off the south coast of Newfoundland (Day 1993) (Figure 2-3). The known range in Newfoundland was extended east to Freshwater Pond (47°06′ N, 55°16′ W) on the Burin Peninsula on the south coast of Newfoundland when four specimens were taken there in 1984 (Gibson et al. 1984).

Figure 2-3 presents four maps indicating the history of important discoveries expanding the distribution of Fundulus diaphanus until the most recent data on Newfoundland populations of this species shown in the final frame. The impetus for the current study was the discovery of Fundulus diaphanus in several freshwater lakes in the Indian Bay watershed on the northeast coast of Newfoundland. In July 1993, the first record of the banded killifish from this area was a single specimen taken from an open area over a rocky outcrop in Second Pond (Indian Bay Big Pond) (Mike van Zyll de Jong, pers.comm.) (Figure 2-3). No additional specimens were taken until July and August

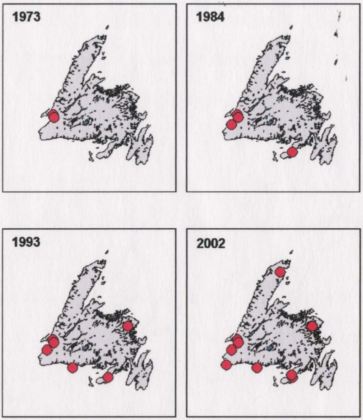

Figure 2-3: Newfoundland banded killifish records by year of discovery. (Note: The most northern record is unconfirmed.)

1997 when 7 killifish were captured in experimental fyke nets in Backup and Third Ponds in the same watershed (personal observations) (Figure 2-3). This represents a further significant easterly extension of the known range of this species. In addition, there has since been an unconfirmed sighting of a banded killifish on the Great Northern Peninsula near the community of Main Brook (Winston Norris, pers. comm.) but subsequent fyke netting in the area failed to substantiate the report (Figure 2-3). An angler caught a large banded killifish in June 1990 in a pond in the town of Winterland (Gerry Yetman, pers. comm.) (Figure 2-3), a few kilometers from the Freshwater Pond populations referenced by Gibson et al. (1984). An additional population was discovered during an aquatic plant study by researchers of the Sir Wilfred Grenfell Campus of Memorial University in lakes on the west coast of the island. The population was found in First Pond, just north of Port aux Basques (Henry Mann, pers. comm.) (Figure 2-3).

Areas surveyed but where banded killifish were neither observed nor caught included Notre Dame and Beothuk Provincial Parks in central Newfoundland, Trinity Bay near Winterton and Hants Harbour, Mint Brook in the Gambo area, and several other lakes in the Indian Bay watershed. Other unsuccessful preliminary surveys were performed in various lakes in the Gros Morne area in conjunction with Parks Canada and the Memorial University Bonne Bay Field Station (Tom Knight, pers. comm.) and a July and August 2002 Parks Canada and the Department of Fisheries and Oceans study of exploratory electrofishing and fyke net fishing in Terra Nova National Park. Provincial government Inland Fish technicians and biologists conducting fyke net surveys on the Avalon peninsula, Millertown area in central Newfoundland, and on the Great Northern Peninsula in the Main Brook area were also instructed to look for banded killifish, to recognize appropriate habitat and were supplied with information sheets and pictures identifying banded killifish, but did not report any occurrences [2].

[2] Since the initial submission of this thesis and the COSEWIC status report presented in Chapter 5, *Fundulus diaphanus* has also been discovered in Star Lake (48°35′ N, 57°18′ W) of the Harry's River system (Bill Dennis, pers. comm.) and in a lagoon (49°03′ N, 58°22′ W) near Lark Harbour on the west coast of Newfoundland (Jackie Wells, pers.comm.). See Figure 2-5 (photograph) below.

2.3.2 Catch Per Unit Effort (CPUE) and Population Estimate (Indian Bay)

Table 2-1 shows the difference in CPUE between Newfoundland populations of banded killifish. Figure 2-4 below shows the relationship between water temperature and the abundance (CPUE) of banded killifish in fyke net sets at all three study sites during the months of May to September. The graph indicates that banded killifish are not caught in fyke net sets below temperatures of 12°C while much larger catches occur in the higher temperature ranges surveyed. The relationship between temperature and killifish abundance in fyke net catches in three study sites between 1999-2001 was significant when the data are log transformed with a $p<0.001$ (Figure 5-4) ($r^2=0.190$, F-ratio=11.776, ss=45).

Table 2-1: Mean catch per unit effort (CPUE) values for three representative Newfoundland Banded Killifish populations.

Population	# of net sets	CPUE (Catch per Unit Effort)
Indian Bay	24	42
Loch Leven	10	29
Freshwater Pond	10	23

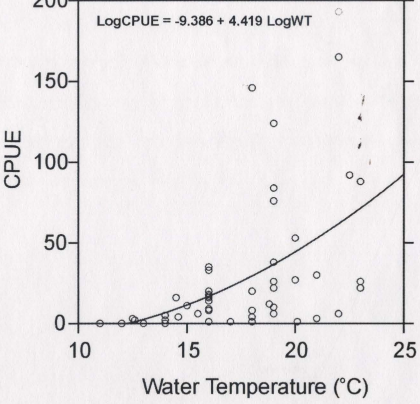

Figure 2-4: Banded killifish catch per unit effort (CPUE) vs water temperature from all three study sites. (Note: Fyke nets were set overnight and for approximately 24hours.)

Water temperatures were lower in July and likely contributed to a population estimate of 1209 individuals (95% confidence limits 619-3423) whereas the August estimate was for 20,569 individuals (95% confidence limits 12,529-40,201) in the Indian Bay watershed (Third Pond). In the absence of additional estimates, these data do not provide suitable information on population trends, but merely describe the condition of the Indian Bay population in 1999.

2.3.3 Habitat description

As Figure 2-5 illustrates, emergent aquatic vegetation is dense between Backup and Third Ponds (Indian Bay) and the substrate (not visible in the photograph) is a very dense mud. Similar conditions exist in the two other study sites as well (Figures 2-6 and 2-7). Table 2-2 presents a relative comparison of qualitative habitat features in the Indian Bay watershed, Freshwater Pond, and Loch Leven.

Figure 2-5: Area between Backup and Third Ponds where banded killifish occur in the Indian Bay watershed.

Figure 2-6: School of Banded Killifish in a lagoon (49°03′ N, 58°22′ W) near York Harbour on the west coast of Newfoundland.

Figure 2-7: Dense emergent aquatic vegetation in Loch Leven on the southwest coast of Newfoundland.

Table 2-2: Qualitative habitat comparison of the three main study sites: Indian Bay watershed (Backup and Third Ponds), Freshwater Pond, and Loch Leven.

Lake(s)	Substrate Type	Relative Size of vegetated areas	Relative density of vegetated areas	Detrital content
Backup and Third Pond	Mud	Large	High	High
Freshwater Pond	Sand	Small	Moderate	Low
Loch Leven	Mud/Sand	Large	High	High

The Indian Bay watershed was studied in detail for macrophyte community composition and densities in areas where banded killifish had been observed (Table 2-3). It appears that spawning behavior was performed near *Potamogeton epihydrus* (Figure 2-8). Males were observed engaging in rigorous circling bouts followed by spawning activity with females. Both *Lobelia dortmanna* and *Eriocaulon sp.* were common to all three study sites. In fact, these two species were the only species emergent through the surface of the water in Freshwater Pond.

Table 2-3: Macrophyte taxa density values per $0.25m^2$ in areas occupied by banded killifish in the Indian Bay watershed[3]

Macrophyte	DENSITY (#/0.25m² quadrats) Quadrat Number													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Sparganium sp.	-	16	8	32	64	2	-	-	-	-	-	-	-	-
Utricularia purpurea	-	4	-	2	-	-	-	-	-	-	-	-	-	-
Potamogeton epihydrus	-	-	8	16	-	4	-	-	-	-	-	-	-	-
Myriophyllum tenellum	8	-	-	-	4	-	8	-	-	-	-	-	-	-
Lobelia dortmanna	16	4	16	8	8	2	-	-	-	-	-	-	-	-
Isoetes sp.	-	-	-	4	16	-	16	16	-	-	16	-	-	-
Eriocaulon sp.	16	4	16	8	8	2	-	-	-	-	-	-	-	-

[3] These 14 quadrats were randomly selected from the area of Backup Pond pictured in Figure 2-7 below. This section of the brook and the surrounding steadies were regularly frequented by banded killifish schools.

Figure 2-8: Banded killifish were observed spawning in this section of Backup Brook in association with a pondweed species (*Potamogeton sp.)*

2.3.3 Indian Bay watershed records

The open red oval in Figure 2-9 indicates the only areas where banded killifish were recorded on a regular basis in the Indian Bay watershed, throughout the adjoining waters of Backup and Third Pond (Ponds 3 and 2). This was confirmed by snorkeling and fyke netting in areas in other lakes with habitat similar to where banded killifish have been found in Backup and Third Ponds. The solid red circles in Indian Bay Big Pond (Pond 4) and between Third and Fourth Pond (Ponds 2 and 1) indicate observations of a single banded killifish. Table 2-4 describes the areas sampled and the method of sampling used in the rest of the watershed. Despite sampling similar habitats in all areas, only a single banded killifish was recorded from each of only two other locations throughout the watershed – the one in Indian Bay Big Pond was the specimen recovered by IBEC in 1993 and the one from Fourth Brook was a visual observation in July 2000 (personal observations). Included in Table 2-4 are the water temperatures, all of which are sufficiently high to ensure that killifish should be observed if they were present in the area.

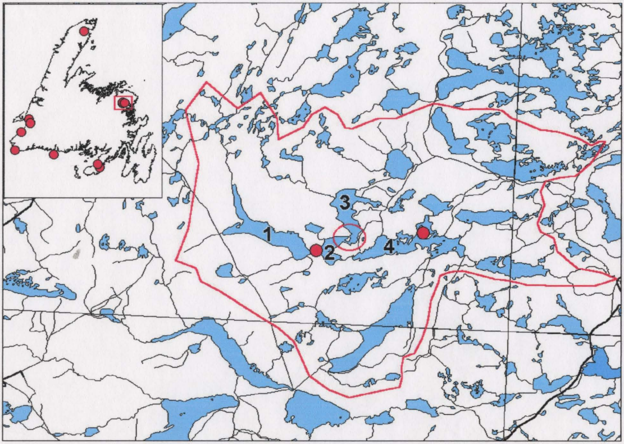

Figure 2-9: Banded killifish records from the Indian Bay watershed (1-Fourth Pond, 2 Third Pond, 3-Backup Pond, 4-Indian Bay Big Pond).

Table 2-4: Areas of the Indian Bay watershed surveyed for *Fundulus diaphanus* presence and absence, associated water temperatures and survey methods used.

Lake	Description	Water Temp. (C)	Methods	Presence (P) or Absence (A)
Third Pond	Left and Right Cuts	18	Snorkelling	**P**
Backup Pond	Backup Steadies	18	Snorkelling	**P**
Third Pond	Fourth Brook (inflow)	18	Snorkelling	**P**
Indian Bay Big Pond	Eastern portion of IBBP	unknown	Fyke Net	**P**
Third pond	Third Brook (outflow)	19	Snorkelling	A
Alleys Pond	Alleys Brook (outflow)	17	Snorkelling/Fyke net	A
Alleys Pond	Grassy Coves	18	Snorkelling/Fyke net	A
Skippers Pond	Inflow from Backup	18	Snorkelling/Fyke net	A
Skippers Pond	Grassy Coves	17	Snorkelling	A
Backup Pond	Grassy Coves	18	Snorkelling	A
Backup Pond	Alleys Brook (inflow)	18	Snorkelling	A
Southern Pond	Grassy Coves	17	Snorkelling	A
Fourth Pond	Fourth Brook (outflow)	19	Snorkelling	A
Fourth Pond	Grassy Angle	18	Snorkelling	A
Four-Mile Pond	Outflow to IBBP	20	Snorkelling/Fyke net	A
Little Bear Cave Pond	Outflow to IBBP	19	Snorkelling/Fyke net	A
Indian Bay Big Pond	Third Brook (inflow)	19	Snorkelling/Fyke net	A
Indian Bay Big Pond	Big Wings Brook (outflow)	19	Snorkelling/Fyke net	A
Indian Bay Big Pond	Bear Cave Steady	19	Snorkelling/Fyke net	A
Big Wings Pond	Big Wings Brook (inflow)	18	Snorkelling	A
Big Wings Pond	Little Wings Brook (outflow)	18	Snorkelling	A
Little Wings Pond	Little Wings Brook (outflow)	18	Snorkelling	A

2.4 Discussion

Although the distribution of *Fundulus diaphanus* in Newfoundland is still scattered at best, the information gathered indicates a wider distribution than has been known previously. Since the latest major report on this species (Houston 1990) several new records have been added to the Newfoundland map. The most significant is the large breeding population of banded killifish in the Indian Bay watershed on the east coast – an easterly range extension from the Freshwater Pond population discovered in 1984 (Gibson et al. 1984). The documented high salinity tolerance of *Fundulus diaphanus* (>20ppt) (Griffith 1974), and the fact that this species is not recorded from Labrador, suggests that banded killifish migrated across the Atlantic Ocean from the Maritime provinces to the southwestern portion of the island of Newfoundland, creating the initial cluster of populations there. Underhill (1986) states that *Fundulus diaphanus* has a marine origin from the Atlantic provinces but does not provide direct evidence for this claim, nor does his account discuss frequency of such migrations. This assumption will be revisited in the discussion of the genetic relationship between Newfoundland and mainland populations in Chapter 3.

It is probable that this species will be found in other areas of the province because fyke net studies continue through the Inland Fish and Wildlife Division of the provincial government Department of Environment and Conservation. From the nature of the literature accounts and the newer records of *Fundulus diaphanus* in Newfoundland it appears that the discovery of the populations that we do know about have been largely accidental findings, often in conjunction with other research being performed on more common species such as brook trout and Atlantic salmon. This is indeed true for the records in Indian Bay and Winterland and may yet be confirmed for the Main Brook report.

It is also interesting to note that very few cabin owners and anglers in the communities that frequently access the Indian Bay watershed are aware of banded killifish in the watershed, likely explained by the fact that the range appears restricted to an area of Backup and Third Ponds that contains very few cabins. This is in contrast to numerous cabin owners along the shore of Freshwater Pond on the Burin peninsula who all refer to *Fundulus diaphanus* as “minnows” or “those fish with rings around them”. The numbers were commonly described as “maggoty” (a Newfoundland and Labrador term meaning very abundant) and a common sentiment was that “every step in the rushes sends hundreds of them in every direction”.

In keeping with these anecdotal observations, the population estimate for the Indian Bay watershed population of 20,569 individuals (August) and the relative abundance as indicated by the CPUE of the species in all three Newfoundland populations surveyed indicate that banded killifish are plentiful in these areas. These results are consistent with observations reported by Houston (1990).

With respect to general habitat descriptions, the Newfoundland lakes fit very well with the descriptions of lakes where banded killifish occur in other parts of Canada and the United States (e.g. Trautman 1957, Gilhen 1974, Houston 1990). The only exception seems to be the relatively turbid water, as compared to Loch Leven and Freshwater Pond, of the area in the Indian Bay watershed where banded killifish are found, likely attributable to the extremely muddy substrate in this area. However, the area is characterized by extremely high densities of macrophytes which serve as ideal spawning habitat. In general, as Figures 2-4 and 2-5 show, dense stands of aquatic macrophytes in shallow, fairly calm water, with a sand-mud substrate and some degree of detrital content is ideal banded killifish habitat in Newfoundland.

The suggestions of a lack of ideal habitat, at least based on qualitative assessments of substrate and density of vegetation, is not likely a factor limiting the distribution of killifish to the specific ponds in which they are found in Newfoundland, i.e. Loch Leven, Freshwater Pond, and Backup and Third Ponds. In the areas surrounding the Freshwater Pond and Loch Leven locations in particular, many of the lakes have an abundance of aquatic vegetation and sandy or muddy bottoms. It would also appear that the majority of regions in Newfoundland would have water temperatures high enough to support banded killifish populations. Water temperatures in shallow areas in the Indian Bay watershed, Loch Leven, and Freshwater Pond reached above 20°C on several occasions. Spawning was observed in July 2000 when water temperatures were 19°C in Backup and Third Ponds and earlier in June of 1999 in the same area when the water temperature in shallow portions of Third Pond reached 21°C. In fact, even in the Main Brook area on the Great Northern Peninsula temperatures in much deeper water reached 17-19°C on a regular basis likely indicating that water temperature is not a limiting factor precluding killifish from occurring in that area (based on Inland Fish Section fyke net data 1997-2000).

Banded killifish in Newfoundland spawn later in the year (June-August) and may spawn at lower temperatures than do banded killifish on the mainland (personal observations). Spawning is described in some accounts as taking place in April to May with a temperature of 21°C being preferred (Carlander 1969) while other spawning observations have been documented at 23°C (McAllister and Coad 1974). Figure 2-8 illustrates the relationship between banded killifish abundance and water temperatures at the three main study sites. Extensive fyke netting in Indian Bay in the areas of Backup and Third Ponds where killifish were known to occur failed to yield any killifish until the water temperature had reached a minimum value of 12-14°C. However, as Figure 2-4 indicates there was an increase in the numbers of killifish caught per 24-hour fyke net set as water temperature increased. Although sampling was not conducted as often at the Loch Leven and Freshwater Pond sites the trend was consistent. In some instances, water temperatures of over 20°C yielded a catch of nearly 300 killifish in a single modified fyke net set for 24 hours.

The rivers between the Atlantic ocean and the lakes with banded killifish populations on the west coast and on the Burin Peninsula are characterized by very shallow stream gradients and slow moving streams whereas the Indian Bay population that is located in Backup and Third Ponds is separated from Indian Bay by a larger river system characterized by a steeper gradient and frequent rapids. This observation adds merit to the possibility that the Indian Bay record may have resulted not by natural dispersal through the sea, but from an introduction by fisherman using live bait while fishing for brook trout. This will be further addressed in the following section.

2.4.1 Indian Bay watershed distribution: An unexplained occurrence?

The distribution of the banded killifish in the Indian Bay watershed is very restricted, and, at best, described as peculiar. Over the years of the IBEC fyke netting, the course of this research, and recent plant community work under CUS, the banded killifish has only been found in the southern half of Backup Pond and the eastern portion of Third Pond. Even after the intense fyke netting program that occurred every summer from 1993-2000, banded killifish only showed up in fyke net sets in this region with the exception of the single initial specimen taken from Indian Bay Big Pond in 1993. Similar aquatic vegetation communities throughout other Indian Bay lakes were identified during this research, and then fyke netted and/or snorkeled during the appropriate temperature range, but yielded no visual observations or fyke net trapped banded killifish (Table 2-3). The single specimens captured or observed in Indian Bay Big Pond and Fourth Brook are likely strays from the population in Backup and Third Ponds. Anecdotal evidence of angling using live bait in the watershed leads to local speculation that banded killifish in Indian Bay may be the result of a recent introduction and that the species has yet to disperse fully through the watershed (Winston Norris, pers.comm.). Both mummichog, *Fundulus heteroclitus,* and the banded killifish have been documented as being used as live bait (Scott and Crossman 1973, Joe Wroblewski, pers.comm.). This observation is strengthened by the fact that there are no extreme barriers to distribution from the area where killifish occur into lakes directly connected to Backup and Third Ponds.

2.4.2 The Impacts of a fragmented distribution

It is possible that the populations of banded killifish will have undergone or will undergo a "bottleneck" and the resulting founder effect in the smaller, isolated populations on the island of Newfoundland. As stated in the introduction, the impact of a bottleneck can be a reduction in genetic variability and an increase in inbreeding, both of which can result in a decrease in fitness for individuals in these separate populations

(Sherwin and Moritz 2000). This matter will be addressed further in Chapter 3 but the fragmented nature of the distribution alone is cause for concern regardless of the current genetic state of the populations in relation to those on the mainland. Meta-population theory suggests that multiple small, isolated populations are much less likely to be colonized by individuals from other populations and are also prone to higher extinction rates than either single large fluctuating populations or multiple small populations that are interconnected (Thrall et al. 2000). Therefore, long-term conservation planning in the case of the banded killifish needs to be at a scale larger than each isolated population, i.e. in terms of all the populations on the island of Newfoundland in concert. In this regard knowing the distribution, or even the number of populations of banded killifish in Newfoundland, is extremely important in evaluating the status of the species here.

2.4.3 Future exploratory work: Suitable Habitat Parameters

The habitat parameters described in this chapter provide a good basis for future researchers interested in investigating or further refining the distribution of banded killifish in Newfoundland. Aside from the Indian Bay watershed site, it is clear the other two study site locations have a very shallow gradient from the ocean to where banded killifish populations are located and this should be the initial consideration when planning potential exploratory sites. In addition, studies should be performed after the water reaches 17-18°C to ensure the greatest possibility of locating these fish. Finally, the presence of a sand or mud substrate and the macrophyte species *Eriocaulon dortmanna* and *Lobelia sp.* are very good habitat indicators and netting near these species of macrophytes usually results in finding banded killifish if they are present. Caution, however, should be used when employing qualitative descriptions of suitable habitat. The localized range of the Indian Bay watershed population, and the in-depth exploratory studies performed there indicate that the presence of appropriate habitat, even in a region with a confirmed banded killifish population, does not assure the presence of this species in all areas of suitable habitat.

The distribution and range of *Fundulus diaphanus* in Newfoundland and a description of the habitat variables associated with this species are key considerations that, when used with genetic and morphometric comparisons to mainland populations (Chapter 3), will lead to an effective evaluation of status (Chapter 5) and an appropriate conservation plan for banded killifish in Newfoundland.

CHAPTER 3. GENETIC AND MORPHOMETRIC COMPARISON OF BANDED KILLIFISH POPULATIONS

3.1 Introduction

As stated in Chapter 2, a fragmented or disjointed distribution can have profound effects on the genetic structure and variance within populations of a species. The effect of a fragmented island distribution, as is the case with banded killifish in Newfoundland, can also manifest itself in morphometric differences. Chapter 3 focuses on an examination of the enzymatic structure of banded killifish populations in Newfoundland and a single population from the mainland and includes a comparison of morphometric characteristics between these populations as well. These analyses are aimed at answering the question of whether the Newfoundland populations of *Fundulus diaphanus* are distinct from mainland banded killifish.

Enzyme electrophoresis is becoming increasingly utilized in determining the status of endangered species of fish and specifically other killifish species (e.g. Fernandez-Pedrosa et al. 1995, Doadrio et al. 1996, Perdices et al. 1996, Maltagliati 1998a, 1998b, 1998c, 1999). Maltagliati (1998a), in his work on two endangered Mediterranean killifish in the genus *Aphanius,* described estimates of genetic variation as important elements in the study of biodiversity, evolutionary processes and the practice of conservation biology when dealing with endangered species that exist only as small natural populations. That is why it is relevant to examine the genetics of the Newfoundland populations of *Fundulus diaphanus* in relation to mainland populations, particularly in light of the fragmented nature of the distribution of banded killifish populations in Newfoundland. This information is important in assigning a status to this species in Newfoundland (see Chapters 4 and 5) and in developing an effective conservation plan for these populations in the future. It also provides clues on levels of gene flow between populations and suggests how best to treat *Fundulus diaphanus* in

Newfoundland, i.e. as a separate species, a separate subspecies or as distinct populations of the same species (Slatkin 1994). This, along with the pertinent life history information and distribution, effectively determines the scale (conservation unit) for which management or conservation strategies need to be developed over the range of the species.

Cellulose acetate electrophoresis was chosen to assess the distinctiveness of the Newfoundland banded killifish for several reasons. This technique has been used recently to assess genetic variation in the Mediterranean work described above (Maltagliati 1998a, 1998b, 1998c, 1999) and endangered species of killifish in that area throughout the 1990's (e.g. Fernandez-Pedrosa et al. 1995, Doadrio et al. 1996, Perdices et al. 1996). This technique has also been used extensively in the closely related mummichog, *Fundulus heteroclitus*, with well-established methodologies and discussions of the adaptive significance of protein polymorphisms as detected through enzyme electrophoresis (e.g. Place and Powers 1978, Powers and Place 1978, Powers et al. 1986, Rhopson et al. 1990, Powers et al. 1991). Another factor contributing to the choice of the enzyme electrophoresis method was that the status of the banded killifish in Newfoundland was uncertain at the time of sample collection and taking large samples, without detailed knowledge of population sizes and/or variability, would have been inappropriate. The Mediterranean studies were able to detect significant genetic differentiation among certain populations with as few as 10 samples representing the separate populations assayed (Maltagliati 1998a).

Little has been attempted in the way of morphometric comparisons among populations of banded killifish. Classic morphometric measurements and meristics (counts) are commonly used for classification and identification of fishes and therefore can help distinguish between populations of the same species or between different, but closely-related, species (Hubbs and Lagler 1974). The collected data were tested for differences between populations using analysis of variance and multi-dimensional scaling. Multi-dimensional scaling, an ordination technique similar to Principal Component Analysis, was used to graphically represent relationships between banded killifish from different populations in multidimensional space with the relationship between the specimens representing their underlying similarities or dissimilarities (Quinn and Keough, 2002). These techniques were applied with a view to providing another assessment of the distinctiveness of Newfoundland populations.

This chapter provides preliminary results of cellulose acetate electrophoresis of 9 enzymes in banded killifish collected from the three main Newfoundland study sites (Indian Bay watershed, Loch Leven, and Freshwater Pond) as compared to specimens from small ponds in the Lake Champlain drainage of Vermont, USA, as well as a comparison of 5 counts and 14 measurements. It is hypothesized that, due to the disjointed nature of the banded killifish populations in Newfoundland and their isolation from the mainland, there is likely to be distinctive genetic and morphological variation when compared to mainland populations due to limited gene flow and potential bottleneck phenomena.

3.2 Methods

3.2.1. Sample collection and size

Banded killifish were collected from Third Pond (49°N, 54°W), Indian Bay watershed, Loch Leven (48°10′N, 58°53′W), and Freshwater Pond (47°6′N, 55°16′W) using modified fyke nets as described in Chapter 2. Samples from the Lake Champlain drainage, Vermont, USA were collected using a minnow seine. Sample sizes varied for enzymatic analysis, morphometric comparisons, and life history analysis (Table 3-1).

Table 3-1: Sample sizes of banded killifish used for various comparisons between the three Newfoundland study sites and the Lake Champlain drainage, Vermont.

Study	Indian Bay	Loch Leven	Freshwater Pond	Vermont	Totals
Enzyme analysis	20	20	20	18	78
Morphometrics	57	42	26	18	143

3.2.2 Cellulose Acetate enzyme electrophoresis

3.2.2.1 Enzyme systems assayed/Buffer systems

Assays were run according to techniques described in Hebert and Beaton 1989. The enzyme systems targeted were decided upon on the basis of electrophoretic studies on *Fundulus heteroclitus* (Powers and Place 1978, Place and Powers 1978, Rhopson et al. 1990, and Brown et al. 1988). The enzymes systems examined were isocitrate dehydrogenase (Idh) , malate dehydrogenase (Mdh), L-lactate dehydrogenase (Ldh), 6-phosphogluconate dehydrogenase (6-Pgdh), fumarase (Fum), mannose-6-phosphate isomerase (Mpi), phosphoglucomutase (Pgm), phosphoglucose isomerase (Pgi) and glutamate-oxaloacetate transferase (Got).

Initially, Newfoundland samples were run for each enzyme on one of four buffer systems: Tris Glycine, Tris Citrate, CAEA, and Tris Malate (Herbert and Beaton 1989). This preparatory work used fin, liver, muscle and eye tissue from each of the individuals assayed. This was done to determine the best combination of buffer systems and enzymes and the most useful tissue type to obtain the best possible resolution of bands on the cellulose acetate plates.

3.2.3. Morphometric comparisons

Measurements and counts were performed by the author following Hubbs and Lagler (1974). Meristics (counts) were performed with the aid of a dissecting microscope and measurements were performed using digital calipers. Table 3-2 provides a list of all morphometric characters investigated and a corresponding description of each. All measurements were taken in a straight line, from point to point (Hubbs and Lagler 1974). The data were standardized as a proportion of the standard length as is customary in descriptions of morphological characteristics in fishes.

After standardization of the data, all measurements and counts were subjected to an Analysis of Variance (ANOVA) using the statistical package SysStat version 10 at a level of $p=0.05$. The standardized data were then subjected to a multi-dimensional scaling analysis using NTSyS version 2.0.

Table 3-2: Name and description of the measurements and counts performed on banded killifish specimens from the Newfoundland and Lake Champlain (Vermont) populations.

Name of Character Measured/Counted	Description of Character
Total Length	Straight line distance between the most anterior projecting part of the head and the farthest tip of the caudal fin.
Standard Length	Straight line distance between the most anterior projecting part of the head and the end of the vertebral column.
Head Length	Straight line distance between the most anterior point on the snout to the most distant part of the opercular membrane.
Inter-Orbital Width	Straight line distance of the least bony width of the interorbital.
Eye Diameter	Greatest straight line distance across the cornea.
Gape	Greatest transverse distance across the opening of the mouth.
Body Width	Straight line distance of the greatest dimension, exclusive of the fleshy or scaly structures which pertain to the fin base.
Caudal Peduncle Depth	Least depth along the length of the previously defined measurement.
Snout	Straight line distance from the most anterior point on the snout or upper lip to the front margin of the orbit.
Caudal Peduncle Length	Oblique straight line distance between the end of the anal base and the hidden base of the middle caudal ray.
Post-Dorsal Length	Straight line distance from the last dorsal ray to the farthest tip of the caudal fin.
Pre-Dorsal Length	Straight line distance from tip of the snout or upper lip to the structural base of the first dorsal ray.
Pre-Anal Length	Straight line distance from the tip of the snout or upper lip to the structural base of the first anal ray.
Anal/Dorsal Fin Rays	Count of anal and dorsal fin rays with the last ray defined as consisting of two ray elements that are separated (counted as one ray).
Pectoral Fin Rays	In paired fins, all rays are counted including the smallest one on the lower or inner end of the fin base.
Pelvic Fin Rays	
Gill Rakers	Count of the gill rakers (projections) on the first arch (including any rudimentary rakers).
Lateral Line Scale Count	Number of scales along the lateral line terminating at the structural caudal base or the end of the hypural plate.

3.3 Results

Various tissue types were effective in generating discernable bands in combination with appropriate buffers in the preliminary analysis (Table 3-3). Liver was used in all subsequent analysis as it proved to be effective in all cases and allowed the analysis to be conducted using the same tissue type for each enzyme. Got failed to provide any bands on the cellulose acetate gels regardless of buffer and tissue combinations. Table 3-3 includes a qualitative description of how well bands were resolved for each enzyme assayed. As Table 3-4 indicates, very little variability was encountered within or among the populations surveyed. In fact, of the total number of fish surveyed (78) for the 8 enzymes (624 samples assayed) which produced discernable bands, only 6 heterozygotes (1.0%) were discovered (Table 3-4). By population, the breakdown of heterozygosity is 2.5% for Loch Leven, 0.7% for Vermont, 0.6% for Indian Bay, and 0% for Freshwater Pond. The heterozygotes were detected in only 2 enzymes: Fum and Ldh, while 1 sample from Loch Leven run for Pgm was a dominant/recessive homozygote that varied from all other samples. With the exception of Pgm (3 loci) and Pgi (2 loci) all other enzymes surveyed expressed only one locus per enzyme. In 5 of the 8 enzymes, no variation was detected at all (i.e. allele frequencies were identical among populations) and in the other three enzymes the variation detected did not warrant detailed statistical analysis.

Table 3-3: Effective enzyme, buffer systems, and tissue type combinations and degree of resolution of bands for cellulose acetate enzyme electrophoretic technique on banded killifish from 3 Newfoundland populations and Lake Champlain drainage, Vermont, USA. (* Resolution given one of three grades: E = excellent, G = good, P = poor).

Enzyme	Buffers	Tissue Type	Resolution*
Idh	TC/CA	All Four	G-E
Mdh	CA	All Four	P-G
Ldh	TM/TC	All Four	G
6-Pgdh	TC	Liver	P-G
Fum	TG	Liver, Fin, Muscle	G-E
Mpi	TG	Liver, Fin, Muscle	G
Pgm	TG	Liver, Eye	E
Pgi	TG/TC/CA	All Four	P-G
Got	None	None	No Resolution

Table 3-4: Summary of the number of loci, and variation in banding patterns for 8 enzyme systems assayed in Newfoundland (Indian Bay (IB), Freshwater Pond (FWP), Loch Leven (LL) and Vermont banded killifish via cellulose acetate electrophoresis.

Enzyme assayed	# Loci	% heterozygozity
Idh	1	0%
Mdh	1	0%
Ldh	1	5.1% H (1 in IB, 1 Vermont, 2 LL)
6-Pgdh	1	0%
Fum	1	2.5% (2 in LL)
Mpi	1	0%
Pgm	3	0% H (1 variant homozygote LL)
Pgi	2 (1 plate indicated 1 locus)	0%

Table 3-5: Meristic comparisons among three Newfoundland populations of banded killifish and the Lake Champlain drainage, Vermont population. Numbers in parentheses indicate the number of individuals expressing the associated value for each count. Mean counts showed no statistically significant variation among populations at p=0.05. Literature values from Scott and Crossman (1973) and Hubbs and Lagler (1974) are also presented.

Meristic	Indian Bay (IB)	Loch Leven (LL)	Freshwater Pond (FWP)	Lake Champlain (Vermont)	Literature values
Anal fin rays	11(34) 12(23)	11(28) 12(14)	11(19) 12(6)	11(12) 12(6)	10-13
Dorsal fin rays	13(42) 12(16)	13(26) 12(16)	13(8) 12(7)	13(12) 12(6)	13-14 (sometimes 12, 15)
Pectoral fin rays	16(44) 15(6) 17(3)	16(33) 14(9)	16(19) 14(5) 15(1)	16(15) 14(2) 15(1)	16-17 (sometimes 14,15, 18,19)
Gill rakers	5(44) 4(13)	5(17) 4(8)	5(17) 4(8)	5(11) 4(7)	4-7 (usually 5-6)
Lateral line scales	41(1) 42(4) 43(2) 44(5) 45(7) 46(16) 47(13) 48(3) 49(2) 51(3)	41(6) 42(2) 43(2) 44(6) 46(16) 47(7) 49(2) 51(1)	41(4) 43(1) 46(6) 47(6) 48(5) 49(4) 51(2)	41(2) 42(1) 43(2) 44(2) 46(5) 47(3) 48(3)	40-55

Table 3-5 illustrates that meristics were similar in range for the four populations examined. For example, anal fin ray counts, dorsal fin ray counts, and gill raker counts, were always 11-12, 12-13 and 4-5 respectively in all specimens from all 4 populations. There was greater variability in lateral line scales and pectoral fin rays. Pelvic fin ray counts are not presented but were 6 for all specimens from all populations. None of the mean counts of each variable differed significantly among populations at a level of p=0.05.

Significant differences among body measurements existed in 6 of 14 variables examined when an ANOVA was performed at a level of p=0.05. As Figures 3-1a and 3-1b show, the average total and standard lengths of the Vermont specimens were significantly less than the same averages for the Newfoundland populations. However, after standardizing the remaining 13 variables by division by the standard length of each individual specimen, only head length, caudal peduncle depth, body width, and body depth showed significant differences among populations. In these variables, Loch Leven specimens were larger than the other two Newfoundland populations in body width and caudal peduncle depth, larger than the three other populations in head length, and larger than Vermont and Freshwater Pond specimens in body depth. These results coincided with field observations that Loch Leven specimens appeared more robust than the specimens taken in Freshwater Pond and Indian Bay.

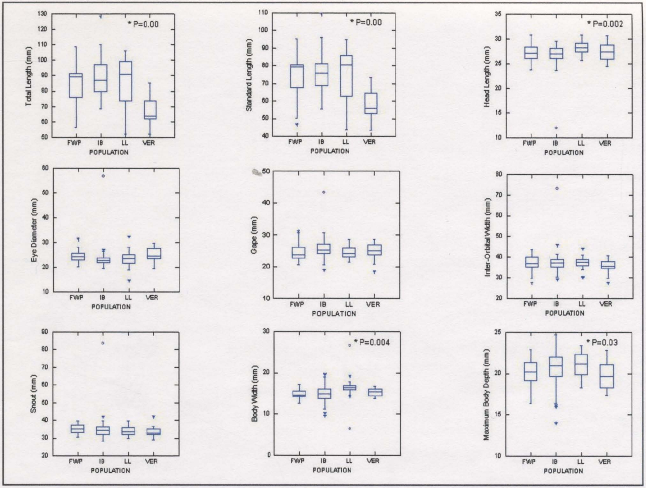

Figure 3-1a: Morphometric comparison (mm) of 4 populations of banded killifish: Freshwater Pond, NL (FWP); Indian Bay Watershed, NL (IBW); Loch Leven, NL (LL); Vermont, USA (VER).

Note: Panels (from left to right) are Standard and Total Length, Head Length, , Eye Diameter, Gape, Inter-Orbital Width, Snout, Body Width, and Maximum Body Depth. * indicates where the p-value indicates that there are significant differences in means between populations at p=0.05. (Note: The Box and Whisker plots include the range [extended lines], standard deviation [rectangle] and median [center line]).

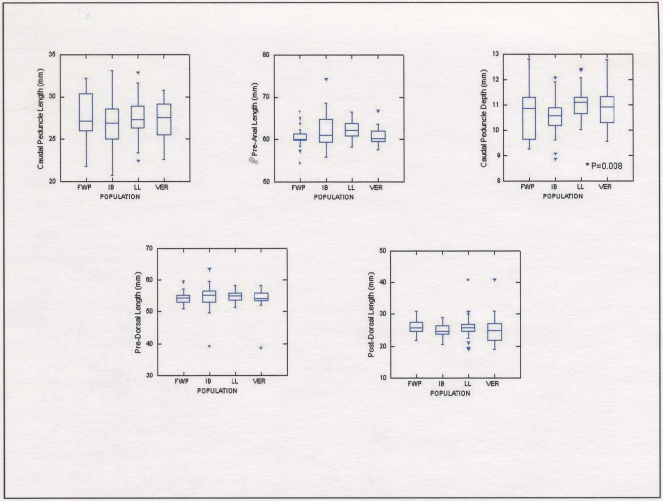

Figure 3-1b: Morphometric comparison (mm) of 4 populations of banded killifish: Freshwater Pond, NL (FWP); Indian Bay Watershed, NL (IBW); Loch Leven, NL (LL); Vermont, USA (VER).

Note: Panels (from left to right) are Caudal Peduncle Length, Pre-Anal Length, Caudal Peduncle Depth, Pre-Dorsal Length, and Post-Dorsal Length. * indicates where the p-value indicates that there are significant differences in means between populations at p=0.05. (Note:The Box and Whisker plots include the range [extended lines], standard deviation [rectangle] and median [center line]).

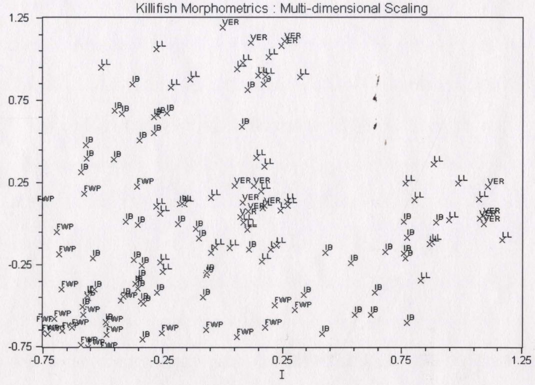

Figure 3-2: Multi-Dimensional Scaling plot showing the spatial distribution of morphometric measurements and counts. The specimens plotted (as represented by Xs) are labeled according to the source population as Freshwater Pond (FWP); Indian Bay (IB); Loch Level (LL); or, Vermont (VER).

The results from the multi-dimensional scaling analysis (Figure 3-2) are consistent with the results of the ANOVA. As Figure 3-2 illustrates specimens from the four populations are scattered throughout all regions of the plot with the Freshwater Pond specimens somewhat restricted to the lower left hand corner. Distinct clusters are not visible in any portion of the plot.

3.4 Discussion

There was little variation in the loci examined for the 8 enzyme systems assayed which produced discernable bands as illustrated by the low number of heterozygotes indicated in Table 3-3. These percentages of heterozygosity are within the range of those reported by Powers et al. (1991) for *Fundulus heteroclitus* (10-40% H) and in Mediterranean studies on endangered cyprinodontids of the genus *Aphanius* (1.3-6.4% H) (Maltagliati 1998a, 1998b, 1998c, 1999) using electrophoretic methods. However, due to the lack of variance in the frequency of alleles for each enzyme among the four populations assayed in the present study, a more detailed statistical analysis of the data was not warranted. The cited work demonstrates that enzyme electrophoresis is an adequate technique to evaluate fish of the genus *Fundulus* and other killifish genera and indicates cellulose acetate electrophoresis could be effective in picking up variation within the genus and family. In these other studies, the authors showed significant variance in allelic frequencies for certain enzymes among populations. For example, among five populations of *Aphanius fasciatus*, Maltagliati (1998a) showed that the loci coding for Ldh showed the presence of two alleles, which were displayed in frequencies which varied from being fixed for one allele in one population, to 0.40 in a second population, to as low as 0.083 in one of the remaining populations. Similar trends were exhibited for Mpi and Pgm. Similarly, Powers et al. (1991), showed significant allele frequency variation among populations of *Fundulus heteroclitus* for the enzymes Fum, Mpi, and Pgm. In contrast, 5 of the 8 enzymes tested in the present study were fixed at a single allele and showed no variation and the other three enzymes showed allele frequencies which differed between populations by at most 0.10 (e.g. Loch Leven specimens showed the presence of two heterozygotes which translated into frequencies of 0.90 for one allele and 0.10 for the second allele while all other populations were fixed for the initial allele).

These results lead to the rejection of the initial hypothesis that the Newfoundland populations would differ from the mainland samples due to the disjunct and isolated nature of the Island's populations structure. A possible explanation for the lack of variation may be linked to the fact that killifish often travel in fairly large schools of approximately 30-50 individuals (personal observations). A founder population in a school this large would likely be able to bring an adequate representation of the variability within a parent population to new areas, thereby averting any bottleneck effects. Alternatively, it is possible, but unlikely, that there are continuous migrations of banded killifish into the Newfoundland populations assayed allowing for a continuous gene flow between mainland populations and the Newfoundland populations. Finally, sufficient time may not have elapsed since the arrival of the species in Newfoundland to allow for the accumulation of variation detectable via the techniques employed.

According to the enzyme markers targeted by cellulose acetate electrophoresis, little variation has accumulated in the banded killifish since arriving in this province. In the future, it may prove important to re-evaluate these populations using the same or alternate techniques, especially if population numbers decrease in any of the Newfoundland populations and subsequently result in decreased genetic variability. Future work also needs to be based on larger samples collected over a wider range. The results from the present analysis allowed the construction of a status report (Chapter 4 and 5) focused on distribution and range descriptions, life history characteristics, and population trends. Genetic variation between populations has been determined to be low by cellulose acetate electrophoresis and therefore does not necessitate treatment of the Newfoundland populations as a separate conservation unit.

Consistent with the electrophoretic results, the morphometric comparisons as tested by ANOVA (Figures 3-1a and 3-1b) and multi-dimensional scaling (Figure 3-2) show little in the way of variation that would justify a separate classification of banded killifish populations and no one population or populations showed consistent variation from any other. While the Newfoundland specimens were significantly larger than Vermont specimens, Loch Leven specimens were larger than some mix of the remaining sampled populations in the four standardized variables showing differences between populations. It is interesting to note that Loch Leven specimens were clearly more robust than specimens collected from the other Newfoundland populations sampled and that the west coast of the Island of Newfoundland is the only place where banded killifish and *Fundulus heteroclitus* (mummichog) populations exist in close proximity. Variables such as body depth and width and caudal peduncle depth may be influenced by nutritional factors and therefore may not be an appropriate measurement of true variation among populations. In addition, the meristics/counts occupied predominantly the same range among populations and showed no significant variation in means among the four populations. The meristics presented by Scott and Crossman (1973), Hubbs and Lagler (1974), Gibson et al. (1984) and Hildebrand and Schroeder (1972) all show similar counts for *Fundulus diaphanus diaphanus*, the eastern banded killifish, compared to the current study (Table 3-4). These references indicate that (1) anal fin rays are usually in the 10-12 range and Scott and Crossman (1973) and Hubbs and Lagler (1974) indicate usually 11 or 12; (2) dorsal fin rays are usually 13 or 13-14 but sometimes 12, 14, or 15; (3) gill rakers are usually 4-7 with Gibson et al. (1984) reporting 4 and 5 at Freshwater Pond and Scott and Crossman (1973) indicating that they usually number 5 or 6; and, (4) lateral line scale counts vary between 40-51 with Gibson et al. (1984) reporting 52-54 in Freshwater Pond. The most notable variation is found in the range of lateral line scale counts which range from 41-51 in Indian Bay specimens, 41-44, 46-47, 49, 51 in Loch Leven specimens, 41, 43, 46-49, 51 in Freshwater Pond, and 41-44 and 46-48 in Lake Champlain drainage (Vermont) specimens.

The genetic results, combined with the morphometric analysis, suggest that the Newfoundland populations do not differ significantly from the mainland population. Given that none of the physical characteristics have been linked to fitness and all are reported as being similar across the range of the species, this result is not surprising.

CHAPTER 4. ASSIGNING A COSEWIC STATUS TO THE BANDED KILLIFISH IN NEWFOUNDLAND AND LABRADOR

4.1 Introduction

An important exercise involved in this project is the review and designation of a status for the Newfoundland populations of *Fundulus diaphanus* through the Committee on the Status for Endangered Wildlife in Canada (COSEWIC). Important considerations in assigning a status to the Newfoundland banded killifish are habitat requirements and distribution and the distinctiveness of these populations from mainland populations in respect to morphological and genetic characteristics (Chapters 2 and 3). These considerations, along with the life history characteristics presented in the COSEWIC report itself (Chapter 5), comprise the basic information needed by COSEWIC to assign a status for *Fundulus diaphanus* in Newfoundland.

The concept for COSEWIC was developed at the 40th Federal-Provincial Wildlife Conference in 1976 when the following recommendation was adopted: "That the Federal-Provincial Wildlife Conference strike a standing committee consisting of representatives of the Federal and Provincial governments and appropriate conservation and scientific organizations for the purpose of establishing the status of endangered and threatened species and habitats in Canada." Following this COSEWIC was organized and officially formed and named in 1977 (Cook and Muir 1984). This organization continues to be a major influence on the development of conservation policy in Canada.

Fundulus diaphanus was placed on a priority list of 14 fish species that needed to be reviewed for status designation by COSEWIC in 1983 (Campbell 1984). The first review of the status of banded killifish occurred in 1989 when the species was reviewed on a national scale. The Newfoundland populations were designated as Vulnerable at this time (Houston 1990). Since that time the "Vulnerable" status designation has been replaced by "Special Concern" (COSEWIC 2000). The 2001-2002 report (Chapter 5) is the first time that the status of this species in Newfoundland has been examined via a COSEWIC status report based solely on information available on the Newfoundland populations.

The next chapter is the status report written by the author of this thesis for COSEWIC in 2001-2002. It is unmodified from the version presented to COSEWIC and provides a summary of the life history characteristics of *Fundulus diaphanus* in Newfoundland. There is a certain degree of repetition between this document and Chapter 2 on distribution and habitat, but it was decided that this document should be presented as is, as a summary of the factors used in evaluating the status of *Fundulus diaphanus* in Newfoundland. The executive summary, which includes ecological information gathered as a part of this thesis, is presented below followed by the status report summary.

4.2 Executive Summary

4.2.1 Species Information

The Banded Killifish, *Fundulus diaphanus* (Lesueur 1817) is a member of the family Fundulidae (Nelson 1984). This species is one of only two members of the genus *Fundulus* found in Newfoundland, the other being the mummichog, *F. heteroclitus*. The Banded Killifish is described as having olive colored sides with numerous vertical bands and a contrasting dark coloration across the dorsal region. The vertical bands give rise to the common name Banded Killifish.

4.2.2 Distribution

There are 7 known populations of Banded Killifish on the island of Newfoundland. The majority of these populations are clustered on the south and western coasts of the province. One of the most recent records of this species, from the Indian Bay watershed (Backup and Third Ponds) on the northeast coast of the island is further east than previous records for this species in Newfoundland. Initially, *Fundulus diaphanus* was only recognized from the very southwestern corner of Newfoundland in the Stephenville Crossing area. From 1980-1990, in addition to the Indian Bay occurrence, new population records include Freshwater Pond and the Rush Ponds (Winterland) on the Burin Peninsula, Ramea Island off the south coast, Loch Leven, and First Pond in the Grand Bay West area, near Port aux Basques.

4.2.3 Habitat

Banded Killifish in Newfoundland depend on clear water, warm water temperatures for spawning, and dense submerged aquatic vegetation growing in a sandy or muddy substrate. This type of habitat is abundant throughout most watersheds in Newfoundland but the species is only found in a few of these watersheds. In addition, in watersheds where Banded Killifish occur and where there are many lakes with appropriate habitat areas, the species is often found only in very restricted areas within one or two lakes. Future research priorities should concentrate on habitat selection and use. Decline in this species in the future would likely be caused by habitat degradation and wetland drainage.

4.2.4 Biology

Newfoundland Banded Killifish grow to an average length of 73-92mm (range of averages taken from the three Newfoundland study sites) and live to a maximum of 3-4 years of age. Maturity is reached at an age of 1+ years and at a length of approximately 60mm. Banded Killifish practice external fertilization and females lay eggs equipped with adhesive threads that adhere to plants, leading to the fish being labeled as plant-spawners. Spawning occurs in July and August at water temperatures of 19-24°C.

4.2.5 Population sizes and trends

Fundulus diaphanus populations in Newfoundland occur over a wide geographic range but local populations are restricted to very confined regions within their respective watersheds. Banded Killifish populations in Newfoundland appear to be locally abundant in representative populations that were sampled. Although yearly data are not available, population estimates indicate that over 20,000 individuals exist in the Indian Bay watershed population on the north east coast. Population estimates are not available for other populations.

4.2.6 Limiting factors and threats

Any disturbance, whether natural or anthropogenic, on the southwest coast of Newfoundland, could have a serious impact on this species due to the cluster of populations in that region. However, direct threats are not perceived in this region at this time. Forestry practices in the Indian Bay watershed may impact on the population in that area in the next few years as much of the forest in this area is scheduled to undergo some form of clear-cutting.

Suitable habitat is present island-wide but inland areas are restricted from immigration of Banded Killifish by rivers with steep gradients and other barriers to inland migration.

4.2.7 Special significance of species

Fundulus diaphanus is the only freshwater fish of Special Concern (COSEWIC) in Newfoundland and represents this species at the eastern extent of its global range. Clustered in very localized regions of the watersheds in which they occur Banded Killifish, that rely on the invertebrate community for food, clear water for prey selection, and dense stands of macrophytes for reproduction are an easily studied indicator species candidate for various measures of ecosystem integrity. Banded Killifish are also important forage fish for brook trout, Atlantic salmon and American eel and form portions of the diet of various waterfowl[4].

4.2.8 Existing protection or other status

The Newfoundland populations of Banded Killifish are currently listed as a species of Special Concern by the COSEWIC. In addition, *Fundulus diaphanus* is one of 20 species protected under the Newfoundland and Labrador provincial government's Endangered Species Act which received royal assent in December 2002. Aside from this

[4] One review of this thesis correctly noted that there was no data to support this statement with specific reference to Newfoundland. The author indicates that the statements are based on the Scott and Crossman (1973) reference that banded killifish may be important forage fish for game fish and White's (1953; 1957) indication that the banded killifish are present in the diet of waterfowl in the Maritime provinces.

protection, the only other protection is made available through the Federal Fisheries Act. The population at Grand Bay West may be included in an ecological reserve being proposed by the Parks and Natural Areas division of the Government of Newfoundland and Labrador and the Rush Ponds population on the Burin Peninsula is in an Eastern Habitat Joint Venture site.

4.2.9 Summary of status report

Banded Killifish populations in Newfoundland are very fragmented in nature. In spite of 7 known population locales, the area of occurrence of these populations is less than 200 km^2. These populations, with the exception of the Indian Bay watershed and the Burin Peninsula populations, are clustered in relative close proximity on the southwestern portion of Newfoundland, maximizing the potential of natural disturbance, urban expansion, and industrial development on 4 of the 7 recognized Newfoundland locales. The three populations surveyed directly (Indian Bay, Loch Leven, and Freshwater Pond) indicate that the species is locally abundant but actual population estimates are only available for the Indian Bay population.

The other major factor restricting *F. diaphanus* in Newfoundland is rivers with steep gradients and other obstructions to inland migration. Habitat, in terms of substrate type and aquatic vegetation, is abundant in central regions, but is likely inaccessible to Banded Killifish due to these difficult migration routes.

The obvious habitat requirements associated with Banded Killifish throughout North America are not limiting factors in Newfoundland. However, habitat selection and use is still not fully understood and warrants further study.

4.3 Conclusion

The COSEWIC process illustrates several important realizations about why reviewing the status of banded killifish in Newfoundland is important.

First, it serves as a template showing how to approach the conservation of species that are not well-known in the public eye and provides the mechanism to evaluate any species, subspecies, or population, with little regard as to how much publicity a decline in that species might generate. The banded killifish is not a well-known constituent of the freshwater fish community in Newfoundland but there is no doubting the importance of this species as a forage fish in the areas where it occurs. In addition, it certainly can serve as an indicator of environmental (i.e. water) quality in these regions. As such, it is certainly worthy of review.

As Chapter 3 indicated, there is little evidence to support the idea that the Newfoundland populations are significantly different from mainland populations in either genetic or morphometric terms. However, COSEWIC also recognizes that geographically isolated populations ("nationally significant populations") are worthy of individual status review, just as distinct species and subspecies are (Campbell 1984). This document illustrates the need to consider all pertinent information when assessing status concerns and to evaluate these populations based on other criteria including regional distribution and range, life history variation, habitat availability and vulnerability, and imminent or perceived threats to populations of banded killifish in Newfoundland.

As the status report in Chapter 5 indicates, one of the most important factors is to consider the continuity of the distribution of *Fundulus diaphanus* in Newfoundland.

While genetic and morphometric analysis do not set the Newfoundland populations apart from mainland fish, weight must be placed on the fact that the distribution is disjointed at best and as time progresses the isolated nature of these populations could have profound effects on the fitness and subsequent survival of this species in Newfoundland due to limited gene flow between populations and potential elimination of populations due to their restricted geographic locations.

Finally, an important role of COSEWIC status reports is to assess what knowledge deficits exist with respect to a particular species or specific populations. As such, the following report not only provides an account of available information on *Fundulus diaphanus* in Newfoundland but also indicates areas that might need to be assessed by future research. Beneficial steps in further reviewing the banded killifish populations in Newfoundland should include population estimates of several populations, additional exploratory netting, additional work on habitat requirements, and a detailed study of stream gradients in areas with suitable banded killifish habitat.

CHAPTER 5: COSEWIC STATUS REPORT ON THE BANDED KILLIFISH POPULATIONS OF NEWFOUNDLAND[5]

5.1 Species Information

5.1.1 Name and Classification

Fundulus diaphanus (Lesueur 1817)

Class Actinopterygii
Order Cyprinodontiformes
Family Fundulidae
Genus *Fundulus*

5.1.2 Description

The Banded Killifish, *Fundulus diaphanus* (Lesueur 1817) is a member of the family Fundulidae containing 5 genera and approximately 40 species (Nelson 1984). Sometimes referred to as egg-laying toothcarps, adult killifish are usually small, reaching between 5-10 cm in length. The largest known killifish of the family Fundulidae, *Fundulus grandissimus*, have been found to measure 18 cm (Berra 1981). Many killifish are slender and pike-like in shape to aid in rapid swimming (Riehl and Baensch 1991) and some species have a flattened head and terminal mouth adapted for surface feeding, hence the name topminnows (Leim and Scott 1966;Scott and Crossman 1973; Houston 1990). Three species of the family Fundulidae, *Fundulus diaphanus*, *F. heteroclitus*, and *F. notatus* have been recorded in Canadian waters (Houston 1990). Of these three, only

[5] The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) considered the Status Report in May 2003. The Report was accepted and the status of Special Concern re-assigned for the Newfoundland populations of the banded killifish.

Fundulus diaphanus and *F. heteroclitus* are found in Newfoundland (Scott and Crossman 1964,1973; Houston 1990).

Fundulus diaphanus, the Banded Killifish, is described as having olive colored sides with numerous vertical bands and a contrasting dark coloration across the dorsal region. The number of bands anterior to the dorsal fin is useful as a means of determining the sex of live fish as a greater number of "anterior" bands (approximately >9) are evident in male Banded Killifish. Bands in females usually appear black in color, are thin and distinct, and often do not appear to span the full width of the body. Males, however, have pale, grey bands that are less distinct and closer together. Figure 5-1 is an illustration of a Banded Killifish.

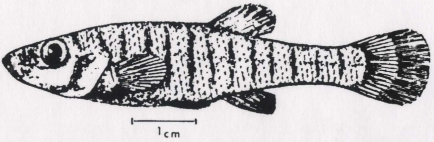

Figure 5-1: Illustration of Banded Killifish (from Scott and Crossman 1973).

Fundulus diaphanus is distinguished from *F. heteroclitus* by having a relatively thin caudal peduncle, larger gill rakers, usually numbering 5 or 6 (9-11 in *F. heteroclitus*), and having branchiostegal rays most often numbering 6,6 (5,5 in *F. heteroclitus*) (Scott and Crossman 1973). *Fundulus heteroclitus* is also most often associated with brackish waters whereas *F. diaphanus*, although euryhaline, is usually found in freshwater (Houston 1990).

Fundulus diaphanus (Lesueur 1817) is divided into two subspecies; *Fundulus diaphanus diaphanus* (Lesueur), the eastern Banded Killifish and *F. d. menona* (Jordan and Copeland), the western Banded Killifish. The eastern Banded Killifish differs from the western subspecies in several ways including a more anterior positioning of the dorsal fin, a greater number of anterior bars in males (9-15 *diaphanus* vs. 5-10 *menona*) and more intense bars along the side that remain intact over the anterior back, a greater number of scale rows (45-49 *diaphanus* vs. 40-44 *menona*), and a combination of dorsal and anal fin rays totaling 24 to 26 (23 to 24 *menona*), as well as being much larger in size (110mm maximum *diaphanus* vs. 74mm maximum *menona*) (Trautman 1957; Hubbs and Lagler 1974).

5.2 Distribution

5.2.1 Global range

Fundulus diaphanus occurs in North America from South Carolina, in the southern United States northward to the Maritime provinces and Newfoundland in Canada, west through the states of New York, Pennsylvania, and southern Canada in the Great Lakes region as far west as the Yellowstone River in eastern Montana (Scott and Crossman 1973; Houston 1990). Figure 5-2 shows the distribution of *Fundulus diaphanus* in North America.

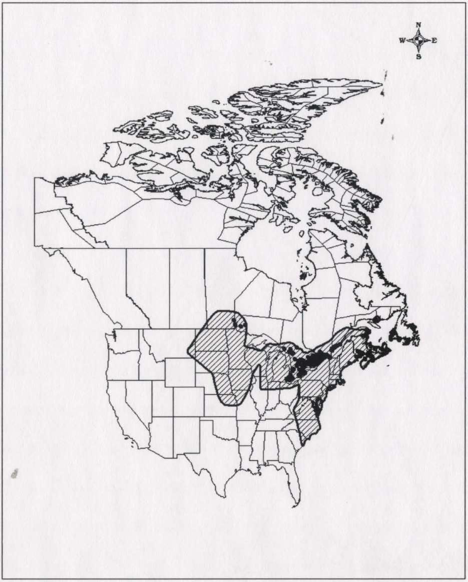

Figure 5-2: North American distribution of Banded Killifish (Range taken from Scott and Crossman 1973 and Gilbert and Shute 1980; Actual population records (shown as black circles) from ROM data).

5.2.2 Canadian range

Fundulus diaphanus is widely distributed in the Maritimes and also in suitable habitat of the St. Lawrence River valley of Quebec. In the Great Lakes watershed, Gilbert and Shute (1980) indicate records in all areas surrounding Lake Michigan, with most concentrated in the area northeast of the lake, numerous records along the western side of Lake Huron, with few records (<10) on the eastern side, at least three records from southeastern Lake Superior, and records in both the northern and southern regions surrounding Lake Erie. In Ontario, the species was also reported from the Lake of the Woods in the northwestern portion of that province in 1986 (K. Stewart, pers. comm.). Gilbert and Shute (1980) describe the St. Lawrence River and the western New York and eastern Ontario drainages of Lake Ontario as the area of integration between the *diaphanus* (eastern) and *menona* (western) subspecies. The western extent of the range of this species in Canada is Manitoba, where two specimens were collected from the Red River near Winnipeg in 1954 (Stewart-Hay 1954), and one other from the southwest arm of Crowduck Lake (50°05' N, 95°08' W) in the Winnipeg River system in 1985 (Stewart et al. 1985; K. Stewart pers. comm.). The most easterly population record is from the Indian Bay watershed on the northeast coast of Newfoundland (49°04'N, 54°06'W) (Chippett, pers. obs.)

5.2.3 Newfoundland range

The eastern Banded Killifish, *Fundulus diaphanus diaphanus* was known from only four localities in southwestern insular Newfoundland (ROM data; Scott and Crossman 1973). *F. d. diaphanus* was first reported from specimens taken in brackish water at the head of St. George's Bay, near Stephenville Crossing in 1951 (Templeman 1951). The distribution was then extended to include a freshwater lake, Loch Leven (48°10'N., 58°53'W.), 50 km to the south of Stephenville Crossing (Gibson et al. 1984) and Ramea Island located 7 km off the south coast of Newfoundland (Day 1993). The known range in Newfoundland was extended east to Freshwater Pond (47°06'N., 55°16' W.) on the Burin Peninsula on the south coast of Newfoundland, when four specimens were taken in 1984 (Gibson et. al 1984).

Throughout the 1990's *F. d. diaphanus* was reported in several freshwater lakes in the Indian Bay watershed on the north side of Bonavista Bay in northeastern Newfoundland. The first record of the eastern Banded Killifish from this area was July 1993 when a single specimen was taken from an open area over a rocky outcrop in Second Pond (Indian Bay Big Pond) (49°04'N, 54°06'W) (M. van Zyll de Jong, pers. comm.). No additional specimens were taken until July-August 1997 when 9 killifish were captured in experimental fyke nets in Backup (49°05'N, 54°11'W) and Third Ponds (49°03'N, 54°12'W) in the same watershed (personal observations). This population is further east than the Freshwater Pond population reported by Gibson et al. (1984). An angler caught a large Banded Killifish in June 1999 in a pond in the town of Winterland (G. Yetman, pers. comm.), just a few kilometers from the Freshwater Pond population referenced by Gibson et al. (1984). An additional population at First Pond (47°35'N, 59°10'W) was discovered during an aquatic plant study by researchers of the Sir Wilfred Grenfell Campus of Memorial University in lakes on the west coast of Newfoundland in the Grand Bay West area (H. Mann, pers. comm.). Figure 5-3 indicates known

Newfoundland populations of Banded Killifish and the years when these populations were discovered or recorded. The records reported since Houston (1990) in Newfoundland could represent true range extensions, however, it is likely that these populations existed but were not documented previously due to a lack of awareness of, and specific surveys targeted for, *Fundulus diaphanus*.

Other areas surveyed where Banded Killifish were not observed or caught included Notre Dame provincial park and Beothuk park (formerly provincial), Trinity Bay near Winterton, Mint Brook in the Gambo area, and all other lakes in the Indian Bay watershed. Other unsuccessful preliminary surveys were performed in various lakes in the Gros Morne National Park area in conjunction with Parks Canada and the Memorial University Bonne Bay Field Station (T. Knight, pers. comm.) and by Parks Canada staff and the author in the Terra Nova National Park area (D. Cote, pers. comm.). Inland Fish (then provincial department of Tourism, Culture, and Recreation – now Environment and Conservation) fyke netting programs on the Avalon Peninsula, the Millertown area in central Newfoundland, and on the Northern Peninsula in the Main Brook area have also failed to produce any new records of this species.

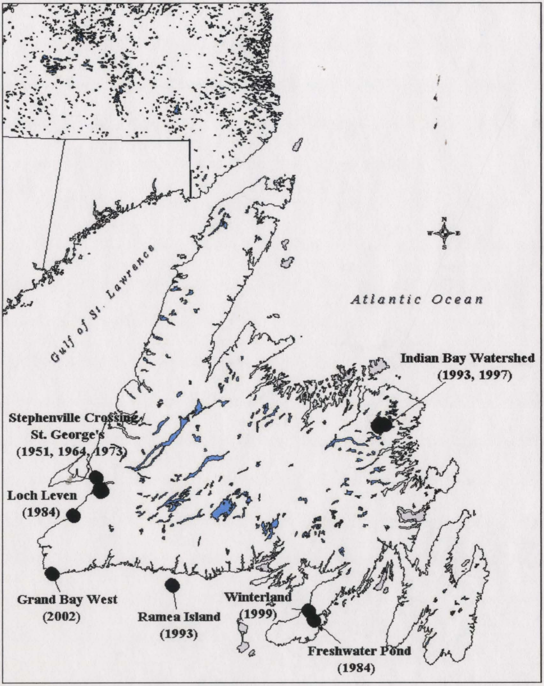

Figure 5-3: Newfoundland distribution of Banded Killifish (year of record in parentheses).

5.3 Habitat

5.3.1 Habitat Requirements

As nearly all the literature accounts indicate, Banded Killifish 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 Banded Killifish populations occur in Newfoundland are consistent with accounts describing Banded Killifish habitat. Dense submerged aquatic vegetation, in particular, and a variety of substrates ranging from fine sand and mud to gravel and cobble, were good indicators of the regions where Banded Killifish were most often observed or caught (Chippett, pers. obs.). The relationship between Banded Killifish and submerged aquatic vegetation is related to the plant-spawning behaviour of Banded Killifish and the need for vegetation for the adherence of eggs. Macrophytes common in areas where Banded Killifish exist in the Indian Bay watershed included *Utricularia purpurea, Potamogeton epihydrus, Myriophyllum tenellum, Lobelia dortmanna*, and *Eriocaulon* and *Isoetes sp.* with densities ranging from 4-16 per 0.25m^2 quadrats. The most predominant plant species are *Lobelia dortmanna, Isoetes sp.* and *Eriocaulon sp.* (Chippett, pers. obs.).

5.3.2 Trends

Banded Killifish habitat, in terms of substrate type and aquatic vegetation, is readily available throughout most regions of Newfoundland (Chippett, pers. obs.). Habitat is limited only to the extent that it is unlikely to be utilized in more inland waters due to rivers of steep gradients and other barriers to killifish migration. Moreover, Banded Killifish are often not observed in areas of suitable habitat in areas connected via passable streams to known populations. This is particularly evident in the Indian Bay watershed where Banded Killifish have been caught in only 3 of 17 lakes, but where appropriate habitat is found in various regions of all lakes (Chippett, pers. obs.) and, for the most part, there do not appear to be any barriers to migration.

5.3.3 Protection/Ownership

Houston (1990) indicated that there is no special protection for this species in Canada and that general protection is available through the habitat sections of the federal Fisheries Act. In August 2002, however, the Newfoundland and Labrador government passed an Endangered Species Act protecting *Fundulus diaphanus* and 19 other species. There are special circumstances surrounding certain populations including the potential of the Grand Bay West population (First Pond) being included in an ecological reserve, the Winterland population being a part of the Eastern Joint Habitat Venture, and the closure of Loch Leven to recreational angling reducing public traffic in, on and around this lake. The presence of Banded Killifish in these areas, however, had little to do with these initiatives and was usually discovered after steps to protect the region had already been taken (Chippett, pers. obs.).

In certain areas of the United States, Banded Killifish have disappeared from watersheds where they were traditionally known to occur. *Fundulus diaphanus* is considered Endangered in Pennsylvania and South Dakota and have entered a period of decline in Illinois (Houston 1990). Protected status has been granted in South Dakota and

Ohio; in the latter a massive effort involving captive breeding and reintroduction has been developed with some success in reintroducing Banded Killifish to parts of its original range in that state. Much of the concerns for Banded Killifish in the United States are due to habitat degradation and loss due to wetland drainage (Houston 1990).

5.4 Biology

5.4.1 General

Of the three Newfoundland populations sampled, the Loch Leven population had the largest mean total length at 91.9mm (56.5-106.3mm) while the Indian Bay population averaged 88.8mm[6] (68.6-128.4mm) and Freshwater Pond population 73.2mm (60.0-120.2mm) (Chippett 2003). In previous studies Banded Killifish adults usually ranged from 60-80mm (Cooper 1983). The 12.8cm record from Indian Bay is likely the largest recorded length for this species. Scott and Crossman (1973) indicated that a Banded Killifish measuring 11.4cm from Lake O' Law in Nova Scotia was the largest record prior to the Indian Bay record. Carlander (1969) reported that individuals reach maturity at 1+ years and at a total length of about 60mm. The minimum size for mature females from the Newfoundland populations was noted to be 56mm (Chippett, pers. obs.).

[6] The preliminary data collected at the time of the COSEWIC report indicated an average length of 88.8mm for the IB Population. The final Appendix II data (using additional data collected after the status report was completed) has an average length of 79.6mm for IB.

5.4.2 Reproduction

Banded Killifish are plant spawners and females release eggs with individual adhesive threads that adhere to aquatic vegetation once released. Males release milt and fertilize the eggs as they hang from the female papilla in clusters of 5-10 eggs (Richardson 1939). Spawning is indicated as taking place in April to May with a temperature of 21°C being preferred (Carlander 1969); other spawning observations have been documented at 23°C (McAllister and Coad 1974).

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 between 19-23°C, most often in association with pondweed species of the genus *Potamogeton.* Males undergo a drastic color change when spawning, developing a bright blue patch near the anal fin (Chippett, pers. obs.; Scott and Crossman 1973). The lower portion of the body, including the area around the anal fin, transforms into a brilliant iridescent blue color. In areas where the water is dark or murky, particularly those with mud substrates like the Indian Bay watershed, the males can be identified by quick darting movements made obvious by the blue coloration against the dark substrate (Chippett, pers. obs.). This color change is much more evident in the wild than in captivity.

Eggs taken from female fish in the Indian Bay watershed in late July were slightly larger ($\bar{x}$ = 2.2mm) than the 2.0mm reported by Cooper (1936) and large females contained as many as 420 eggs as compared to the 250 reported by Carlander (1969) (Chippett, pers. obs.). [7]

5.4.3 Physiology

Banded Killifish are tolerant of low oxygen levels and a wide range of temperatures (Scott and Crossman 1973; Houston 1990). Carlander (1969) observed Banded Killifish at 38.3°C while Rombough and Garside (1977) reported 34.5°C as the upper temperature limit for this species. In Newfoundland, Banded Killifish spawning was observed at water temperatures of 22-24°C in the shallows and abundance of *Fundulus diaphanus* in fyke net catches was strongly related to water temperatures (Chippett, pers. obs.). These observations concur with those of Melisky et al. (1980) who found that Banded Killifish in Pennsylvania had a preference for waters of approximately 28.6°C and that fish in Nova Scotia prefer the lower temperature of 21.0°C. Banded Killifish move into deeper sections of lakes during late fall and winter before emerging into the shallows after the ice melts in April or May (J.G. Godin, pers. comm.).

Banded Killifish are euryhaline but usually inhabit freshwater streams and lakes, rarely existing in brackish or marine waters (Fritz and Garside 1974, 1975) This is true of the Newfoundland populations (Chippett, pers. obs.). *Fundulus diaphanus* is tolerant, however, of salinities in excess of 20ppt, making dispersal through salt water possible (Griffith 1974). It is believed that this is how Banded Killifish initially migrated to the southwestern portion of Newfoundland from the Maritime provinces (Griffith 1974; Underhill 1986). The populations on the south and west coasts appear close enough to

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[7] Appendix III contains fecundity and length weight data of Newfoundland Banded Killifish

make migration between the Newfoundland populations possible, but, such movement is undoubtedly small in scale (Chippett, pers. obs.). The population on the northeast coast in the Indian Bay watershed may have been the result of an introduction, as anecdotal evidence by local anglers suggest, outside anglers using minnows have traditionally fished in Backup and Third Ponds (W. Norris, pers. comm.).

5.4.4 Movements/Dispersal

Banded Killifish were observed in shallow, sheltered areas during the day in areas with abundant, dense, submerged aquatic vegetation, with very little observed migration during the daylight hours. However, data from fyke nets set in a variety of habitat types indicated a greater abundance of killifish in deeper, more exposed rocky areas suggesting nocturnal movements away from and/or between vegetated areas (Chippett, pers. obs.).

The Banded Killifish in the Indian Bay watershed occupy a very restricted range. It is likely that the species has had little success in dispersing throughout the watershed due to long stretches of deep, open water where brook trout and Atlantic salmon predation would be substantially higher than would be the case in the weedy shallows (Chippett, pers. obs.).

5.4.5 Nutrition and interspecific interactions

Keast and Webb (1966) indicated that despite the superior position of the mouth, Banded Killifish feed in all levels of the water column. Smaller individuals eat chironomid larvae, ostracods, cladocerans, copepods, and small quantities of amphipods and some flying insects while larger individuals feed on the aforementioned species and also take Odonata and Ephemoptera nymphs, molluscs, tubellarians, and small crustaceans (Keast and Webb 1966; Baker-Dittus 1978). While specific information on Banded Killifish feeding is not available for Newfoundland populations, specimens taken from the Indian Bay watershed did contain a high proportion of chironomid larvae (Chippett, pers. obs.).

Fundulus diaphanus is a forage fish for larger species like Atlantic salmon (*Salmo salar*), brook trout (*Salvelinus fontinalis*) and American eels (*Anguilla rostrata*) and is also preyed upon by Belted Kingfishers (*Megaceryle alcyon*) and American Mergansers (*Mergus merganser*) (White 1953,1957; Scott and Crossman 1973). However, adult Banded Killifish are often observed in association with large schools of young brook trout of similar size and are caught in fyke nets with brook trout, American eels (*Anguilla rostrata*), three-spined sticklebacks (*Gasterosteus aculeatus*), Atlantic salmon adults and parr, and rainbow smelt (*Osmerus mordax*). Predation in Loch Leven is likely extremely high from the large population of American eels in this area as indicated by the numbers in fyke net catches (Chippett, pers. obs.)

5.4.6 Behaviour

5.4.6.1 Schooling

Banded Killifish adults (3-4 yrs) were usually observed in small schools of 3-6 individuals while younger fish (1-2+ yrs) were most often recorded in schools of 8-12 individuals. Schools remained in the same general area for long periods of time. Smaller fish use edges of areas of still water with abundant riparian vegetation for shelter while the adults (3-4 yrs) were found in more open areas, particularly at the outflows of streams and brooks (Chippett, pers. obs.). Schooling likely plays a role in predator avoidance and feeding (Keast and Webb 1966; Godin and Morgan 1985).

5.4.6.2 Spawning

Banded Killifish in the Indian Bay watershed were observed exhibiting pre-spawning and spawning behaviour in late June through to the middle of August when water temperatures reached between 19-24°C (Chippett, pers. obs.). As observed by Richardson (1939) males selected breeding areas in quiet weedy pools and defended these areas vigorously after which males and females of similar size paired off. The intense circling bouts between rival males were also observed to the extent of the pursued males being forced out of the water (Chippett, pers. obs.).

5.5 Population sizes and trends

Population estimates have not been attempted with this species previous to the current research (Houston 1990). Schnabel mark-recapture estimates were performed using anal fin clip marks in the Indian Bay watershed in July and August of 1999. Water temperatures were lower in July and likely contributed to an estimate of 1209 individuals (95% confidence limits 619-3423) whereas the August estimate was for 20,569 individuals (95% confidence limits 12,529-40,201). In the absence of additional estimates, these data do not provide suitable information on population trends, but merely describe the condition of the Indian Bay population in 1999. The relationship between temperature and killifish abundance in fyke net catches in three study sites between 1999-

2001 was significant when the data are log transformed with a $p<0.001$ (Figure 5-4) ($r^2=0.190$, F-ratio=11.776, ss=45).

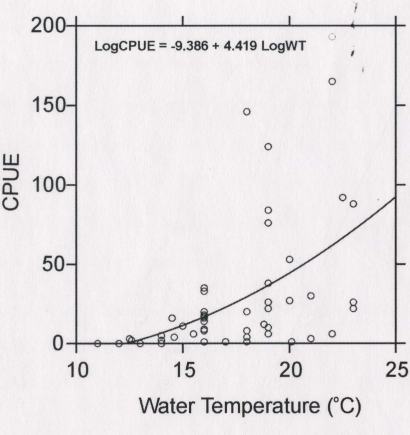

Figure 5-4. Relationship between Banded Killifish catch per unit effort and water temperature in three Newfoundland lakes (Loch Leven, Third Pond (Indian Bay Watershed), and Freshwater Pond).

Any future investigation of population size would best be performed in late July and through August when water temperatures are higher and killifish abundance and activity are at their highest levels (Chippett, pers. obs.). Figure 5-4 indicates the relationship between water temperature and catch per unit effort of Banded Killifish in three Newfoundland lakes. The catch per unit effort (CPUE) values presented in Table 5-1 are much higher for the Indian Bay watershed than for the Loch Leven and Freshwater Pond populations. Banded Killifish are so restricted in distribution in the Indian Bay watershed that nets were always placed in areas where Banded Killifish were known to occur based on prior experience. As a result, the Indian Bay sampling may have targeted areas with greater numbers of Banded Killifish in the area. However, in the other populations, particularly Freshwater Pond, the range of the species is larger and individual fish would be found throughout a larger area making sampling site selection a factor. The large CPUEs and the maximum numbers of killifish caught in fyke nets in July and August indicate that this species is locally abundant at Loch Leven, Freshwater Pond and Indian Bay, which is in agreement with Houston (1990).

Table 5-1: Mean catch per unit effort (CPUE – individuals/set) values for three representative Newfoundland Banded Killifish populations.

Population	# of net sets	CPUE (Catch per Unit Effort)
Indian Bay	24[8]	42
Loch Leven	10	29
Freshwater Pond	10	23

In Third Pond in the Indian Bay watershed, Banded Killifish numbers reached maxima of nearly 200 killifish per net in late July and early August (Figure 5-4). At Loch Leven, large schools of Banded Killifish of approximately 25-40 individuals are easily observed in the sandy shallows, particularly on warm sunny days (personal observations).

[8] Number of net sets for Indian Bay population after conclusion of study was 40.

The size and movements of these schools in the shallows create the illusion of "bubbling" or "boiling" water as described by Gilhen (1974).

5.6 Limiting factors and threats

There are two limiting factors to be considered with respect to Banded Killifish populations in Newfoundland. These are forestry activity (or any other potential anthropogenic disturbance) and the potential impacts of forestry on freshwater watersheds inhabited by this species, and obstacles, such as steep river gradients and physical barriers, preventing inland migration and access to additional suitable habitat.

While little in the way of clear cutting is occurring on the west coast in the area around Banded Killifish populations (H. Smith, pers. comm.), much of the area surrounding several lakes in the Indian Bay watershed, particularly around Fourth Pond, directly connected to Third Pond, one of the lakes containing Banded Killifish, has been or is planned to be clear cut over the next 5 years (M. Wells, pers. comm.). Wells (2002) indicated statistically significant sediment accumulation increase for a 20 m buffer with selective harvesting within the Indian Bay watershed along a headwater stream ($p=0.0172$ for sediment > 1mm in diameter, 4-fold increase, $p=0.0001$ for sediment < 1mm in diameter, 5-fold). The effects of such increased suspended sediments include reductions in invertebrate abundances, decreased feeding success for sight feeding species, and dislocation and mortality of early life stages (Miller 1981). Sediments can also abrade and suffocate periphyton and macrophytes thus decreasing the primary production (Waters 1995). Desgagne and Lalancette (1984) indicated that Banded Killifish feed based on visual perception and, as Richardson (1939) stated, Banded Killifish make use of macrophytes in their reproductive cycle. Therefore these developments may have a severe impact on Banded Killifish populations in Indian Bay should this phenomenon occur throughout the watershed.

Despite the broadened distribution since the previous status report, the newest records are coastal in nature, likely confirming that migration inland is restricted by steep river gradients and impassable rapids or falls. This fact will likely mean that future discoveries will be coastal in nature and that further inland discoveries will be highly unlikely.

Other suggested limiting factors such as low water temperatures and the availability of suitable habitat (Gibson et al. 1984; Houston 1990) are probably not limiting to Banded Killifish in Newfoundland. Shallow regions in all population locales surveyed reached temperatures of at least 23°C in July and August meaning that spawning should have been easily accomplished in these areas. However, in areas where Banded Killifish were restricted in distribution to one or two lakes, abundant suitable habitat in other lakes linked by easily passable brooks and streams showed no evidence of Banded Killifish presence. This trend is evident in several of the watersheds where populations occur and indicates a more detailed study of potential habitat parameters and selection is required.

5.7 Special significance of the species

Fundulus diaphanus is one of two species of the Family Fundulidae in Newfoundland, the other being the mummichog, the closely related *F. heteroclitus*. As stated earlier Banded Killifish are considered a forage fish for brook trout and Atlantic salmon and are used as a bait fish in certain parts of North America (Houston 1990).

The populations of Banded Killifish in Newfoundland are at the eastern extent of the global North American range of this species and are clustered in a fairly confined geographical area, with the exception of the outlying Indian Bay population. This distribution of Banded Killifish makes it an ideal indicator species for development or industry in these areas that may impact upon freshwater ecosystems. The research contributing to this status report has helped to raise awareness of this species in Newfoundland and to synthesize much of the independent work being conducted on this species. The Banded Killifish is currently the subject of proposals by Parks Canada and the Eastern Habitat Joint Venture that will look at habitat selection and use in greater detail and the potential of artificial substrate utilization and is recognized in the Winterland ecomuseum, an interpretive boardwalk through wetland and barrens on the Burin Peninsula, as a species existing in the Rush Ponds, and needing the muddy and densely-vegetated habitat these waterbodies provide. The most recently documented population is in the Grand Bay West area, where the Government of Newfoundland and Labrador is in the process of creating an ecological reserve.

5.8 Existing protection or other status

The Newfoundland populations of Banded Killifish, *Fundulus diaphanus*, were designated as Vulnerable (species of special concern) by the Committee on the Status of Endangered Wildlife in Canada in 1989 (Houston 1990). More recently, a new Endangered Species Act passed by the Newfoundland and Labrador provincial government in August 2002 lists *F. diaphanus* as one of 20 species protected under this Act. Houston (1990) indicated that Manitoba populations are considered of special concern while this species has an Endangered status in the states of Pennsylvania and South Dakota. Since this report, the Manitoba Conservation Data Centre has ranked the Banded Killifish as G5, S1 (Stewart, pers. comm.). The only other specific protection afforded Banded Killifish in Canada is through the Federal Fisheries Act that prohibits the destruction of fish habitat.

5.9 Summary of status report

The Newfoundland populations of Banded Killifish, *Fundulus diaphanus*, were designated as Vulnerable (species of special concern) by the Committee on the Status of Endangered Wildlife in Canada in 1989 (Houston 1990). This updated report recommends that this species be evaluated based on the following conclusions.

Banded Killifish populations in Newfoundland are very restricted in nature. In spite of 7 known population locales, the area of occurrence of these populations is less than 200 km^2. In addition, these populations, with the exception of the Indian Bay watershed population, are clustered in relatively close proximity on the southwestern portion of Newfoundland, maximizing the potential of natural disturbance, urban expansion, and industrial development, on 4 of the 7 recognized Newfoundland locales.

The most likely limiting factor as regards dispersal of *F. diaphanus* in Newfoundland is rivers with steep gradients and other obstructions to migration. This geographic feature will restrict this species to the coastal regions where it has been discovered thus far and prevent dispersal throughout the central waters of insular

Newfoundland. Therefore, although appropriate habitat is abundant in these regions, much of it is inaccessible to Banded Killifish due to difficult migration routes.

The obvious habitat requirements associated with Banded Killifish throughout North America, which include dense submerged aquatic vegetation, muddy or sandy substrates, and warm water temperatures for spawning, are not limiting factors in Newfoundland. However, even in coastal watersheds that include easily passable linkages between several lakes with much habitat as described previously, Banded Killifish still remain restricted in one "isolated" geographical pocket population and do not appear to spread throughout the entire system. More information is required on the strict parameters surrounding habitat selection and use and the dispersal of Banded Killifish throughout watersheds in Newfoundland and this should be a priority for any future research on this species in Newfoundland.

5.10 Technical summary

Fundulus diaphanus
Banded Killifish , Swimp (NF name) Fondule barre
Newfoundland Populations
Southeastern Manitoba to northeast coast of Newfoundland

Extent and Area information	
• *extent of occurrence (EO)(km²)*	45,050
• *specify trend (decline, stable, increasing, unknown)*	Increasing
• *are there extreme fluctuations in EO (> 1 order of magnitude)?*	No
• *area of occupancy (AO) (km²)*	>200
• *specify trend (decline, stable, increasing, unknown)*	Stable
• *are there extreme fluctuations in AO (> 1 order magnitude)?*	No
• *number of extant locations*	7
• *specify trend in # locations (decline, stable, increasing, unknown)*	Stable
• *are there extreme fluctuations in # locations (>1 order of magnitude)?*	No
• *habitat trend: specify declining, stable, increasing or unknown trend in area, extent or quality of habitat*	Stable (only accessible in coastal regions)
Population information	
• *generation time (average age of parents in the population) (indicate years, months, days, etc.)*	Mature at 1+ years
• *number of mature individuals (capable of reproduction) in the Canadian population (or, specify a range of plausible values)*	Not Available
• *total population trend: specify declining, stable, increasing or unknown trend in number of mature individuals*	Unknown
• *if decline, % decline over the last/next 10 years or 3 generations, whichever is greater (or specify if for shorter time period)*	Not Available
• *are there extreme fluctuations in number of mature individuals (> 1 order of magnitude)?*	Not Available
• *is the total population severely fragmented (most individuals found within small and relatively isolated (geographically or otherwise) populations between which there is little exchange, i.e., ≤ 1 successful migrant / year)?*	Yes

• *list each population and the number of mature individuals in each*	Indian Bay (1209-20569) Loch Leven (unknown) Stephenville Crossing (unknown) Ramea Island (unknown) Winterland (unknown) Freshwater Pond (unknown) Grand Bay West (unknown)
• *specify trend in number of populations (decline, stable, increasing, unknown)*	Stable
• *are there extreme fluctuations in number of populations (>1 order of magnitude)?*	No
Threats (actual or imminent threats to populations or habitats)	
- Forestry in Indian Bay Watershed on northeast coast of Newfoundland. - West Coast populations would be vulnerable to any disturbance impacting on water quality or macrophyte communities due to their restricted ranges and close proximity to one another.	
Rescue Effect (immigration from an outside source)	Low
• *does species exist elsewhere (in Canada or outside)?*	Canada and USA
• *status of the outside population(s)?*	Manitoba – Special Concern (G5, S1) South Dakota-Endangered Pennsylvania – Endangered Remaining populations not listed
• *is immigration known or possible?*	Low
• *would immigrants be adapted to survive here?*	Yes
• *is there sufficient habitat for immigrants here?*	Yes
Quantitative Analysis	Not Available

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APPENDIX 1 DATA – Morphometric data for four populations of banded killifish (FWP=Freshwater Pond; IB=Indian Bay Watershed; LL=Loch Leven; VER=Vermont).

Pop	TL	SL	HL	IOW	ED	GAPE	BW	BD	CPD	SNOUT	CPL	POST DL	PREDL	PAL	AFR	DFR	Pec	Pel	GR	LLS
FWP	59.4	50.1	28.343	33.802	28.169	25.352	14.171	20.159	9.980	30.985	29.141	23.752	56.087	58.483	11	13	16	6	5	4
FWP	59.9	51.8	29.150	32.450	27.814	20.529	13.899	18.339	9.459	30.463	29.536	24.710	56.370	60.038	11	13	16	6	5	4
FWP	76.1	67.5	25.925	35.428	25.714	24.571	14.222	17.629	9.481	34.857	30.814	29.185	55.111	60.888	11	13	15	6	5	4
FWP	108.7	95.3	29.905	41.403	20.350	22.105	14.900	21.406	11.43	38.596	28.331	28.226	57.292	59.916	12	13	16	6	5	4
FWP	105.8	95.3	26.757	36.862	24.313	22.745	13.955	19.517	9.758	38.431	30.115	31.059	56.558	62.329	11	13	16	6	5	4
FWP	91.4	80.3	26.899	38.425	21.296	27.777	14.445	19.302	10.95	36.111	26.650	28.518	52.179	59.651	11	13	16	6	4	5
FWP	85.2	73.6	28.396	37.320	24.880	24.880	14.538	19.021	9.646	37.320	29.347	28.260	54.483	61.277	11	12	14	6	4	4
FWP	87.8	74.9	27.102	43.349	22.167	25.615	16.421	21.895	11.74	38.423	27.102	23.230	54.739	60.614	12	12	16	6	4	4
FWP	90	80	28.125	43.555	23.111	23.555	15.5	21.5	11.37	33.777	32.25	27.5	53.125	60.125	11	12	16	6	5	4
FWP	89.2	79.5	27.044	36.279	22.790	23.255	14.339	18.113	9.433	37.674	30.943	31.069	53.836	59.874	11	13	14	6	4	4
FWP	75.1	64.9	28.505	27.567	24.864	23.243	15.254	18.181	10.93	32.432	24.653	25.885	55.007	60.708	12	13	16	6	5	4
FWP	75.1	67.7	25.406	35.465	25.581	22.093	15.361	19.202	10.78	35.465	31.314	25.553	51.994	57.459	12	13	16	6	5	4
FWP	101.3	89.3	28.331	35.177	20.553	26.086	14.669	20.940	10.52	33.201	25.979	27.435	51.063	54.423	11	12	16	6	5	4
FWP	103.6	86.4	23.726	40.487	22.926	30.731	17.245	21.875	9.837	39.512	21.759	21.990	59.490	66.666	11	13	16	6	4	4
FWP	85.3	74.6	25.737	40.104	25	26.041	15.817	19.973	10.85	35.416	26.139	24.798	55.093	65.013	11	13	16	6	4	4
FWP	84.8	73.4	25.885	39.473	25.263	25.789	15.531	19.891	11.30	35.263	26.158	23.978	54.359	63.760	12	13	14	6	5	4
FWP	102.6	90.3	27.242	39.024	24.390	28.455	14.839	21.151	11.73	31.300	26.024	27.353	51.716	57.253	11	13	16	6	5	4
FWP	105.3	94.6	26.109	37.651	24.291	31.174	12.684	16.384	9.302	37.246	30.655	25.687	55.285	61.310	11	12	16	6	5	4
FWP	56.4	46.4	30.603	30.281	31.690	21.830	15.732	21.767	12.71	31.690	30.387	26.293	54.310	61.637	11	12	16	6	5	4
FWP	56.8	46.8	30.769	29.861	31.25	22.916	16.239	22.863	12.82	31.25	30.341	26.495	55.769	61.752	11	13	16	6	5	4
FWP	90.3	80.4	28.358	42.543	22.368	23.684	14.179	21.019	11.06	33.333	26.616	25.621	53.109	60.074	12	12	16	6	5	4
FWP	89.5	79.7	26.850	36.448	23.364	20.560	14.303	20.828	9.410	35.046	25.972	22.961	53.952	59.974	11	13	14	6	4	4
FWP	90.4	80.6	28.039	41.592	23.008	26.548	14.516	21.339	11.29	34.513	26.302	25.806	53.101	59.429	11	13	16	6	5	5
FWP	76.6	68.7	25.909	35.393	25.842	23.595	15.283	20.232	10.91	35.393	25.181	24.890	54.876	60.553	11	13	16	6	5	4
FWP	89.2	79.8	26.566	36.792	23.584	22.169	14.536	21.052	9.273	34.905	25.563	23.684	52.882	60.025	11	13	14	6	4	4
IB	87.4	76.2	26.377	39.303	21.890	27.860	14.566	19.028	11.54	31.840	27.690	24.540	56.692	61.286	12	13	16	6	5	5
IB	87.2	75.9	26.086	38.383	22.222	26.262	14.756	19.894	10.54	37.373	28.458	24.637	51.646	58.761	12	13	16	6	5	4
IB	87.5	76.6	26.762	39.024	21.463	27.804	14.751	19.712	10.31	34.634	30.156	23.759	56.657	61.096	11	12	15	6	4	4
IB	89.8	77.4	26.744	38.164	24.637	28.502	14.857	18.475	10.85	33.333	29.069	24.806	56.847	62.015	12	13	15	6	4	4
IB	86.3	77.1	26.070	37.313	21.890	28.358	15.693	21.141	11.41	34.825	28.534	24.643	51.361	57.198	12	13	16	6	5	4
IB	87.1	75.1	27.030	38.423	22.660	26.600	15.446	20.505	10.11	34.482	31.957	27.030	56.324	59.786	11	12	16	6	5	4

IB	87.5	77.2	26.424	38.235	22.549	25.980	15.803	19.948	10.88	35.294	30.440	24.222	53.108	61.010	12	13	16	6	5	4
IB	88.7	79	27.088	35.514	19.626	24.299	14.936	20.126	11.13	34.112	27.848	24.050	52.151	60.253	11	12	16	6	5	5
IB	84.1	75.8	27.176	35.436	22.330	27.184	13.720	19.261	11.08	31.553	28.627	26.253	51.583	57.915	12	13	16	6	4	4
IB	90	79.8	25.689	36.585	22.439	25.365	14.912	18.170	10.90	35.609	27.944	25.939	55.388	61.779	12	13	16	6	5	4
IB	73.4	65.6	25.304	39.156	23.493	24.698	14.024	19.512	10.97	30.722	25	25.304	39.176	59.603	12	13	16	6	5	4
IB	85.5	76.6	26.631	37.745	23.529	24.509	15.404	19.451	10.57	33.823	26.501	24.804	55.744	64.751	12	12	15	6	4	4
IB	89.8	78.8	26.269	40.096	24.154	28.019	16.370	20.050	10.40	32.367	26.649	26.142	56.979	59.644	12	13	16	6	5	5
IB	79.8	70.1	26.390	35.135	22.162	24.864	13.266	20.256	10.12	32.432	26.248	23.537	58.059	59.201	11	13	16	6	4	4
IB	83.1	75.6	25.793	37.435	23.076	23.076	17.857	22.751	9.788	34.358	25	25.396	57.010	62.037	12	13	15	6	5	4
IB	104.7	90.3	28.792	33.461	21.153	28.076	14.285	23.034	12.07	36.153	27.021	29.125	53.156	59.025	11	12	16	6	5	4
IB	100.5	87	29.080	35.177	20.553	27.272	15.057	21.494	10.80	32.015	30.574	28.160	52.413	55.862	12	12	16	6	5	4
IB	84.9	72.3	28.077	35.467	23.152	24.630	14.937	19.778	10.37	35.960	24.343	25.864	53.803	58.921	11	13	16	6	4	4
IB	80.9	72.5	29.103	33.649	19.905	20.853	13.379	21.241	10.48	35.545	26.896	23.448	53.793	58.482	11	13	16	6	5	4
IB	78.3	68.7	27.074	34.946	23.118	24.731	13.391	21.397	11.64	32.795	25.764	24.745	51.382	60.698	11	13	17	6	5	4
IB	109.7	95.1	26.393	34.262	21.513	25.099	11.146	16.403	10.51	32.270	33.123	29.022	56.572	62.460	11	12	16	6	5	4
IB	84.6	77.2	25.388	36.224	22.448	22.448	18.911	20.725	10.75	34.693	25.388	22.797	54.922	65.025	11	12	16	6	5	4
IB	87.4	76.4	26.963	39.805	22.815	25.242	17.931	22.643	10.99	37.378	24.345	22.774	57.722	64.921	12	13	16	6	5	4
IB	70.4	59.5	28.235	29.166	24.404	24.404	9.5798	16.134	9.915	37.5	27.563	25.378	50.588	61.176	12	13	16	6	5	4
IB	80.4	67.1	27.719	29.032	22.580	18.817	11.177	14.008	9.090	30.107	27.421	28.464	49.776	60.208	11	12	16	6	5	4
IB	105.8	93.6	25.427	34.453	22.268	23.529	10.256	15.918	8.867	32.352	32.051	27.136	55.982	58.547	11	12	16	6	5	4
IB	86	74.4	29.569	31.818	21.363	24.545	12.768	19.489	10.75	30.909	27.419	25.403	53.091	60.618	12	13	16	6	5	4
IB	110.3	86.4	29.166	38.492	20.238	24.603	19.560	23.611	10.18	31.349	29.513	27.893	63.425	74.305	11	13	16	6	5	4
IB	85.9	73.2	27.459	37.313	19.402	22.885	16.803	21.311	9.972	36.318	26.092	24.043	54.918	68.579	11	12	16	6	5	4
IB	107.9	96.1	27.159	35.632	22.222	26.436	18.106	21.956	10.30	32.950	29.136	26.014	55.359	65.140	11	13	16	6	5	4
IB	76.9	66.5	27.819	36.216	21.621	20.540	13.834	19.248	10.67	30.810	24.661	24.360	53.383	60.300	11	13	16	6	4	4
IB	102.4	89.7	27.424	39.024	24.390	25.203	14.938	21.293	11.81	31.300	30.546	27.870	51.282	57.302	11	13	16	6	4	4
IB	98.3	86.4	27.777	40	22.916	30	16.666	21.990	11.34	35.416	26.851	26.620	50.810	55.902	11	12	16	6	4	4
IB	90.1	78.8	25.253	36.180	21.105	22.613	15.989	19.543	10.65	39.698	29.060	28.172	54.314	61.928	11	13	16	6	5	4
IB	128.4	109.4	26.782	37.883	21.843	27.303	14.168	21.297	11.15	31.058	29.524	25.502	58.318	65.082	12	13	16	6	5	4
IB	80.1	65.3	28.177	41.304	22.826	23.369	15.926	24.655	10.10	35.326	22.358	26.493	59.571	68.453	11	13	14	6	5	4
IB	75.8	62.3	28.571	37.078	21.348	23.033	13.804	21.348	10.43	35.393	21.829	26.805	56.340	60.995	11	13	16	6	5	4
IB	89.7	73.7	27.815	37.073	23.902	23.902	17.910	22.659	9.633	33.170	26.458	24.287	58.751	66.485	12	12	16	6	5	4
IB	68.6	55.7	29.263	32.515	26.993	23.312	15.619	21.005	10.77	32.515	22.262	28.186	58.886	67.324	11	13	14	6	5	4
IB	86.9	73.7	28.900	30.516	22.065	23.474	16.824	19.267	9.090	31.924	27.001	22.659	59.023	66.214	11	13	14	6	5	4
IB	76.3	63.9	27.856	34.831	23.033	26.966	12.832	19.874	10.32	35.955	28.951	26.291	53.208	59.780	12	13	16	6	5	4
IB	79.2	66.1	28.290	36.363	21.390	24.064	14.826	21.633	11.19	36.898	26.172	24.810	55.219	59.455	11	13	14	6	5	4
IB	69.9	56.1	11.942	73.134	56.716	43.283	14.081	21.212	10.87	83.582	26.024	24.598	57.754	64.349	12	13	17	6	5	4

IB	78.8	66.6	27.327	35.714	26.373	24.175	15.615	20.870	10.81	36.263	25.225	20.570	54.954	57.357	12	13	16	6	5	4
IB	78.8	65.6	27.134	37.640	24.719	24.719	14.634	19.664	10.51	34.831	25.609	23.780	56.097	60.670	11	12	16	6	5	4
IB	82.5	69.7	28.550	35.175	25.125	25.628	15.638	21.233	10.90	39.195	24.103	28.694	54.088	57.675	11	13	17	6	4	4
IB	.	72.1	24.133	37.356	26.436	28.160	15.256	20.943	10.40	34.482	24.826	22.052	57.142	64.909	11	13	15	6	5	4
IB	97.6	83.5	25.748	32.093	22.790	25.581	13.053	23.113	10.17	30.232	25.628	26.946	55.209	64.790	11	13	16	6	5	4
IB	87.8	74.4	25.268	38.829	24.468	28.191	13.306	20.295	10.75	42.021	20.698	23.790	56.586	59.811	12	12	16	6	4	4
IB	104.4	88.8	26.463	36.170	23.404	26.382	19.707	24.324	9.684	37.872	27.702	25.675	55.743	64.076	11	13	16	6	5	4
IB	104.8	90.8	24.339	40.271	23.981	27.149	17.621	24.339	10.02	37.104	28.964	25.330	54.735	62.775	12	13	16	6	4	4
IB	94.1	81	23.703	45.833	26.562	30.729	14.197	22.469	10.74	34.375	25.185	23.827	50.370	59.753	11	15	16	6	5	4
IB	103.1	85.8	23.892	40.487	22.926	28.292	17.365	22.027	10.37	39.512	25.058	23.776	57.808	66.317	12	13	15	6	5	4
IB	96.6	82.2	25.790	38.679	23.584	25.943	13.746	22.871	10.46	37.735	27.493	21.897	53.406	59.489	11	13	16	6	5	4
IB	98.9	81.3	26.691	38.709	22.580	24.884	18.696	23.124	9.840	33.640	24.231	21.402	56.088	65.067	11	13	16	6	5	4
IB	79	66.1	29.652	37.244	24.489	24.489	13.010	21.785	10.74	31.122	23.146	21.180	51.437	61.119	11	13	16	6	5	4
IB	77.8	67.9	29.013	31.979	23.350	23.857	13.107	20.913	11.92	28.426	21.060	23.858	52.282	58.762	11	13	16	6	4	4
LL	99.9	87.5	28.228	34.817	21.052	23.886	17.257	22.857	11.08	37.246	28.228	25.142	51.771	58.285	12	13	16	6	4	5
LL	103.1	91	30.219	37.818	23.636	23.636	17.912	23.406	12.08	36	26.483	25.934	54.065	59.670	12	12	16	6	5	4
LL	101.1	88.1	27.922	40.243	23.577	23.983	16.004	19.409	10.78	35.772	26.106	24.744	53.461	65.153	11	13	16	6	5	4
LL	73.8	62.8	28.821	39.226	22.099	24.309	16.719	20.063	11.14	30.939	25.159	26.751	57.961	63.853	12	12	16	6	4	4
LL	98.7	85.2	29.225	37.751	22.088	23.293	16.431	22.300	11.73	32.530	29.107	25.469	54.460	60.563	11	12	16	6	4	4
LL	106.2	94.9	27.397	39.230	23.461	22.692	15.068	19.704	10.32	39.615	30.242	29.083	53.530	64.910	11	13	16	6	4	4
LL	69.4	58	28.275	39.024	25.609	25	16.034	21.034	12.41	31.707	30.689	25.172	54.827	60.172	11	13	16	6	5	4
LL	101.6	87.9	30.147	35.849	21.509	23.396	16.951	21.387	11.14	29.811	26.621	22.639	52.787	61.092	12	13	16	6	5	4
LL	98.6	85.9	28.870	37.096	20.967	24.596	16.065	22.002	11.17	33.870	28.405	24.447	53.550	61.466	11	13	16	6	5	4
LL	99.5	85.4	28.454	37.448	24.279	22.222	17.213	22.833	11.24	36.213	27.166	25.058	56.088	61.007	12	13	16	6	5	4
LL	92.2	81	29.135	36.864	20.338	24.152	15.802	21.604	11.35	38.135	26.666	25.802	53.827	61.728	11	13	16	6	5	4
LL	92.6	80	30.75	34.959	14.634	23.170	16.125	22.375	11.37	36.178	24.5	25.375	51.375	58.5	11	13	16	6	5	4
LL	85.8	75.5	26.490	35.5	28	24.5	16.158	19.867	10.59	34	26.622	25.695	55.894	63.046	11	13	16	6	5	4
LL	57.2	47.7	30.398	30.344	32.413	21.379	16.352	21.174	12.36	31.724	30.817	24.737	56.184	63.102	12	12	14	6	5	4
LL	101.7	90	28.777	44.015	25.096	26.254	16.555	22.666	11.22	39.382	27.555	27.444	55.444	61.444	11	12	14	6	5	4
LL	84.7	73.5	28.163	41.062	25.120	24.637	16.054	22.993	11.29	38.164	23.401	25.850	53.333	58.367	11	13	16	6	5	4
LL	52.1	43.7	27.688	35.537	23.140	23.140	14.645	18.306	11.21	33.057	22.425	22.654	52.860	60.411	11	12	16	6	4	4
LL	91.4	80.9	27.194	36.818	23.636	27.272	16.934	21.137	10.63	33.181	29.048	26.081	54.882	62.299	11	13	16	6	4	4
LL	80.4	70.5	27.375	36.787	24.352	24.870	15.886	21.843	10.92	33.160	32.907	27.801	54.893	60.283	12	13	16	6	5	4
LL	102.5	88.7	27.733	38.211	23.170	26.016	16.572	22.209	10.71	36.991	25.366	27.508	56.820	66.065	11	13	16	6	4	4
LL	103.1	92.5	29.729	36.363	18.909	24.363	26.594	22.486	11.24	33.454	26.378	24.648	55.459	62.270	11	13	16	6	5	4
LL	76.9	66.5	26.315	38.857	25.142	24	15.789	19.248	11.42	37.714	30.526	26.315	55.338	59.849	12	13	16	6	5	4
LL	62.8	53.9	27.458	34.459	23.648	27.027	15.213	21.335	10.01	31.081	30.612	40.816	55.287	60.853	11	12	16	6	4	4

LL	89.8	76.2	29.002	40.723	23.529	28.506	15.748	20.997	11.02	32.579	27.821	25.196	55.380	62.467	11	12	14	6	5
LL	64.1	56.3	25.754	38.620	27.586	26.896	15.985	18.650	10.47	30.344	27.353	26.820	54.351	61.278	12	13	16	6	4
LL	59.7	52.1	27.063	34.042	24.113	22.695	14.779	19.577	10.36	35.460	31.669	29.750	54.894	62.380	11	12	16	6	4
LL	97	83.4	27.817	37.068	22.413	25	16.666	20.743	10.55	33.620	25.779	24.340	55.755	64.028	11	13	16	6	5
LL	91.2	81.1	27.620	37.053	20.982	25.892	16.276	20.715	10.72	32.142	28.729	27.620	55.980	65.967	11	13	14	6	5
LL	87	75.6	27.777	40.476	22.857	28.095	16.534	21.164	10.58	33.809	25.661	26.851	56.746	62.301	12	13	14	6	5
LL	73.9	61.4	29.641	40.109	24.725	23.076	16.286	19.055	10.58	34.615	26.058	19.055	58.306	66.612	11	13	14	6	4
LL	58.8	49.8	28.112	30	23.571	22.142	14.257	19.477	11.24	30.714	26.907	24.698	56.024	61.244	11	12	14	6	4
LL	103.5	90.8	29.955	36.029	21.323	22.794	17.621	21.035	10.90	35.661	28.744	21.145	53.744	63.546	12	12	16	6	5
LL	96.5	82.8	29.468	37.704	24.180	23.770	19.202	23.188	12.07	36.475	26.086	19.444	54.227	60.265	11	13	16	6	5
LL	99.3	85.8	28.205	37.603	20.661	23.140	17.832	22.027	11.30	33.057	28.205	22.494	56.643	64.685	11	13	16	6	4
LL	84.9	72.2	29.362	37.735	23.113	26.886	16.897	22.576	11.21	33.018	28.947	25.069	54.155	63.850	11	12	16	6	5
LL	101.8	89.2	29.035	37.451	21.235	23.166	16.704	22.533	10.20	34.749	30.941	26.569	56.726	66.367	11	13	16	6	5
LL	94.3	82	29.146	33.891	20.920	22.594	6.4634	21.585	10.73	35.146	28.170	25.853	56.219	65.121	12	12	16	6	5
LL	85.8	75.5	29.139	39.545	24.545	23.181	16.026	21.456	10.72	33.181	26.490	26.490	53.642	60.794	12	13	16	6	4
LL	91.8	81.6	25.735	38.095	25.714	27.619	16.544	19.485	10.66	30	26.960	25.245	54.289	64.705	11	13	16	6	5
LL	66.5	57.3	26.352	37.748	25.165	25.165	16.404	21.116	11.34	31.788	26.352	30.017	57.591	63.699	12	12	14	6	4
LL	79.9	70.6	28.895	38.235	25.490	25.490	16.855	20.113	11.75	32.352	28.895	28.186	55.524	61.898	11	12	16	6	5
LL	70.8	62	27.096	35.119	26.785	27.380	15.483	19.354	10.80	32.142	27.096	30.806	55.483	62.096	11	12	14	6	5
VER	76.3	66.3	26.093	35.260	23.699	27.167	13.876	19.909	11.76	31.791	22.926	19.909	52.036	57.616	12	13	16	6	5
VER	63.1	53.9	28.014	35.099	25.827	28.476	15.584	21.706	11.31	29.139	30.241	19.109	55.287	61.966	11	13	16	6	4
VER	59.7	50.8	29.330	30.872	27.516	20.805	14.173	18.307	9.645	34.228	29.133	27.952	55.905	60.236	11	13	14	6	5
VER	64.1	56.2	25.800	37.931	27.586	26.206	15.658	18.149	10.67	31.724	26.868	26.690	53.736	60.320	12	13	16	6	4
VER	63.6	55.8	25.448	36.619	28.169	26.056	15.412	20.071	11.11	29.577	26.344	26.164	52.150	59.498	11	13	16	6	4
VER	75.1	64.5	28.682	27.567	23.243	18.378	15.038	18.139	10.85	32.972	24.806	28.527	55.348	60.620	11	13	16	6	5
VER	62.8	52.9	28.166	34.899	23.489	26.845	15.500	21.550	11.15	32.214	30.812	40.831	54.253	62.003	11	12	16	6	5
VER	64.1	56.3	26.110	38.095	28.571	27.210	15.985	18.650	10.30	36.734	27.353	26.465	53.818	60.035	11	13	16	6	4
VER	66.5	58	26.206	36.184	24.342	25	16.034	21.034	11.20	32.236	25.517	23.448	57.241	63.620	11	12	16	6	4
VER	62.1	52.6	26.996	34.507	24.647	28.169	15.209	21.102	10.26	33.098	29.087	30.988	54.182	57.604	11	12	16	6	4
VER	73.4	65.4	24.464	39.375	23.75	24.375	13.761	19.113	10.55	36.25	24.159	24.770	38.685	59.633	12	13	16	6	4
VER	63.1	55.4	25.992	38.194	23.611	25	15.523	17.870	11.01	31.944	27.797	27.075	53.610	60.649	12	13	16	6	5
VER	76.1	66.9	25.560	35.087	25.730	21.637	14.200	17.339	9.566	35.087	29.446	23.617	55.007	60.089	12	13	15	6	5
VER	59.9	52.8	28.787	32.236	29.605	24.342	14.393	19.318	10.03	32.894	29.166	23.295	56.25	59.280	11	13	14	6	5
VER	85.3	73.2	29.371	37.209	19.534	26.976	16.666	22.540	11.33	33.488	28.688	25	54.098	62.704	12	12	16	6	5
VER	52.4	43.3	27.944	36.363	23.140	23.966	15.242	18.244	12.24	42.148	22.632	21.016	53.117	60.277	11	12	16	6	5
VER	74	61.7	29.335	40.883	22.099	23.756	16.369	20.421	10.53	33.701	26.256	19.286	58.346	66.774	11	13	16	6	5
VER	56.9	46.9	30.703	29.861	28.472	23.611	16.417	22.814	12.79	36.805	30.490	21.961	56.289	61.833	11	12	16	6	5

APPENDIX II DATA – Fyke net catch data including water and air temperature, wind direction and velocity, length of banded killifish, and other species (SJ – Salmon Juvenile; STB – Sticklebacks; AE – American Eel; BK – Banded Killifish).

Lake/Site	Date	Time	Air Temp	Water Temp	Wind	Cloud Cover (%)	Species	#	TL
Freshwater Pond	1999-08-27	11:05am	9	16	SE/Moderate	95	SJ	2	NA
Freshwater Pond	1999-08-27	11:05am	9	16	SE/Moderate	95	STB	105	NA
Freshwater Pond	1999-08-27	11:05am	9	16	SE/Moderate	95	BK	1	6.7
Freshwater Pond	1999-08-27	11:05am	9	16	SE/Moderate	95	BK	1	6.5
Freshwater Pond	1999-08-27	11:05am	9	16	SE/Moderate	95	BK	1	6.3
Freshwater Pond	1999-08-27	11:05am	9	16	SE/Moderate	95	BK	1	7.1
Freshwater Pond	1999-08-27	11:05am	9	16	SE/Moderate	95	BK	1	7.2
Freshwater Pond	1999-08-27	11:05am	9	16	SE/Moderate	95	BK	1	7.2
Freshwater Pond	1999-08-27	11:05am	9	16	SE/Moderate	95	BK	1	6.9
Freshwater Pond	1999-08-27	11:05am	9	16	SE/Moderate	95	BK	1	6.8
Freshwater Pond	1999-08-27	11:05am	9	16	SE/Moderate	95	BK	1	7
Freshwater Pond	1999-08-27	11:05am	9	16	SE/Moderate	95	BK	1	7.4
Freshwater Pond	1999-08-27	11:05am	9	16	SE/Moderate	95	BK	1	7.3
Freshwater Pond	1999-08-27	11:05am	9	16	SE/Moderate	95	BK	1	7.6
Freshwater Pond	1999-08-27	11:05am	9	16	SE/Moderate	95	BK	1	6.9
Freshwater Pond	1999-08-27	11:05am	9	16	SE/Moderate	95	BK	1	6.5
Freshwater Pond	1999-08-27	11:05am	9	16	SE/Moderate	95	BK	1	7
Freshwater Pond	1999-08-27	11:05am	9	16	SE/Moderate	95	BK	1	6.2
Freshwater Pond	1999-08-27	11:05am	9	16	SE/Moderate	95	BK	1	6.2
Freshwater Pond	1999-08-27	11:05am	9	16	SE/Moderate	95	BK	1	6.4
Freshwater Pond	1999-08-27	11:05am	9	16	SE/Moderate	95	BK	1	6.3
Freshwater Pond	1999-08-27	11:05am	9	16	SE/Moderate	95	BK	1	6.1
Freshwater Pond	1999-08-27	11:25am	9	15	SE/Moderate	95	STB	45	NA
Freshwater Pond	1999-08-27	11:25am	9	15	SE/Moderate	95	BK	1	6.8
Freshwater Pond	1999-08-27	11:25am	9	15	SE/Moderate	95	BK	1	7
Freshwater Pond	1999-08-27	11:25am	9	15	SE/Moderate	95	BK	1	7.4
Freshwater Pond	1999-08-27	11:25am	9	15	SE/Moderate	95	BK	1	6.5
Freshwater Pond	1999-08-27	11:25am	9	15	SE/Moderate	95	BK	1	7
Freshwater Pond	1999-08-27	11:25am	9	15	SE/Moderate	95	BK	1	6.2
Freshwater Pond	1999-08-27	11:25am	9	15	SE/Moderate	95	BK	1	6.3
Freshwater Pond	1999-08-27	11:25am	9	15	SE/Moderate	95	BK	1	7.1

Freshwater Pond	1999-08-27	11:25am	9	15	SE/Moderate	95	BK	1	7.2
Freshwater Pond	1999-08-27	11:25am	9	15	SE/Moderate	95	BK	1	7
Freshwater Pond	1999-08-27	11:25am	9	14	SE/Moderate	95	BK	1	6.2
Freshwater Pond	1999-08-27	10.30am	9	14	SE/Moderate	95	STB	7	NA
Freshwater Pond	1999-08-27	10.30am	9	14	SE/Moderate	95	BK	1	6.9
Freshwater Pond	1999-08-27	10.30am	9	14	SE/Moderate	95	BK	1	6.2
Freshwater Pond	1999-09-01	12.15 pm	25	16	Southerly Light	0	STB	200	NA
Freshwater Pond	1999-09-01	12.15 pm	25	16	Southerly Light	0	BK	1	7.4
Freshwater Pond	1999-09-01	12.15 pm	25	16	Southerly Light	0	BK	1	6.4
Freshwater Pond	1999-09-01	12.15 pm	25	16	Southerly Light	0	BK	1	9.3
Freshwater Pond	1999-09-01	12.15 pm	25	16	Southerly Light	0	BK	1	11.6
Freshwater Pond	1999-09-01	12.15 pm	25	16	Southerly Light	0	BK	1	7.1
Freshwater Pond	1999-09-01	12.15 pm	25	16	Southerly Light	0	BK	1	6.8
Freshwater Pond	1999-09-01	12.15 pm	25	16	Southerly Light	0	BK	1	9.5
Freshwater Pond	1999-09-01	12.15 pm	25	16	Southerly Light	0	BK	1	7.4
Freshwater Pond	1999-09-01	12.15 pm	25	16	Southerly Light	0	BK	1	7
Freshwater Pond	1999-09-01	12.15 pm	25	16	Southerly Light	0	BK	1	6.5
Freshwater Pond	1999-09-01	12.15 pm	25	16	Southerly Light	0	BK	1	5.8
Freshwater Pond	1999-09-01	12.15 pm	25	16	Southerly Light	0	BK	1	8.8
Freshwater Pond	1999-09-01	12.15 pm	25	16	Southerly Light	0	BK	1	6.6
Freshwater Pond	1999-09-01	12.15 pm	25	16	Southerly Light	0	BK	1	6.8
Freshwater Pond	1999-09-01	12.15 pm	25	16	Southerly Light	0	BK	1	6.6
Freshwater Pond	1999-09-01	12.15 pm	25	16	Southerly Light	0	BK	1	6.6
Freshwater Pond	1999-09-01	12.15 pm	25	16	Southerly Light	0	BK	1	7.2
Freshwater Pond	1999-09-01	12.15 pm	25	16	Southerly Light	0	BK	1	7.6
Freshwater Pond	1999-09-01	12.15 pm	25	16	Southerly Light	0	STB	111	NA
Freshwater Pond	1999-09-01	12.15 pm	25	16	Southerly Light	0	BK	1	8.8
Freshwater Pond	1999-09-01	12.15 pm	25	16	Southerly Light	0	BK	1	11.6
Freshwater Pond	1999-09-01	12.15 pm	25	16	Southerly Light	0	BK	1	6.8
Freshwater Pond	1999-09-01	12.15 pm	25	16	Southerly Light	0	BK	1	6.6
Freshwater Pond	1999-09-01	12.15 pm	25	16	Southerly Light	0	BK	1	6.8
Freshwater Pond	1999-09-01	12.15 pm	25	16	Southerly Light	0	BK	1	9.5
Freshwater Pond	1999-09-01	12.15 pm	25	16	Southerly Light	0	BK	1	6.8
Freshwater Pond	1999-09-01	12.15 pm	25	16	Southerly Light	0	BK	1	9.5

Freshwater Pond	1999-09-01	12.15 pm	25	16	Southerly Light	0	BK	1	6.6
Freshwater Pond	1999-09-01	11.30 am	22	16	Southerly/ Light	0	SM	1	NA
Freshwater Pond	1999-09-01	11.30 am	22	16	Southerly/ Light	0	STB	250	NA
Freshwater Pond	1999-09-01	11.30 am	22	16	Southerly/ Light	0	BK	1	12
Freshwater Pond	1999-09-01	11.30 am	22	16	Southerly/ Light	0	BK	1	6.2
Freshwater Pond	1999-09-01	11.30 am	22	16	Southerly/ Light	0	BK	1	6.9
Freshwater Pond	1999-09-01	11.30 am	22	16	Southerly/ Light	0	BK	1	8.2
Freshwater Pond	1999-09-01	11.30 am	22	16	Southerly/ Light	0	BK	1	11.4
Freshwater Pond	1999-09-01	11.30 am	22	16	Southerly/ Light	0	BK	1	9.3
Freshwater Pond	1999-09-01	11.30 am	22	16	Southerly/ Light	0	BK	1	7.6
Freshwater Pond	1999-09-01	11.30 am	22	16	Southerly/ Light	0	BK	1	7.6
Freshwater Pond	1999-09-01	11.30 am	22	16	Southerly/ Light	0	BK	1	7.3
Freshwater Pond	1999-09-01	11.30 am	22	16	Southerly/ Light	0	BK	1	6.5
Freshwater Pond	1999-09-01	11.30 am	22	16	Southerly/ Light	0	BK	1	7.2
Freshwater Pond	1999-09-01	11.30 am	22	16	Southerly/ Light	0	BK	1	6.4
Freshwater Pond	1999-09-01	11.30 am	22	16	Southerly/ Light	0	BK	1	6
Freshwater Pond	1999-09-01	11.30 am	22	16	Southerly/ Light	0	BK	1	6.9
Freshwater Pond	1999-09-01	11.30 am	22	16	Southerly/ Light	0	BK	1	6.8
Freshwater Pond	1999-09-01	11.30 am	22	16	Southerly/ Light	0	BK	1	7.1
Freshwater Pond	1999-09-01	11.30 am	22	16	Southerly/ Light	0	BK	1	6.9
Freshwater Pond	1999-09-01	11.30 am	22	16	Southerly/ Light	0	BK	1	6.7
Freshwater Pond	1999-09-01	11.30 am	22	16	Southerly/ Light	0	BK	1	8.1
Freshwater Pond	1999-09-01	11.30 am	22	16	Southerly/ Light	0	BK	1	6.3
Freshwater Pond	1999-09-01	11.30 am	22	16	Southerly/ Light	0	BK	1	7.2
Freshwater Pond	1999-09-01	11.30 am	22	16	Southerly/ Light	0	BK	1	6.5
Freshwater Pond	1999-09-01	11.30 am	22	16	Southerly/ Light	0	BK	1	6.6
Freshwater Pond	1999-09-01	11.30 am	22	16	Southerly/ Light	0	BK	1	7
Freshwater Pond	1999-09-01	11.30 am	22	16	Southerly/ Light	0	BK	1	7.1
Freshwater Pond	1999-09-01	11.30 am	22	16	Southerly/ Light	0	BK	1	7.6
Freshwater Pond	1999-09-01	11.30 am	22	16	Southerly/ Light	0	BK	1	6.9
Freshwater Pond	1999-09-01	11.30 am	22	16	Southerly/ Light	0	BK	1	7.4
Freshwater Pond	1999-09-01	11.30 am	22	16	Southerly/ Light	0	BK	1	7.4
Freshwater Pond	1999-09-01	11.30 am	22	16	Southerly/ Light	0	BK	1	7.4
Freshwater Pond	1999-09-01	11.30 am	22	16	Southerly/ Light	0	BK	1	7.2
Freshwater Pond	1999-09-01	11.30 am	22	16	Southerly/ Light	0	BK	1	6.3

Freshwater Pond	1999-09-01	11.30 am	22	16	Southerly/ Light	0	BK	1	6.5
Freshwater Pond	2002-08-04	1.30 pm	22	18	Southerly/ Light	0	BK	1	7.1
Freshwater Pond	2002-08-04	1.30 pm	22	18	Southerly/ Light	0	BK	1	6.9
Freshwater Pond	2002-08-04	1.30 pm	22	18	Southerly/ Light	0	BK	1	6.7
Freshwater Pond	2002-08-04	1.30 pm	22	18	Southerly/ Light	0	BK	1	8.1
Freshwater Pond	2002-08-04	1.30 pm	22	18	Southerly/ Light	0	BK	1	6.3
Freshwater Pond	2002-08-04	1.30 pm	22	18	Southerly/ Light	0	BK	1	7.2
Freshwater Pond	2002-08-04	1.30 pm	22	18	Southerly/ Light	0	BK	1	6.5
Freshwater Pond	2002-08-04	1.30 pm	22	18	Southerly/ Light	0	BK	1	6.7
Freshwater Pond	2002-08-04	1.30 pm	22	18	Southerly/ Light	0	BK	1	8.1
Freshwater Pond	2002-08-04	1.30 pm	22	18	Southerly/ Light	0	BK	1	7.4
Freshwater Pond	2002-08-04	1.30 pm	22	18	Southerly/ Light	0	BK	1	7.2
Freshwater Pond	2002-08-04	1.30 pm	22	18	Southerly/ Light	0	BK	1	6.3
Freshwater Pond	2002-08-04	1.30 pm	22	18	Southerly/ Light	0	BK	1	7.4
Freshwater Pond	2002-08-04	1.30 pm	22	18	Southerly/ Light	0	BK	1	9
Freshwater Pond	2002-08-04	1.30 pm	22	18	Southerly/ Light	0	BK	1	6.3
Freshwater Pond	2002-08-04	1.30 pm	22	18	Southerly/ Light	0	BK	1	10.4
Freshwater Pond	2002-08-04	1.30 pm	22	18	Southerly/ Light	0	BK	1	9.3
Freshwater Pond	2002-08-04	1.30 pm	22	18	Southerly/ Light	0	BK	1	7.4
Freshwater Pond	2002-08-04	1.30 pm	22	18	Southerly/ Light	0	BK	1	6.9
Freshwater Pond	2002-08-04	1.30 pm	22	18	Southerly/ Light	0	BK	1	7.3
Freshwater Pond	2002-08-04	1.30 pm	22	18	Southerly/ Light	0	BK	1	7.6
Freshwater Pond	2002-08-04	1.30 pm	22	18	Southerly/ Light	0	BK	1	6.8
Freshwater Pond	2002-08-04	1.30 pm	22	18	Southerly/ Light	0	BK	1	7.1
Freshwater Pond	2002-08-04	1.30 pm	22	18	Southerly/ Light	0	BK	1	6.9
Freshwater Pond	2002-08-04	1.30 pm	22	18	Southerly/ Light	0	BK	1	6.7
Freshwater Pond	2002-08-04	1.30 pm	22	18	Southerly/ Light	0	BK	1	8.1
Freshwater Pond	2002-08-04	1.30 pm	22	18	Southerly/ Light	0	BK	1	6.3
Freshwater Pond	2002-08-04	1.30 pm	22	18	Southerly/ Light	0	BK	1	7.2
Freshwater Pond	2002-08-04	1.30 pm	22	18	Southerly/ Light	0	BK	1	6.5
Freshwater Pond	2002-08-04	1.30 pm	22	18	Southerly/ Light	0	BK	1	6.6
Freshwater Pond	2002-08-04	1.30 pm	22	18	Southerly/ Light	0	BK	1	7.2
Freshwater Pond	2002-08-04	1.30 pm	22	18	Southerly/ Light	0	BK	1	6.3
Freshwater Pond	2002-08-04	1.30 pm	22	18	Southerly/ Light	0	BK	1	6.6
Freshwater Pond	2002-08-04	1.30 pm	22	18	Southerly/ Light	0	BK	1	7.4
Freshwater Pond	2002-08-04	1.30 pm	22	18	Southerly/ Light	0	BK	1	7.6

Freshwater Pond	2002-08-04	1.30 pm	22	18	Southerly/ Light	0	BK	1	7.3
Freshwater Pond	2002-08-04	1.30 pm	22	18	Southerly/ Light	0	BK	1	7.6
Freshwater Pond	2002-08-04	1.30 pm	22	18	Southerly/ Light	0	BK	1	6.8
Freshwater Pond	2002-08-04	1.30 pm	22	18	Southerly/ Light	0	BK	1	7.1
Freshwater Pond	2002-08-04	1.30 pm	22	18	Southerly/ Light	0	BK	1	9.5
Freshwater Pond	2002-08-04	1.30 pm	22	18	Southerly/ Light	0	BK	1	6.8
Freshwater Pond	2002-08-04	1.30 pm	22	18	Southerly/ Light	0	BK	1	7.6
Freshwater Pond	2002-08-04	1.30 pm	22	18	Southerly/ Light	0	BK	1	6.3
Freshwater Pond	2002-08-04	1.30 pm	22	18	Southerly/ Light	0	BK	1	6.6
Freshwater Pond	2002-08-04	1.30 pm	22	18	Southerly/ Light	0	BK	1	7.3
Freshwater Pond	2002-08-04	1.30 pm	22	18	Southerly/ Light	0	BK	1	10.2
Freshwater Pond	2002-08-04	1.30 pm	22	18	Southerly/ Light	0	BK	1	6.4
Freshwater Pond	2002-08-04	1.30 pm	22	18	Southerly/ Light	0	BK	1	7.3
Freshwater Pond	2002-08-04	1.30 pm	22	18	Southerly/ Light	0	BK	1	7.6
Freshwater Pond	2002-08-04	1.30 pm	22	18	Southerly/ Light	0	BK	1	6.8
Freshwater Pond	2002-08-04	1.30 pm	22	18	Southerly/ Light	0	BK	1	6.6

Freshwater Pond	2002-08-04	12.15 pm	22	18	Southerly Light	0	STB	38	NA
Freshwater Pond	2002-08-04	12.15 pm	22	18	Southerly Light	0	BK	1	7.4
Freshwater Pond	2002-08-04	12.15 pm	22	18	Southerly Light	0	BK	1	7.6
Freshwater Pond	2002-08-04	12.15 pm	22	18	Southerly Light	0	BK	1	7.3
Freshwater Pond	2002-08-04	12.15 pm	22	18	Southerly Light	0	BK	1	6.8
Freshwater Pond	2002-08-04	12.15 pm	22	18	Southerly Light	0	BK	1	6.8
Freshwater Pond	2002-08-04	12.15 pm	22	18	Southerly Light	0	BK	1	7.1
Freshwater Pond	2002-08-04	12.15 pm	22	18	Southerly Light	0	BK	1	9.5
Freshwater Pond	2002-08-04	12.15 pm	22	18	Southerly Light	0	BK	1	6.8
Freshwater Pond	2002-08-04	12.15 pm	22	18	Southerly Light	0	BK	1	11.6
Freshwater Pond	2002-08-04	12.15 pm	22	18	Southerly Light	0	BK	1	6.8
Freshwater Pond	2002-08-04	12.15 pm	22	18	Southerly Light	0	BK	1	6.6
Freshwater Pond	2002-08-04	12.15 pm	22	18	Southerly Light	0	BK	1	7.6
Freshwater Pond	2002-08-04	12.15 pm	22	18	Southerly Light	0	BK	1	6.8
Freshwater Pond	2002-08-04	12.15 pm	22	18	Southerly Light	0	BK	1	7.1
Freshwater Pond	2002-08-04	12.15 pm	22	18	Southerly Light	0	BK	1	7.6
Freshwater Pond	2002-08-04	12.15 pm	22	18	Southerly Light	0	BK	1	7.3
Freshwater Pond	2002-08-04	12.15 pm	22	18	Southerly Light	0	BK	1	7.6
Freshwater Pond	2002-08-04	12.15 pm	22	18	Southerly Light	0	BK	1	6.8

Freshwater Pond	2002-08-04	2.15 pm	25	18	Southerly Light	0	STB	65	NA
Freshwater Pond	2002-08-04	2.15 pm	25	18	Southerly Light	0	BK	1	6.3
Freshwater Pond	2002-08-04	2.15 pm	25	18	Southerly Light	0	BK	1	7.1
Freshwater Pond	2002-08-04	2.15 pm	25	18	Southerly Light	0	BK	1	7.2
Freshwater Pond	2002-08-04	2.15 pm	25	18	Southerly Light	0	BK	1	7.2
Freshwater Pond	2002-08-04	2.15 pm	25	18	Southerly Light	0	BK	1	6.9
Freshwater Pond	2002-08-04	2.15 pm	25	18	Southerly Light	0	BK	1	6.8
Freshwater Pond	2002-08-04	2.15 pm	25	18	Southerly Light	0	BK	1	7.3
Freshwater Pond	2002-08-04	2.15 pm	25	18	Southerly Light	0	BK	1	7.6
Freshwater Pond	2002-08-04	2.15 pm	25	18	Southerly Light	0	BK	1	6.8
Freshwater Pond	2002-08-04	2.15 pm	25	18	Southerly Light	0	BK	1	7.1
Freshwater Pond	2002-08-04	2.15 pm	25	18	Southerly Light	0	BK	1	7.1
Freshwater Pond	2002-08-04	2.15 pm	25	18	Southerly Light	0	BK	1	6.5
Freshwater Pond	2002-08-04	2.15 pm	25	18	Southerly Light	0	BK	1	7.1
Freshwater Pond	2002-08-04	2.15 pm	25	18	Southerly Light	0	BK	1	6.8
Freshwater Pond	2002-08-04	2.15 pm	25	18	Southerly Light	0	BK	1	7.2
Freshwater Pond	2002-08-04	2.15 pm	25	18	Southerly Light	0	BK	1	7.2
Freshwater Pond	2002-08-04	2.15 pm	25	18	Southerly Light	0	BK	1	7.2
Freshwater Pond	2002-08-04	2.15 pm	25	18	Southerly Light	0	BK	1	6.9
Freshwater Pond	2002-08-04	2.15 pm	25	18	Southerly Light	0	BK	1	6.8
Freshwater Pond	2002-08-04	2.15 pm	25	18	Southerly Light	0	BK	1	6.9
Freshwater Pond	2002-08-04	2.15 pm	25	18	Southerly Light	0	BK	1	7.3
Freshwater Pond	2002-08-04	2.15 pm	25	18	Southerly Light	0	BK	1	7.4
Freshwater Pond	2002-08-04	2.15 pm	25	18	Southerly Light	0	BK	1	7.3
Freshwater Pond	2002-08-04	2.15 pm	25	18	Southerly Light	0	BK	1	9.4
Freshwater Pond	2002-08-04	2.15 pm	25	18	Southerly Light	0	BK	1	11.3
Freshwater Pond	2002-08-04	2.15 pm	25	18	Southerly Light	0	BK	1	6.6
Freshwater Pond	2002-08-04	2.15 pm	25	18	Southerly Light	0	BK	1	7.3
Freshwater Pond	2002-08-04	2.15 pm	25	18	Southerly Light	0	BK	1	7.6
Freshwater Pond	2002-08-04	2.15 pm	25	18	Southerly Light	0	BK	1	6.8
Freshwater Pond	2002-08-04	2.15 pm	25	18	Southerly Light	0	BK	1	7.3
Freshwater Pond	2002-08-04	2.15 pm	25	18	Southerly Light	0	BK	1	7.6
Freshwater Pond	2002-08-04	2.15 pm	25	18	Southerly Light	0	BK	1	7.2
Freshwater Pond	2002-08-04	2.15 pm	25	18	Southerly Light	0	BK	1	6.5
Freshwater Pond	2002-08-04	2.15 pm	25	18	Southerly Light	0	BK	1	6.8
Freshwater Pond	2002-08-04	2.15 pm	25	18	Southerly Light	0	BK	1	7.3
Freshwater Pond	2002-08-04	2.15 pm	25	18	Southerly Light	0	BK	1	7.6

Freshwater Pond	2002-08-04	2.15 pm	25	18	Southerly Light	0	BK	1	6.8
Freshwater Pond	2002-08-04	2.15 pm	25	18	Southerly Light	0	BK	1	7.4
Freshwater Pond	2002-08-04	2.15 pm	25	18	Southerly Light	0	BK	1	6.8
Freshwater Pond	2002-08-04	2.15 pm	25	18	Southerly Light	0	BK	1	7.1
Freshwater Pond	2002-08-04	2.15 pm	25	18	Southerly Light	0	BK	1	7.1
Freshwater Pond	2002-08-04	2.15 pm	25	18	Southerly Light	0	BK	1	6.9
Freshwater Pond	2002-08-04	2.15 pm	25	18	Southerly Light	0	BK	1	7.1
Freshwater Pond	2002-08-04	2.15 pm	25	18	Southerly Light	0	BK	1	8.1
Freshwater Pond	2002-08-04	2.15 pm	25	18	Southerly Light	0	BK	1	6.3
Freshwater Pond	2002-08-04	2.15 pm	25	18	Southerly Light	0	BK	1	7.2
Freshwater Pond	2002-08-04	2.15 pm	25	18	Southerly Light	0	BK	1	6.5
Freshwater Pond	2002-08-04	2.15 pm	25	18	Southerly Light	0	BK	1	6.6
Freshwater Pond	2002-08-04	2.15 pm	25	18	Southerly Light	0	BK	1	7.4
Freshwater Pond	2002-08-04	2.15 pm	25	18	Southerly Light	0	BK	1	6.8
Freshwater Pond	2002-08-04	2.15 pm	25	18	Southerly Light	0	BK	1	7.4
Freshwater Pond	2002-08-04	2.15 pm	25	18	Southerly Light	0	BK	1	7.2
Freshwater Pond	2002-08-04	2.15 pm	25	18	Southerly Light	0	BK	1	7.6
Freshwater Pond	2002-08-04	2.15 pm	25	18	Southerly Light	0	BK	1	6.9
Freshwater Pond	2002-08-04	2.15 pm	25	18	Southerly Light	0	BK	1	7.2
Freshwater Pond	2002-08-04	2.15 pm	25	18	Southerly Light	0	BK	1	6.9
Freshwater Pond	2002-08-05	1.30 pm	15	16	Southerly/ Light	0	STB	98	NA
Freshwater Pond	2002-08-05	1.30 pm	15	16	Southerly/ Light	0	BK	1	6.8
Freshwater Pond	2002-08-05	1.30 pm	15	16	Southerly/ Light	0	BK	1	7.6
Freshwater Pond	2002-08-05	1.30 pm	15	16	Southerly/ Light	0	BK	1	6.8
Freshwater Pond	2002-08-05	1.30 pm	15	16	Southerly/ Light	0	BK	1	7.1
Freshwater Pond	2002-08-05	1.30 pm	15	16	Southerly/ Light	0	BK	1	9.5
Freshwater Pond	2002-08-05	1.30 pm	15	16	Southerly/ Light	0	BK	1	6.8
Freshwater Pond	2002-08-05	1.30 pm	15	16	Southerly/ Light	0	BK	1	7.6
Freshwater Pond	2002-08-05	1.30 pm	15	16	Southerly/ Light	0	BK	1	7.6
Freshwater Pond	2002-08-05	1.30 pm	15	16	Southerly/ Light	0	BK	1	7.6
Freshwater Pond	2002-08-05	1.30 pm	15	16	Southerly/ Light	0	BK	1	6.8
Freshwater Pond	2002-08-05	1.30 pm	15	16	Southerly/ Light	0	BK	1	7.2
Freshwater Pond	2002-08-05	1.30 pm	15	16	Southerly/ Light	0	BK	1	7.4
Freshwater Pond	2002-08-05	1.30 pm	15	16	Southerly/ Light	0	BK	1	8.7
Freshwater Pond	2002-08-05	1.30 pm	15	16	Southerly/ Light	0	BK	1	8.1

Loch Leven	1999-07-25	7:15am	10.6	19	Nil	0	AE	1	NA
Loch Leven	1999-07-25	7:15am	10.6	19	Nil	0	STB	1	NA
Loch Leven	1999-07-25	7:15am	10.6	19	Nil	0	BK	1	DEAD
Loch Leven	1999-07-25	7:15am	10.6	19	Nil	0	BK	1	Not full specimen
Loch Leven	1999-07-25	7:15am	10.6	19	Nil	0	BK	1	9.4
Loch Leven	1999-07-25	7:15am	10.6	19	Nil	0	BK	1	10.2
Loch Leven	1999-07-24	12:00pm	22.4	20	South/Light	10	AE	3	NA
Loch Leven	1999-07-24	12:00pm	22.4	20	South/Light	10	BK	1	9
Loch Leven	1999-07-24	12:00pm	22.4	20	South/Light	10	BK	1	9.5
Loch Leven	1999-07-24	12:00pm	22.4	20	South/Light	10	BK	1	10.6
Loch Leven	1999-07-24	12:00pm	22.4	20	South/Light	10	BK	1	10.1
Loch Leven	1999-07-24	12:00pm	22.4	20	South/Light	10	BK	1	9.1
Loch Leven	1999-07-24	12:00pm	22.4	20	South/Light	10	BK	1	7.1
Loch Leven	1999-07-24	12:00pm	22.4	20	South/Light	10	BK	1	11.4
Loch Leven	1999-07-24	12:00pm	22.4	20	South/Light	10	BK	1	9.5
Loch Leven	1999-07-24	12:00pm	22.4	20	South/Light	10	BK	1	6.8
Loch Leven	1999-07-24	12:00pm	22.4	20	South/Light	10	BK	1	7.6
Loch Leven	1999-07-24	12:00pm	22.4	20	South/Light	10	BK	1	11
Loch Leven	1999-07-24	12:00pm	22.4	20	South/Light	10	BK	1	7.6
Loch Leven	1999-07-24	12:00pm	22.4	20	South/Light	10	BK	1	7
Loch Leven	1999-07-24	12:00pm	22.4	20	South/Light	10	BK	1	10.4
Loch Leven	1999-07-24	12:00pm	22.4	20	South/Light	10	BK	1	9.8
Loch Leven	1999-07-24	12:00pm	22.4	20	South/Light	10	BK	1	10.8
Loch Leven	1999-07-24	12:00pm	22.4	20	South/Light	10	BK	1	6.3
Loch Leven	1999-07-24	12:00pm	22.4	20	South/Light	10	BK	1	10.8
Loch Leven	1999-07-24	12:00pm	22.4	20	South/Light	10	BK	1	8.1
Loch Leven	1999-07-24	12:00pm	22.4	20	South/Light	10	BK	1	6.6
Loch Leven	1999-07-24	12:00pm	22.4	20	South/Light	10	BK	1	9.8
Loch Leven	1999-07-24	12:00pm	22.4	20	South/Light	10	BK	1	7.4
Loch Leven	1999-07-24	12:00pm	22.4	20	South/Light	10	BK	1	10.8
Loch Leven	1999-07-24	12:00pm	22.4	20	South/Light	10	BK	1	9.1
Loch Leven	1999-07-24	12:00pm	22.4	20	South/Light	10	BK	1	7.1
Loch Leven	1999-07-24	12:00pm	22.4	20	South/Light	10	BK	1	6.9
Loch Leven	1999-07-24	12:00pm	22.4	20	South/Light	10	BK	1	9.6
Loch Leven	1999-07-24	12:00pm	22.4	20	South/Light	10	BK	1	10.7

Loch Leven	1999-07-24	12:00pm	22.4	20	South/Light	10	BK	1	6.3
Loch Leven	1999-07-24	12:00pm	22.4	20	South/Light	10	BK	1	8.9
Loch Leven	1999-07-24	12:00pm	22.4	20	South/Light	10	BK	1	7.9
Loch Leven	1999-07-24	12:00pm	22.4	20	South/Light	10	BK	1	10.5
Loch Leven	1999-07-24	12:00pm	22.4	20	South/Light	10	BK	1	9.6
Loch Leven	1999-07-24	12:00pm	22.4	20	South/Light	10	BK	1	6.3
Loch Leven	1999-07-24	12:00pm	22.4	20	South/Light	10	BK	1	7.2
Loch Leven	1999-07-24	12:00pm	22.4	20	South/Light	10	BK	1	11.4
Loch Leven	1999-07-24	12:00pm	22.4	20	South/Light	10	BK	1	11
Loch Leven	1999-07-24	12:00pm	22.4	20	South/Light	10	BK	1	6.8
Loch Leven	1999-07-24	12:00pm	22.4	20	South/Light	10	BK	1	11.4
Loch Leven	1999-07-24	12:00pm	22.4	20	South/Light	10	BK	1	9.4
Loch Leven	1999-07-24	12:00pm	22.4	20	South/Light	10	BK	1	10.5
Loch Leven	1999-07-24	12:00pm	22.4	20	South/Light	10	BK	1	7.5
Loch Leven	1999-07-24	12:00pm	22.4	20	South/Light	10	BK	1	6.9
Loch Leven	1999-07-24	12:00pm	22.4	20	South/Light	10	BK	1	9.4
Loch Leven	1999-07-24	12:00pm	22.4	20	South/Light	10	BK	1	10.7
Loch Leven	1999-07-24	12:00pm	22.4	20	South/Light	10	BK	1	9.7
Loch Leven	1999-07-24	12:00pm	22.4	20	South/Light	10	BK	1	6.9
Loch Leven	1999-07-24	12:00pm	22.4	20	South/Light	10	BK	1	7.1
Loch Leven	1999-07-24	12:00pm	22.4	20	South/Light	10	BK	1	Not full specimen
Loch Leven	1999-07-24	12:00pm	22.4	20	South/Light	10	BK	1	11.5
Loch Leven	1999-07-24	12:00pm	22.4	20	South/Light	10	BK	1	Not full specimen
Loch Leven	1999-07-24	12:00pm	22.4	20	South/Light	10	BK	1	10.8
Loch Leven	1999-07-24	1:10pm	20.7	19	South/Light	10	AE	6	NA
Loch Leven	1999-07-24	1:10pm	20.7	19	South/Light	10	STB	6	NA
Loch Leven	1999-07-24	1:10pm	20.7	19	South/Light	10	BK	1	Not full specimen
Loch Leven	1999-07-24	1:10pm	20.7	19	South/Light	10	BK	1	Not full specimen
Loch Leven	1999-07-24	1:10pm	20.7	19	South/Light	10	BK	1	5.6
Loch Leven	1999-07-24	1:10pm	20.7	19	South/Light	10	BK	1	6.5
Loch Leven	1999-07-24	1:10pm	20.7	19	South/Light	10	BK	1	11.4
Loch Leven	1999-07-24	1:10pm	20.7	19	South/Light	10	BK	1	Not full

									specimen
Loch Leven	1999-07-24	1:10pm	20.7	19	South/Light	10	BK	1	Not full specimen
Loch Leven	1999-07-24	1:10pm	20.7	19	South/Light	10	BK	1	9.6
Loch Leven	1999-07-24	1:10pm	20.7	19	South/Light	10	BK	1	10.9
Loch Leven	1999-07-24	1:10pm	20.7	19	South/Light	10	BK	1	8.9
Loch Leven	1999-07-24	1:10pm	20.7	19	South/Light	10	BK	1	9.4
Loch Leven	1999-07-24	1:10pm	20.7	19	South/Light	10	BK	1	6.3
Loch Leven	1999-07-24	1:10pm	20.7	19	South/Light	10	BK	1	10.2
Loch Leven	1999-07-24	1:10pm	20.7	19	South/Light	10	BK	1	10.6
Loch Leven	1999-07-24	1:10pm	20.7	19	South/Light	10	BK	1	9.2
Loch Leven	1999-07-24	1:10pm	20.7	19	South/Light	10	BK	1	8.8
Loch Leven	1999-07-24	1:10pm	20.7	19	South/Light	10	BK	1	9
Loch Leven	1999-07-24	1:10pm	20.7	19	South/Light	10	BK	1	10.2
Loch Leven	1999-07-24	1:10pm	20.7	19	South/Light	10	BK	1	8.5
Loch Leven	1999-07-24	1:10pm	20.7	19	South/Light	10	BK	1	Not full specimen
Loch Leven	1999-07-24	1:10pm	20.7	19	South/Light	10	BK	1	10.6
Loch Leven	1999-07-24	1:10pm	20.7	19	South/Light	10	BK	1	7.1
Loch Leven	1999-07-24	1:10pm	20.7	19	South/Light	10	BK	1	10.7
Loch Leven	1999-07-24	1:10pm	20.7	19	South/Light	10	BK	1	11
Loch Leven	1999-07-24	1:10pm	20.7	19	South/Light	10	BK	1	11
Loch Leven	1999-07-24	1:10pm	20.7	19	South/Light	10	BK	1	9.9
Loch Leven	1999-07-24	1:10pm	20.7	19	South/Light	10	BK	1	9
Loch Leven	1999-07-24	1:10pm	20.7	19	South/Light	10	BK	1	6.9
Loch Leven	1999-07-24	1:10pm	20.7	19	South/Light	10	BK	1	9.4
Loch Leven	1999-07-24	1:10pm	20.7	19	South/Light	10	BK	1	6.7
Loch Leven	1999-07-24	1:10pm	20.7	19	South/Light	10	BK	1	9.8
Loch Leven	1999-07-24	1:10pm	20.7	19	South/Light	10	BK	1	7.8
Loch Leven	1999-07-24	1:10pm	20.7	19	South/Light	10	BK	1	6.9
Loch Leven	1999-07-24	1:10pm	20.7	19	South/Light	10	BK	1	10.6
Loch Leven	1999-07-24	1:10pm	20.7	19	South/Light	10	BK	1	9.4
Loch Leven	1999-07-24	1:10pm	20.7	19	South/Light	10	BK	1	10.7
Loch Leven	1999-07-24	1:10pm	20.7	19	South/Light	10	BK	1	9.8
Loch Leven	1999-07-25	7:00am	10.6	16	Nil	0	AE	4	NA
Loch Leven	1999-07-25	7:00am	10.6	16	Nil	0	BK	1	10.3

Loch Leven	1999-07-25	7:00am	10.6	16	Nil	0	BK	1	8.9
Loch Leven	1999-07-25	7:00am	10.6	16	Nil	0	BK	1	9.9
Loch Leven	1999-07-25	7:00am	10.6	16	Nil	0	BK	1	10
Loch Leven	1999-07-25	7:00am	10.6	16	Nil	0	BK	1	7.6
Loch Leven	1999-07-25	7:00am	10.6	16	Nil	0	BK	1	10
Loch Leven	1999-07-25	7:00am	10.6	16	Nil	0	BK	1	8.8
Loch Leven	1999-07-25	7:00am	10.6	16	Nil	0	BK	1	10.2
Loch Leven	1999-07-25	7:00am	10.6	16	Nil	0	BK	1	8.9
Loch Leven	1999-07-25	7:00am	10.6	16	Nil	0	BK	1	9.9
Loch Leven	1999-07-25	7:00am	10.6	16	Nil	0	BK	1	6.7
Loch Leven	1999-07-25	7:00am	10.6	16	Nil	0	BK	1	9.8
Loch Leven	1999-07-25	7:00am	10.6	16	Nil	0	BK	1	11.2
Loch Leven	1999-07-25	7:00am	10.6	16	Nil	0	BK	1	8.9
Loch Leven	1999-07-25	7:30am	11	16	Nil	0	AE	2	NA
Loch Leven	1999-07-25	7:30am	11	16	Nil	0	STB	32	NA
Loch Leven	1999-07-25	7:30am	11	16	Nil	0	BK	1	11.6
Loch Leven	1999-07-25	7:30am	11	16	Nil	0	BK	1	10.4
Loch Leven	1999-07-25	7:30am	11	16	Nil	0	BK	1	9.8
Loch Leven	1999-07-25	7:30am	11	16	Nil	0	BK	1	7.6
Loch Leven	1999-07-25	7:30am	11	16	Nil	0	BK	1	7.6
Loch Leven	1999-07-25	7:30am	11	16	Nil	0	BK	1	10.4
Loch Leven	1999-07-25	7:30am	11	16	Nil	0	BK	1	8.7
Loch Leven	1999-07-25	7:30am	11	16	Nil	0	BK	1	10.6
Loch Leven	1999-07-25	7:30am	11	16	Nil	0	BK	1	7.6
Loch Leven	1999-07-25	7:30am	11	16	Nil	0	BK	1	11.1
Loch Leven	1999-07-25	7:30am	11	16	Nil	0	BK	1	7.6
Loch Leven	1999-07-25	7:30am	11	16	Nil	0	BK	1	9.6
Loch Leven	1999-07-25	7:30am	11	16	Nil	0	BK	1	11.4
Loch Leven	1999-07-25	7:30am	11	16	Nil	0	BK	1	9.8
Loch Leven	1999-07-25	7:30am	11	16	Nil	0	BK	1	6.9
Loch Leven	1999-07-25	7:30am	11	16	Nil	0	BK	1	9
Loch Leven	1999-07-25	7:30am	11	16	Nil	0	BK	1	10.4
Loch Leven	1999-07-25	7:30am	11	16	Nil	0	BK	1	6.8
Loch Leven	1999-07-25	7:30am	11	16	Nil	0	BK	1	9.6
Loch Leven	1999-07-25	7:30am	11	16	Nil	0	BK	1	9
Loch Leven	1999-07-25	7:30am	11	16	Nil	0	BK	1	6.7

Loch Leven	1999-07-25	7:30am	11	16	Nil	0	BK	1	6.9
Loch Leven	1999-07-25	7:30am	11	16	Nil	0	BK	1	8.9
Loch Leven	1999-07-25	7:30am	11	16	Nil	0	BK	1	9.9
Loch Leven	1999-07-25	7:30am	11	16	Nil	0	BK	1	9
Loch Leven	1999-07-25	7:30am	11	16	Nil	0	BK	1	6.8
Loch Leven	1999-07-25	7:30am	11	16	Nil	0	BK	1	9.3
Loch Leven	1999-07-25	7:30am	11	16	Nil	0	BK	1	7.6
Loch Leven	1999-07-25	7:30am	11	16	Nil	0	BK	1	9.4
Loch Leven	1999-07-25	7:30am	11	16	Nil	0	BK	1	6.9
Loch Leven	1999-07-25	7:30am	11	16	Nil	0	BK	1	8.9
Loch Leven	1999-07-25	7:30am	11	16	Nil	0	BK	1	8.5
Loch Leven	1999-07-25	7:30am	11	16	Nil	0	BK	1	10.9
Loch Leven	1999-07-25	7:30am	11	16	Nil	0	BK	1	10.8
Loch Leven	1999-07-25	7:30am	11	16	Nil	0	BK	1	7.4
Loch Leven	1999-07-24	11:15am	22	19	Southerly/Light	25	AE	8	NA
Loch Leven	1999-07-24	11:15am	22	19	Southerly/Light	25	SJ	1	NA
Loch Leven	1999-07-24	11:15am	22	19	Southerly/Light	25	BK	1	10.6
Loch Leven	1999-07-24	11:15am	22	19	Southerly/Light	25	BK	1	11.2
Loch Leven	1999-07-24	11:15am	22	19	Southerly/Light	25	BK	1	8.6
Loch Leven	1999-07-24	11:15am	22	19	Southerly/Light	25	BK	1	6.5
Loch Leven	1999-07-24	11:15am	22	19	Southerly/Light	25	BK	1	8.8
Loch Leven	1999-07-24	11:15am	22	19	Southerly/Light	25	BK	1	9.7
Loch Leven	1999-07-24	11:15am	22	19	Southerly/Light	25	BK	1	9.6
Loch Leven	1999-07-24	11:15am	22	19	Southerly/Light	25	BK	1	7.6
Loch Leven	1999-07-24	11:15am	22	19	Southerly/Light	25	BK	1	6
Loch Leven	1999-07-24	11:15am	22	19	Southerly/Light	25	BK	1	9.7
Loch Leven	1999-07-24	11:15am	22	19	Southerly/Light	25	BK	1	9.6
Loch Leven	1999-07-24	11:15am	22	19	Southerly/Light	25	BK	1	9.2
Loch Leven	1999-07-24	11:15am	22	19	Southerly/Light	25	BK	1	11.6
Loch Leven	1999-07-24	11:15am	22	19	Southerly/Light	25	BK	1	10
Loch Leven	1999-07-24	11:15am	22	19	Southerly/Light	25	BK	1	8.4
Loch Leven	1999-07-24	11:15am	22	19	Southerly/Light	25	BK	1	6.5
Loch Leven	1999-07-24	11:15am	22	19	Southerly/Light	25	BK	1	10.8
Loch Leven	1999-07-24	11:15am	22	19	Southerly/Light	25	BK	1	9.2
Loch Leven	1999-07-24	11:15am	22	19	Southerly/Light	25	BK	1	Not full specimen

Loch Leven	1999-07-24	11:15am	22	19	Southerly/Light	25	BK	1	8.6
Loch Leven	1999-07-24	11:15am	22	19	Southerly/Light	25	BK	1	10.2
Loch Leven	1999-07-24	11:15am	22	19	Southerly/Light	25	BK	1	9.8
Loch Leven	1999-07-24	11:15am	22	19	Southerly/Light	25	BK	1	10
Loch Leven	1999-07-24	11:15am	22	19	Southerly/Light	25	BK	1	7.4
Loch Leven	1999-07-24	11:15am	22	19	Southerly/Light	25	BK	1	11.2
Loch Leven	1999-07-24	11:15am	22	19	Southerly/Light	25	BK	1	10.6
Loch Leven	1999-07-24	10:30am	22	19	Southerly/Light	30	AE	3	NA
Loch Leven	1999-07-24	10:30am	22	19	Southerly/Light	30	SJ	3	NA
Loch Leven	1999-07-24	10:30am	22	19	Southerly/Light	30	STB	2	NA
Loch Leven	1999-07-24	10:30am	22	19	Southerly/Light	30	BK	1	10.7
Loch Leven	1999-07-24	10:30am	22	19	Southerly/Light	30	BK	1	10
Loch Leven	1999-07-24	10:30am	22	19	Southerly/Light	30	BK	1	8.9
Loch Leven	1999-07-24	10:30am	22	19	Southerly/Light	30	BK	1	9.7
Loch Leven	1999-07-24	10:30am	22	19	Southerly/Light	30	BK	1	9.5
Loch Leven	1999-07-24	10:30am	22	19	Southerly/Light	30	BK	1	Not full specimen
Loch Leven	1999-07-24	10:30am	22	19	Southerly/Light	30	BK	1	10.1
Loch Leven	1999-07-24	10:30am	22	19	Southerly/Light	30	BK	1	10.3
Loch Leven	1999-07-24	10:30am	22	19	Southerly/Light	30	BK	1	7.9
Loch Leven	1999-07-24	10:30am	22	19	Southerly/Light	30	BK	1	10
Loch Leven	1999-07-24	10:30am	22	19	Southerly/Light	30	BK	1	9.3
Loch Leven	1999-07-24	10:30am	22	19	Southerly/Light	30	BK	1	11.4
Loch Leven	1999-07-24	10:30am	22	19	Southerly/Light	30	BK	1	10.1
Loch Leven	1999-07-24	10:30am	22	19	Southerly/Light	30	BK	1	6.4
Loch Leven	1999-07-24	10:30am	22	19	Southerly/Light	30	BK	1	10.6
Loch Leven	1999-07-24	10:30am	22	19	Southerly/Light	30	BK	1	10
Loch Leven	1999-07-24	10:30am	22	19	Southerly/Light	30	BK	1	9.1
Loch Leven	1999-07-24	10:30am	22	19	Southerly/Light	30	BK	1	8.6
Loch Leven	1999-07-24	10:30am	22	19	Southerly/Light	30	BK	1	10.2
Loch Leven	1999-07-24	10:30am	22	19	Southerly/Light	30	BK	1	8.5
Loch Leven	1999-07-24	10:30am	22	19	Southerly/Light	30	BK	1	7.6
Loch Leven	1999-07-24	10:30am	22	19	Southerly/Light	30	BK	1	6.4
Loch Leven	1999-07-24	10:30am	22	19	Southerly/Light	30	BK	1	9.9
Loch Leven	1999-07-24	10:30am	22	19	Southerly/Light	30	BK	1	Not full specimen

Loch Leven	1999-07-24	10:30am	22	19	Southerly/Light	30	BK	1	9.7
Loch Leven	1999-07-24	10:30am	22	19	Southerly/Light	30	BK	1	10.3
Loch Leven	1999-07-24	10:30am	22	19	Southerly/Light	30	BK	1	7.6
Loch Leven	1999-07-24	10:30am	22	19	Southerly/Light	30	BK	1	6
Loch Leven	1999-07-24	10:30am	22	19	Southerly/Light	30	BK	1	9.7
Loch Leven	1999-07-24	10:30am	22	19	Southerly/Light	30	BK	1	9.9
Loch Leven	1999-07-24	10:30am	22	19	Southerly/Light	30	BK	1	Not full specimen
Loch Leven	1999-07-24	10:30am	22	19	Southerly/Light	30	BK	1	10.6
Loch Leven	1999-07-24	10:30am	22	19	Southerly/Light	30	BK	1	9.6
Loch Leven	1999-07-24	10:30am	22	19	Southerly/Light	30	BK	1	8.3
Loch Leven	1999-07-24	10:30am	22	19	Southerly/Light	30	BK	1	6.5
Loch Leven	1999-07-24	10:30am	22	19	Southerly/Light	30	BK	1	10.8
Loch Leven	1999-07-24	10:30am	22	19	Southerly/Light	30	BK	1	9.4
Loch Leven	1999-07-24	10:30am	22	19	Southerly/Light	30	BK	1	Not full specimen
Loch Leven	1999-07-24	10:30am	22	19	Southerly/Light	30	BK	1	5.7
Loch Leven	1999-07-24	10:30am	22	19	Southerly/Light	30	BK	1	8.5
Loch Leven	1999-07-24	10:30am	22	19	Southerly/Light	30	BK	1	11.6
Loch Leven	1999-07-24	10:30am	22	19	Southerly/Light	30	BK	1	Not full specimen
Loch Leven	1999-07-24	10:30am	22	19	Southerly/Light	30	BK	1	11.4
Loch Leven	1999-07-24	10:30am	22	19	Southerly/Light	30	BK	1	10
Loch Leven	1999-07-24	10:30am	22	19	Southerly/Light	30	BK	1	10.8
Loch Leven	1999-07-24	10:30am	22	19	Southerly/Light	30	BK	1	10.3
Loch Leven	1999-07-24	10:30am	22	19	Southerly/Light	30	BK	1	8.9
Loch Leven	1999-07-24	10:30am	22	19	Southerly/Light	30	BK	1	9.8
Loch Leven	1999-07-24	10:30am	22	19	Southerly/Light	30	BK	1	9.7
Loch Leven	1999-07-24	10:30am	22	19	Southerly/Light	30	BK	1	9.6
Loch Leven	1999-07-24	10:30am	22	19	Southerly/Light	30	BK	1	9.9
Loch Leven	1999-07-24	10:30am	22	19	Southerly/Light	30	BK	1	7.8
Loch Leven	1999-07-24	10:30am	22	19	Southerly/Light	30	BK	1	8.7
Loch Leven	1999-07-24	10:30am	22	19	Southerly/Light	30	BK	1	9.7
Loch Leven	1999-07-24	10:30am	22	19	Southerly/Light	30	BK	1	9
Loch Leven	1999-07-24	10:30am	22	19	Southerly/Light	30	BK	1	7.3
Loch Leven	1999-07-24	10:30am	22	19	Southerly/Light	30	BK	1	6.4
Loch Leven	1999-07-24	10:30am	22	19	Southerly/Light	30	BK	1	7.8

Loch Leven	1999-07-24	10:30am	22	19	Southerly/Light	30	BK	1	9.8
Loch Leven	1999-07-24	10:30am	22	19	Southerly/Light	30	BK	1	9.4
Loch Leven	1999-07-24	10:30am	22	19	Southerly/Light	30	BK	1	5.7
Loch Leven	1999-07-24	10:30am	22	19	Southerly/Light	30	BK	1	11.6
Loch Leven	1999-07-24	10:30am	22	19	Southerly/Light	30	BK	1	10
Loch Leven	1999-07-24	10:30am	22	19	Southerly/Light	30	BK	1	10.8
Loch Leven	1999-07-24	10:30am	22	19	Southerly/Light	30	BK	1	Not full specimen
Loch Leven	1999-07-24	10:30am	22	19	Southerly/Light	30	BK	1	6.2
Loch Leven	1999-07-24	10:30am	22	19	Southerly/Light	30	BK	1	Not full specimen
Loch Leven	1999-07-24	10:30am	22	19	Southerly/Light	30	BK	1	10.8
Loch Leven	1999-07-24	10:30am	22	19	Southerly/Light	30	BK	1	5.8
Loch Leven	1999-07-24	10:30am	22	19	Southerly/Light	30	BK	1	10.5
Loch Leven	1999-07-24	10:30am	22	19	Southerly/Light	30	BK	1	9.9
Loch Leven	1999-07-24	10:30am	22	19	Southerly/Light	30	BK	1	10.5
Loch Leven	1999-07-24	10:30am	22	19	Southerly/Light	30	BK	1	8.9
Loch Leven	1999-07-24	10:30am	22	19	Southerly/Light	30	BK	1	10.5
Loch Leven	1999-07-25	6:45am	10.6	18.2	Nil	0	BK	1	10.4
Loch Leven	1999-07-25	6:45am	10.6	18.2	Nil	0	BK	1	11
Loch Leven	1999-07-25	6:45am	10.6	18.2	Nil	0	BK	1	8.9
Loch Leven	1999-07-25	6:45am	10.6	18.2	Nil	0	BK	1	10.4
Loch Leven	1999-07-25	6:45am	10.6	18.2	Nil	0	BK	1	9.8
Loch Leven	1999-07-25	6:45am	10.6	18.2	Nil	0	BK	1	Not full specimen
Loch Leven	1999-07-25	6:45am	10.6	18.2	Nil	0	BK	1	6.8
Loch Leven	1999-07-25	6:45am	10.6	18.2	Nil	0	BK	1	5.7
Loch Leven	2000-06-24	8:00am	14	17	Nil	25	AE	2	NA
Loch Leven	2000-06-24	8:00am	14	17	Nil	25	SJ	1	NA
Loch Leven	2000-06-24	8:00am	14	17	Nil	25	BK	1	10.6
Loch Leven	2000-06-24	8:00am	14	17	Nil	25	BK	1	10.1
Loch Leven	2000-06-24	8:00am	14	17	Nil	25	BK	1	9.9
Loch Leven	2000-06-24	8:00am	14	17	Nil	25	BK	1	6.5
Loch Leven	2000-06-24	8:00am	14	17	Nil	25	BK	1	9.9
Loch Leven	2000-06-24	8:00am	14	17	Nil	25	BK	1	11.2

Loch Leven	2000-06-24	8:00am	14	17	Nil	25	BK	1	11.6
Loch Leven	2000-06-24	8:00am	14	17	Nil	25	BK	1	7.8
Loch Leven	2000-06-24	8:00am	14	17	Nil	25	BK	1	6.4
Loch Leven	2000-06-24	8:00am	14	17	Nil	25	BK	1	10.6
Loch Leven	2000-06-24	8:00am	14	17	Nil	25	BK	1	9.6
Loch Leven	2000-06-24	8:00am	14	17	Nil	25	BK	1	9.9
Loch Leven	2000-06-24	8:00am	14	17	Nil	25	BK	1	11
Loch Leven	2000-06-24	8:00am	14	17	Nil	25	BK	1	9.6
Loch Leven	2000-06-24	8:00am	14	17	Nil	25	BK	1	10
Loch Leven	2000-06-24	8:00am	14	17	Nil	25	BK	1	6.5
Loch Leven	2000-06-24	8:00am	14	17	Nil	25	BK	1	10.8
Loch Leven	2000-06-24	8:00am	14	17	Nil	25	BK	1	9.8
Loch Leven	2000-06-24	8:00am	14	17	Nil	25	BK	1	11.6
Loch Leven	2000-06-24	8:00am	14	17	Nil	25	BK	1	Not full specimen
Loch Leven	2000-06-24	8:00am	14	17	Nil	25	BK	1	10.6
Loch Leven	2000-06-24	8:00am	14	17	Nil	25	BK	1	Not full specimen
Loch Leven	2000-06-24	8:00am	14	17	Nil	25	BK	1	7.5
Loch Leven	2000-06-24	8:00am	14	17	Nil	25	BK	1	7.5
Loch Leven	2000-06-24	8:00am	14	17	Nil	25	BK	1	10.7
Loch Leven	2000-06-24	8:00am	14	17	Nil	25	BK	1	8.7
Loch Leven	2000-06-24	8:00am	14	17	Nil	25	BK	1	Not full specimen
Loch Leven	2000-06-24	8:00am	14	17	Nil	25	BK	1	10.8
Loch Leven	2000-06-24	8:00am	14	17	Nil	25	BK	1	8.9
Loch Leven	2000-06-24	8:00am	14	17	Nil	25	BK	1	10.5
Loch Leven	2000-06-24	8:00am	14	17	Nil	25	BK	1	Not full specimen
Loch Leven	2000-06-24	8:00am	14	17	Nil	25	BK	1	Not full specimen
Loch Leven	2000-06-24	8:30am	14	17	Nil	25	AE	2	NA
Loch Leven	2000-06-24	8:30am	14	17	Nil	25	BK	1	9.5
Loch Leven	2000-06-24	8:30am	14	17	Nil	25	BK	1	10.4
Loch Leven	2000-06-24	8:30am	14	17	Nil	25	BK	1	Not full specimen

Loch Leven	2000-06-24	8:30am	14	17	Nil	25	BK	1	9
Loch Leven	2000-06-24	8:30am	14	17	Nil	25	BK	1	11.6
Loch Leven	2000-06-24	8:30am	14	17	Nil	25	BK	1	10.2
Loch Leven	2000-06-24	8:30am	14	17	Nil	25	BK	1	Not full specimen
Third Pond	1999-05-20	10:00am	15	14	Southwest/Light-Mod	0	BT	4	NA
Third Pond	1999-05-20	10:00am	15	14	Southwest/Light-Mod	0	SJ	12	NA
Third Pond	1999-05-20	10:00am	15	14	Southwest/Light-Mod	0	SM	1	NA
Third Pond	1999-05-20	10:00am	15	14	Southwest/Light-Mod	0	BK	1	9.6
Third Pond	1999-05-20	10:00am	15	14	Southwest/Light-Mod	0	BK	1	10.1
Third Pond	1999-05-20	10:00am	15	14	Southwest/Light-Mod	0	BK	1	9.5
Third Pond (not used in CPUE Calculations - IBEC Data)	1999-05-20	10:00am	15	14	Southwest/Light-Mod	0	BK	1	8.9
Third Pond	1999-05-26	10:00am	9	9	Easterly/strong	100	BT	42	NA
Third Pond	1999-05-26	10:00am	9	9	Easterly/strong	100	BK	1	11.6
Third Pond	1999-05-26	10:00am	9	9	Easterly/strong	100	BK	1	9.5
Third Pond	1999-05-26	10:00am	9	9	Easterly/strong	100	BK	1	9.8
Third Pond	1999-05-26	10:00am	9	9	Easterly/strong	100	BK	1	9.5
Third Pond	1999-05-26	10:00am	9	9	Easterly/strong	100	BK	1	9.4
Third Pond	1999-05-26	10:00am	9	9	Easterly/strong	100	BK	1	9.8
Third Pond	1999-05-26	10:00am	9	9	Easterly/strong	100	BK	1	10.6
Third Pond	1999-05-26	10:00am	9	9	Easterly/strong	100	BK	1	8.4
Third Pond	1999-05-26	10:00am	9	9	Easterly/strong	100	BK	1	7.9
Third Pond (not used in CPUE Calculations - IBEC Data)	1999-05-26	10:00am	9	9	Easterly/strong	100	BK	1	10.8
Third Pond	1999-05-27	1:20pm	14	12	Southwest/verylight	90	SJ	13	NA
Third Pond	1999-05-27	1:20pm	14	12	Southwest/verylight	90	SM	4	NA
Third Pond	1999-05-27	1:20pm	14	12	Southwest/verylight	90	BT	5	NA
Third Pond (not used in CPUE	1999-05-27	1:20pm	14	12	Southwest/verylight	90	STB	42	NA

Calculations - IBEC Data)									
Third Pond	1999-05-28	3:15pm	11	14	Northeast/Light	100	SJ	1	NA
Third Pond	1999-05-28	3:15pm	11	14	Northeast/Light	100	STB	50	NA
Third Pond	1999-05-28	3:15pm	11	14	Northeast/Light	100	SM	20	NA
Third Pond	1999-05-28	3:15pm	11	14	Northeast/Light	100	Giant Water Bug		
(not used in CPUE Calculations - IBEC Data)									
Third Pond	1999-05-28	2:55pm	11	14	Northeast/Light	100	STB	45	NA
Third Pond	1999-05-28	2:55pm	11	14	Northeast/Light	100	SM	4	NA
Third Pond	1999-05-28	2:55pm	11	14	Northeast/Light	100	SJ	1	NA
(not used in CPUE Calculations - IBEC Data)									
Third Pond	1999-05-28	2:30pm	11	14	Northeast/Light	100	SJ	13	NA
Third Pond	1999-05-28	2:30pm	11	14	Northeast/Light	100	BT	3	NA
Third Pond	1999-05-28	2:30pm	11	14	Northeast/Light	100	SM	2	NA
Third Pond	1999-05-28	2:30pm	11	14	Northeast/Light	100	STB	90	NA
Third Pond	1999-05-28	2:30pm	11	14	Northeast/Light	100	BK	1	8.9
(not used in CPUE Calculations - IBEC Data)									
Third Pond	1999-06-09	8:50am	8	11	Strong/Westerly	80	BT	4	NA
Third Pond	1999-06-09	8:50am	8	11	Strong/Westerly	80	SJ	2	NA
Third Pond	1999-06-09	8:50am	8	11	Strong/Westerly	80	STB	15	NA
Third Pond	1999-06-09	8:50am	8	11	Strong/Westerly	80	SM	1	NA
Third Pond	1999-06-09	9:30am	8	11	Strong/Westerly	80	BT	2	NA
Third Pond	1999-06-09	9:30am	8	11	Strong/Westerly	80	ST	3	NA
Third Pond	1999-06-09	9:30am	8	11	Strong/Westerly	80	STB	7	NA

Third Pond	1999-06-09	9:10am	8	11	Westerly/ Strong	80	BT	6	N/A
Third Pond	1999-06-09	9:10am	8	11	Westerly/ Strong	80	SJ	7	N/A
Third Pond	1999-06-09	9:10am	8	11	Westerly/ Strong	80	STB	12	N/A
Third Pond	1999-06-10	1:25pm	21		Southwest/Light	80	STB	12	NA
Third Pond	1999-06-10	1:25pm	21		Southwest/Light	80	BK	1	
Third Pond	1999-06-22	11:00am	13.5	16	Southeast/ Light	100	SJ	1	NA
Third Pond	1999-06-22	11:00am	13.5	16	Southeast/ Light	100	SM	1	NA
Third Pond	1999-06-22	11:00am	13.5	16	Southeast/ Light	100	BT	3	NA
Third Pond	1999-06-22	11:00am	13.5	16	Southeast/ Light	100	STB	71	NA
Third Pond	1999-06-22	11:00am	13.5	16	Southeast/ Light	100	BK	1	9.8
Third Pond	1999-06-23	11:20am	24	18	Southwest/ Light	5	SJ	2	NA
Third Pond	1999-06-23	11:20am	24	18	Southwest/ Light	5	SM	1	NA
Third Pond	1999-06-23	11:20am	24	18	Southwest/ Light	5	STB	7	NA
Third Pond	1999-06-23	11:20am	24	18	Southwest/ Light	5	BK	1	8.3
Third Pond	1999-06-23	11:20am	24	18	Southwest/ Light	5	BK	1	9.4
Third Pond	1999-06-23	11:20am	24	18	Southwest/ Light	5	BK	1	8.1
Third Pond	1999-06-23	11:20am	24	18	Southwest/ Light	5	BK	1	5.9
Third Pond	1999-06-23	12:10pm	23	18.6	Southwest/Light	5	SJ	1	NA
Third Pond	1999-06-23	12:10pm	23	18.6	Southwest/Light	5	STB	77	NA
Third Pond	1999-06-23	12:10pm	23	18.6	Southwest/Light	5	BT	1	NA
Third Pond	1999-06-23	12:10pm	23	18.6	Southwest/Light	5	BK	1	10.6
Third Pond	1999-06-23	12:10pm	23	18.6	Southwest/Light	5	BK	1	9.8
Third Pond	1999-06-23	12:10pm	23	18.6	Southwest/Light	5	BK	1	9.8
Third Pond	1999-06-23	12:10pm	23	18.6	Southwest/Light	5	BK	1	9.3
Third Pond	1999-06-23	12:10pm	23	18.6	Southwest/Light	5	BK	1	9.3
Third Pond	1999-06-23	12:10pm	23	18.6	Southwest/Light	5	BK	1	9.4
Third Pond	1999-06-23	12:10pm	23	18.6	Southwest/Light	5	BK	1	9.7
Third Pond	1999-06-23	12:10pm	23	18.6	Southwest/Light	5	BK	1	9.4
Third Pond	1999-06-24	9:41am	18	18	Southwest/ Light	25	STB	50	NA
Third Pond	1999-06-24	9:41am	18	18	Southwest/ Light	25	SJ	8	NA
Third Pond	1999-06-24	9:41am	18	18	Southwest/ Light	25	SM	1	NA
Third Pond	1999-06-24	9:41am	18	18	Southwest/ Light	25	BK	1	11.1

Third Pond	1999-06-24	9:41am	18	18	Southwest/ Light	25	BK	1	5.9
Third Pond	1999-06-24	9:41am	18	18	Southwest/ Light	25	BK	1	10.4
Third Pond	1999-06-24	9:21am	18	18	Southwest/Light	25	STB	65	NA
Third Pond	1999-06-24	9:21am	18	18	Southwest/Light	25	DFL	1	NA
Third Pond	1999-06-24	9:21am	18	18	Southwest/Light	25	WATER BUG	1	NA
Third Pond	1999-06-24	9:21am	18	18	Southwest/Light	25	BK	1	10
Third Pond	1999-06-24	9:21am	18	18	Southwest/Light	25	BK	1	10.5
Third Pond	1999-06-24	9:21am	18	18	Southwest/Light	25	BK	1	8.8
Third Pond	1999-06-24	9:21am	18	18	Southwest/Light	25	BK	1	8.7
Third Pond	1999-06-24	9:21am	18	18	Southwest/Light	25	BK	1	6.7
Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	WATER BUG	1	NA
Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	SJ	2	NA
Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	STB	25	NA
Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	BK	1	11.4
Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	BK	1	6.6
Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	BK	1	5.8
Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	BK	1	6.5
Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	BK	1	9.6
Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	BK	1	6.7
Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	BK	1	11.1
Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	BK	1	7.2
Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	BK	1	10.8
Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	BK	1	6.8
Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	BK	1	10.7
Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	BK	1	11.3
Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	BK	1	5.8
Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	BK	1	6.9
Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	BK	1	11.4
Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	BK	1	10.2
Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	BK	1	7.7
Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	BK	1	7.8
Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	BK	1	10.8
Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	BK	1	7.2

Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	BK	1	7.3
Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	BK	1	10.6
Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	BK	1	7
Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	BK	1	8.2
Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	BK	1	7.1
Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	BK	1	9.9
Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	BK	1	7.2
Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	BK	1	8
Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	BK	1	10.6
Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	BK	1	6.9
Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	BK	1	7.1
Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	BK	1	8.8
Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	BK	1	11.9
Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	BK	1	7
Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	BK	1	7.3
Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	BK	1	7.2
Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	BK	1	7
Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	BK	1	10.6
Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	BK	1	11
Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	BK	1	10.7
Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	BK	1	11
Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	BK	1	12.1
Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	BK	1	8
Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	BK	1	7.6
Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	BK	1	11
Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	BK	1	6.8
Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	BK	1	8.8
Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	BK	1	7.6
Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	BK	1	10.6
Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	BK	1	9.9
Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	BK	1	7.4
Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	BK	1	8.8
Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	BK	1	10.6
Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	BK	1	6.9
Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	BK	1	6.9
Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	BK	1	6.9
Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	BK	1	11.8

Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	BK	1	7
Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	BK	1	7.3
Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	BK	1	10.6
Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	BK	1	7
Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	BK	1	7.1
Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	BK	1	7.1
Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	BK	1	9
Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	BK	1	7.1
Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	BK	1	7.4
Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	BK	1	10.6
Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	BK	1	6.8
Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	BK	1	7
Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	BK	1	9.8
Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	BK	1	10.6
Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	BK	1	7
Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	BK	1	7.1
Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	BK	1	8.9
Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	BK	1	8.9
Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	BK	1	7.1
Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	BK	1	7.2
Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	BK	1	10.6
Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	BK	1	10
Third Pond	1999-06-24	9:40am	19	18	Southwest/Light	25	BK	1	10.6
Third Pond	1999-07-02	11:00am	15.2	19	Southwest/Very Strong	90	BT	1	NA
Third Pond	1999-07-02	11:00am	15.2	19	Southwest/Very Strong	90	SJ	1	NA
Third Pond	1999-07-02	11:00am	15.2	19	Southwest/Very Strong	90	STB	63	NA
Third Pond	1999-07-02	11:00am	15.2	19	Southwest/Very Strong	90	BK	1	6.1
Third Pond	1999-07-02	11:00am	15.2	19	Southwest/Very Strong	90	BK	1	6.3
Third Pond	1999-07-02	11:00am	15.2	19	Southwest/Very Strong	90	BK	1	6.6
Third Pond	1999-07-02	11:00am	15.2	19	Southwest/Very Strong	90	BK	1	10
Third Pond	1999-07-02	11:00am	15.2	19	Southwest/Very Strong	90	BK	1	6.2
Third Pond	1999-07-02	11:00am	15.2	19	Southwest/Very Strong	90	BK	1	6.2
Third Pond	1999-07-02	11:00am	15.2	19	Southwest/Very Strong	90	BK	1	6.8
Third Pond	1999-07-02	11:00am	15.2	19	Southwest/Very Strong	90	BK	1	10.4
Third Pond	1999-07-02	11:00am	15.2	19	Southwest/Very Strong	90	BK	1	8.6
Third Pond	1999-07-02	11:00am	15.2	19	Southwest/Very Strong	90	BK	1	9.5

Third Pond	1999-07-06	2:00pm	12.9	14.4	Westerly/Moderate-Strong	95	STB	48	NA
Third Pond	1999-07-06	2:00pm	12.9	14.4	Westerly/Moderate-Strong	95	BK	1	6.6
Third Pond	1999-07-06	2:00pm	12.9	14.4	Westerly/Moderate-Strong	95	BK	1	6.4
Third Pond	1999-07-06	2:00pm	12.9	14.4	Westerly/Moderate-Strong	95	BK	1	6
Third Pond	1999-07-06	2:00pm	12.9	14.4	Westerly/Moderate-Strong	95	BK	1	5.9
Third Pond	1999-07-06	2:00pm	12.9	14.4	Westerly/Moderate-Strong	95	BK	1	10.3
Third Pond	1999-07-06	9:30am	12.9	16	Westerly/Moderate-Strong	95	SM	2	NA
Third Pond	1999-07-06	9:30am	12.9	16	Westerly/Moderate-Strong	95	SJ	1	NA
Third Pond	1999-07-06	9:30am	12.9	16	Westerly/Moderate-Strong	95	STB	46	NA
Third Pond	1999-07-06	9:30am	12.9	16	Westerly/Moderate-Strong	95	BK	1	9.1
Third pond	1999-07-07	10:00am	10.6	14.6	Northwest/Light	100	SJ	1	NA
Third pond	1999-07-07	10:00am	10.6	14.6	Northwest/Light	100	STB	28	NA
Third pond	1999-07-07	10:00am	10.6	14.6	Northwest/Light	100	BK	1	6.7
Third pond	1999-07-07	10:00am	10.6	14.6	Northwest/Light	100	BK	1	5.9
Third pond	1999-07-07	10:00am	10.6	14.6	Northwest/Light	100	BK	1	6.4
Third pond	1999-07-07	10:00am	10.6	14.6	Northwest/Light	100	BK	1	6.2
Third Pond	1999-07-07	10:20am	10.6	12.6	Northwest/ Light	100	STB	27	NA
Third Pond	1999-07-07	10:20am	10.6	12.6	Northwest/ Light	100	BK	1	6.1
Third Pond	1999-07-07	10:20am	10.6	12.6	Northwest/ Light	100	BK	1	6.3
Third Pond	1999-07-20	10:30am	18.5	20	Southwest/Light	100	BK	1	6.2
Third Pond	1999-07-20	10:30am	18.5	20	Southwest/Light	100	BK	1	6.3
Third Pond	1999-07-20	10:30am	18.5	20	Southwest/Light	100	BK	1	5.9

Third Pond	1999-07-20	10:30am	18.5	20	Southwest/Light	100	BK	1	6.4
Third Pond	1999-07-20	10:30am	18.5	20	Southwest/Light	100	BK	1	6.6
Third Pond	1999-07-20	10:30am	18.5	20	Southwest/Light	100	BK	1	10.2
Third Pond	1999-07-20	10:30am	18.5	20	Southwest/Light	100	BK	1	6.3
Third Pond	1999-07-20	10:30am	18.5	20	Southwest/Light	100	BK	1	9.5
Third Pond	1999-07-20	10:30am	18.5	20	Southwest/Light	100	BK	1	6.6
Third Pond	1999-07-20	10:30am	18.5	20	Southwest/Light	100	BK	1	6.3
Third Pond	1999-07-20	10:30am	18.5	20	Southwest/Light	100	BK	1	11
Third Pond	1999-07-20	10:30am	18.5	20	Southwest/Light	100	BK	1	6.8
Third Pond	1999-07-20	10:30am	18.5	20	Southwest/Light	100	BK	1	6.7
Third Pond	1999-07-20	10:30am	18.5	20	Southwest/Light	100	BK	1	6.5
Third Pond	1999-07-20	10:30am	18.5	20	Southwest/Light	100	BK	1	4.8
Third Pond	1999-07-20	10:30am	18.5	20	Southwest/Light	100	BK	1	5.7
Third Pond	1999-07-20	10:30am	18.5	20	Southwest/Light	100	BK	1	6.8
Third Pond	1999-07-20	10:30am	18.5	20	Southwest/Light	100	BK	1	11
Third Pond	1999-07-20	10:30am	18.5	20	Southwest/Light	100	BK	1	6.6
Third Pond	1999-07-20	10:30am	18.5	20	Southwest/Light	100	BK	1	6.7
Third Pond	1999-07-20	10:30am	18.5	20	Southwest/Light	100	BK	1	6.9
Third Pond	1999-07-20	10:30am	18.5	20	Southwest/Light	100	BK	1	6.2
Third Pond	1999-07-20	10:30am	18.5	20	Southwest/Light	100	BK	1	6.5
Third Pond	1999-07-20	10:30am	18.5	20	Southwest/Light	100	BK	1	11
Third Pond	1999-07-20	10:30am	18.5	20	Southwest/Light	100	BK	1	9.1
Third Pond	1999-07-20	10:30am	18.5	20	Southwest/Light	100	BK	1	5.3
Third Pond	1999-07-20	10:30am	18.5	20	Southwest/Light	100	BK	1	6.1
Third Pond	1999-07-20	10:30am	18.5	20	Southwest/Light	100	STB	39	NA
Third Pond	1999-07-20	10:30am	18.5	20	Southwest/Light	100	BT	1	NA
Third Pond	1999-07-20	10:55am	18.5	21	Southwest/Light	100	STB	59	NA
Third Pond	1999-07-20	10:55am	18.5	21	Southwest/Light	100	SM	1	NA
Third Pond	1999-07-20	10:55am	18.5	21	Southwest/Light	100	BK	1	6.5
Third Pond	1999-07-20	10:55am	18.5	21	Southwest/Light	100	B K	1	6.3
Third Pond	1999-07-20	10:55am	18.5	21	Southwest/Light	100	BK	1	5.9
Third Pond	1999-07-20	1:00pm	24.3	21.5	Southwest/Light	100	BK	1	5.9
Third Pond	1999-07-20	1:00pm	24.3	21.5	Southwest/Light	100	BK	1	6.5
Third Pond	1999-07-20	1:00pm	24.3	21.5	Southwest/Light	100	BK	1	5.9
Third Pond	1999-07-20	1:00pm	24.3	21.5	Southwest/Light	100	BK	1	6.5

Third Pond	1999-07-20	1:00pm	24.3	21.5	Southwest/Light	100	BK	1	10.5
Third Pond	1999-07-20	1:00pm	24.3	21.5	Southwest/Light	100	BK	1	6.3
Third Pond	1999-07-20	1:00pm	24.3	21.5	Southwest/Light	100	BK	1	6.2
Third Pond	1999-07-20	1:00pm	24.3	21.5	Southwest/Light	100	BK	1	6.5
Third Pond	1999-07-20	1:00pm	24.3	21.5	Southwest/Light	100	BK	1	6.5
Third Pond	1999-07-20	1:00pm	24.3	21.5	Southwest/Light	100	BK	1	6.5
Third Pond	1999-07-20	1:00pm	24.3	21.5	Southwest/Light	100	BK	1	6.2
Third Pond	1999-07-20	1:00pm	24.3	21.5	Southwest/Light	100	BK	1	5.8
Third Pond	1999-07-20	1:00pm	24.3	21.5	Southwest/Light	100	BK	1	6.7
Third Pond	1999-07-20	1:00pm	24.3	21.5	Southwest/Light	100	BK	1	6.5
Third Pond	1999-07-20	1:00pm	24.3	21.5	Southwest/Light	100	BK	1	6.3
Third Pond	1999-07-20	1:00pm	24.3	21.5	Southwest/Light	100	BK	1	6.8
Third Pond	1999-07-20	1:00pm	24.3	21.5	Southwest/Light	100	BK	1	7.8
Third Pond	1999-07-20	1:00pm	24.3	21.5	Southwest/Light	100	BK	1	6.6
Third Pond	1999-07-20	1:00pm	24.3	21.5	Southwest/Light	100	BK	1	6.7
Third Pond	1999-07-20	1:00pm	24.3	21.5	Southwest/Light	100	BK	1	8.8
Third Pond	1999-07-20	1:00pm	24.3	21.5	Southwest/Light	100	BK	1	6.9
Third Pond	1999-07-20	1:00pm	24.3	21.5	Southwest/Light	100	BK	1	6.7
Third Pond	1999-07-20	1:00pm	24.3	21.5	Southwest/Light	100	BK	1	9.5
Third Pond	1999-07-20	1:00pm	24.3	21.5	Southwest/Light	100	BK	1	6.8
Third Pond	1999-07-20	1:00pm	24.3	21.5	Southwest/Light	100	BK	1	6.7
Third Pond	1999-07-20	1:00pm	24.3	21.5	Southwest/Light	45	BK	1	7
Third Pond	1999-07-20	1:00pm	24.3	21.5	Southwest/Light	45	BK	1	6.6
Third Pond	1999-07-20	1:00pm	24.3	21.5	Southwest/Light	45	BK	1	6.5
Third Pond	1999-07-20	1:00pm	24.3	21.5	Southwest/Light	45	BK	1	6.9
Third Pond	1999-07-20	1:00pm	24.3	21.5	Southwest/Light	45	BK	1	6.7
Third Pond	1999-07-20	1:40pm	18.5	20	Southwest/Light	100	BK	1	6.2
Third Pond	1999-07-20	1:40pm	18.5	20	Southwest/Light	100	BK	1	6.3
Third Pond	1999-07-20	1:40pm	18.5	20	Southwest/Light	100	BK	1	5.9
Third Pond	1999-07-20	1:40pm	18.5	20	Southwest/Light	100	BK	1	6.4
Third Pond	1999-07-20	1:40pm	18.5	20	Southwest/Light	100	BK	1	6.6
Third Pond	1999-07-20	1:40pm	18.5	20	Southwest/Light	100	BK	1	5.6
Third Pond	1999-07-20	1:40pm	18.5	20	Southwest/Light	100	BK	1	6.3
Third Pond	1999-07-20	1:40pm	18.5	20	Southwest/Light	100	BK	1	9.5
Third Pond	1999-07-20	1:40pm	18.5	20	Southwest/Light	100	BK	1	6.6
Third Pond	1999-07-20	1:40pm	18.5	20	Southwest/Light	100	BK	1	6.3

Third Pond	1999-07-20	1:40pm	18.5	20	Southwest/Light	100	BK	1	7.1
Third Pond	1999-07-20	1:40pm	18.5	20	Southwest/Light	100	BK	1	6.8
Third Pond	1999-07-20	1:40pm	18.5	20	Southwest/Light	100	BK	1	6.7
Third Pond	1999-07-20	1:40pm	18.5	20	Southwest/Light	100	BK	1	6.5
Third Pond	1999-07-20	1:40pm	18.5	20	Southwest/Light	100	BK	1	7.8
Third Pond	1999-07-20	1:40pm	18.5	20	Southwest/Light	100	BK	1	5.7
Third Pond	1999-07-20	1:40pm	18.5	20	Southwest/Light	100	BK	1	6.8
Third Pond	1999-07-20	1:40pm	18.5	20	Southwest/Light	100	BK	1	6.6
Third Pond	1999-07-20	1:40pm	18.5	20	Southwest/Light	100	BK	1	6.6
Third Pond	1999-07-20	1:40pm	18.5	20	Southwest/Light	100	BK	1	6.7
Third Pond	1999-07-20	1:40pm	18.5	20	Southwest/Light	100	BK	1	6.9
Third Pond	1999-07-20	1:40pm	18.5	20	Southwest/Light	100	BK	1	6.2
Third Pond	1999-07-20	1:40pm	18.5	20	Southwest/Light	100	BK	1	6.5
Third Pond	1999-07-20	1:40pm	18.5	20	Southwest/Light	100	BK	1	6.4
Third Pond	1999-07-20	1:40pm	18.5	20	Southwest/Light	100	BK	1	9.1
Third Pond	1999-07-20	1:40pm	18.5	20	Southwest/Light	100	BK	1	5.3
Third Pond	1999-07-20	1:40pm	18.5	20	Southwest/Light	100	BK	1	6.1
Third Pond	1999-07-20	1:40pm	18.5	20	Southwest/Light	100	STB	39	NA
Third Pond	1999-07-20	1:40pm	18.5	20	Southwest/Light	100	BT	1	NA
Third Pond	1999-07-21	12:20pm	15.3	18	Southwest/Strong	95	STB	27	NA
Third Pond	1999-07-21	12:20pm	15.3	18	Southwest/Strong	95	BK	1	6.5
Third Pond	1999-07-21	12:20pm	15.3	18	Southwest/Strong	95	BK	1	6.7
Third Pond	1999-07-21	12:20pm	15.3	18	Southwest/Strong	95	BK	1	6.8
Third Pond	1999-07-21	12:20pm	15.3	18	Southwest/Strong	95	BK	1	6.7
Third Pond	1999-07-21	12:20pm	15.3	18	Southwest/Strong	95	BK	1	6.8
Third Pond	1999-07-21	12:20pm	15.3	18	Southwest/Strong	95	BK	1	6.2
Third Pond	1999-07-21	12:20pm	15.3	18	Southwest/Strong	95	BK	1	6.5
Third Pond	1999-07-21	12:20pm	15.3	18	Southwest/Strong	95	BK	1	6.6
Third Pond	1999-07-21	12:20pm	15.3	18	Southwest/Strong	95	BK	1	6.1
Third Pond	1999-07-21	12:20pm	15.3	18	Southwest/Strong	95	BK	1	9.8
Third Pond	1999-07-21	12:20pm	15.3	18	Southwest/Strong	95	BK	1	6.4
Third Pond	1999-07-21	12:20pm	15.3	18	Southwest/Strong	95	BK	1	6.8
Third Pond	1999-07-21	12:20pm	15.3	18	Southwest/Strong	95	BK	1	6.4
Third Pond	1999-07-21	12:20pm	15.3	18	Southwest/Strong	95	BK	1	6.2
Third Pond	1999-07-21	12:20pm	15.3	18	Southwest/Strong	95	BK	1	5.9
Third Pond	1999-07-21	12:20pm	15.3	18	Southwest/Strong	95	BK	1	6.6

Third Pond	1999-07-21	12:20pm	15.3	18	Southwest/Strong	95	BK	1	5.9
Third Pond	1999-07-21	12:20pm	15.3	18	Southwest/Strong	95	BK	1	6.7
Third Pond	1999-07-21	12:20pm	15.3	18	Southwest/Strong	95	BK	1	6.5
Third Pond	1999-07-21	12:20pm	15.3	18	Southwest/Strong	95	BK	1	10
Third Pond	1999-07-21	12:20pm	15.3	18	Southwest/Strong	95	BK	1	6.4
Third Pond	1999-07-21	12:20pm	15.3	18	Southwest/Strong	95	BK	1	6.3
Third Pond	1999-07-21	12:20pm	15.3	18	Southwest/Strong	95	BK	1	6.5
Third Pond	1999-07-21	12:20pm	15.3	18	Southwest/Strong	95	BK	1	6.6
Third Pond	1999-07-21	12:20pm	15.3	18	Southwest/Strong	95	BK	1	5.4
Third Pond	1999-07-21	12:20pm	15.3	18	Southwest/Strong	95	BK	1	6.7
Third Pond	1999-07-21	12:20pm	15.3	18	Southwest/Strong	95	BK	1	6.6
Third Pond	1999-07-21	12:20pm	15.3	18	Southwest/Strong	95	BK	1	7
Third Pond	1999-07-21	12:20pm	15.3	18	Southwest/Strong	95	BK	1	6.8
Third Pond	1999-07-21	12:20pm	15.3	18	Southwest/Strong	95	BK	1	5.8
Third Pond	1999-07-21	12:20pm	15.3	18	Southwest/Strong	95	BK	1	5.9
Third Pond	1999-07-21	12:20pm	15.3	18	Southwest/Strong	95	BK	1	6.3
Third Pond	1999-07-21	12:20pm	15.3	18	Southwest/Strong	95	BK	1	6.4
Third Pond	1999-07-21	12:20pm	15.3	18	Southwest/Strong	95	BK	1	7
Third Pond	1999-07-21	12:20pm	15.3	18	Southwest/Strong	95	BK	1	6.7
Third Pond	1999-07-21	12:20pm	15.3	18	Southwest/Strong	95	BK	1	7.1
Third Pond	1999-07-21	12:20pm	15.3	18	Southwest/Strong	95	BK	1	6.5
Third Pond	1999-07-21	12:20pm	15.3	18	Southwest/Strong	95	BK	1	6.9
Third Pond	1999-07-21	12:20pm	15.3	18	Southwest/Strong	95	BK	1	6.2
Third Pond	1999-07-21	12:20pm	15.3	18	Southwest/Strong	95	BK	1	6.9
Third Pond	1999-07-21	12:20pm	15.3	18	Southwest/Strong	95	BK	1	5.6
Third Pond	1999-07-21	12:20pm	15.3	18	Southwest/Strong	95	BK	1	6.1
Third Pond	1999-07-21	1:20pm	15.6	18.8	Southwest/Very Strong	100	DFI	2	NA
Third Pond	1999-07-21	1:20pm	15.6	18.8	Southwest/Very Strong	100	STB	39	NA
Third Pond	1999-07-21	1:20pm	15.6	18.8	Southwest/Very Strong	100	BK	1	6.2
Third Pond	1999-07-21	1:20pm	15.6	18.8	Southwest/Very Strong	100	BK	1	7.5
Third Pond	1999-07-21	1:20pm	15.6	18.8	Southwest/Very Strong	100	BK	1	5.5
Third Pond	1999-07-21	1:20pm	15.6	18.8	Southwest/Very Strong	100	BK	1	6.8
Third Pond	1999-07-21	1:20pm	15.6	18.8	Southwest/Very Strong	100	BK	1	7.1
Third Pond	1999-07-21	1:20pm	15.6	18.8	Southwest/Very Strong	100	BK	1	6.6
Third Pond	1999-07-21	1:20pm	15.6	18.8	Southwest/Very Strong	100	BK	1	5.6
Third Pond	1999-07-21	1:20pm	15.6	18.8	Southwest/Very Strong	100	BK	1	6.5

Third Pond	1999-07-21	1:20pm	15.6	18.8	Southwest/Very Strong	100	BK	1	6.6
Third Pond	1999-07-21	1:20pm	15.6	18.8	Southwest/Very Strong	100	BK	1	7.1
Third Pond	1999-07-21	1:20pm	15.6	18.8	Southwest/Very Strong	100	BK	1	6.8
Third Pond	1999-07-21	1:20pm	15.6	18.8	Southwest/Very Strong	100	BK	1	6.8
Third Pond	1999-08-03	11:30am					STB	10	NA
Third Pond	1999-08-03	11:30am					BK	1	10.4
Third Pond	1999-08-03	11:30am					BK	1	6.8
Third Pond	1999-08-03	11:30am					BK	1	6.9
Third Pond	1999-08-03	11:30am					BK	1	7.3
Third Pond	1999-08-03	11:30am					BK	1	7.1
Third Pond	1999-08-03	11:30am					BK	1	7.6
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	STB	150	NA
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	SJ	6	NA
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	10.4
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	6.8
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	7.3
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	6.4
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	6.9
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	7.4
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	6
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	10.1
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	7.2
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	7
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	7.1
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	7.5
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	7.2
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	10.2
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	6.6
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	6.2
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	6.7
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	7.6
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	7
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	7.3

Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	10.6
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	7
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	7.1
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	7.1
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	7
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	7.1
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	7.2
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	10.6
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	6.8
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	6.6
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	6.6
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	6.6
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	6.1
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	10.5
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	6.8
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	6.9
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	7.4
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	7.2
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	7
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	7.2
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	9.6
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	7.3
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	6.1
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	7.1
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	7
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	6.5
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	7
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	5.9
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	7.1
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	7.5
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	6.5
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	6.9
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	6.8
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	7.2
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	7
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	6.6

Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	7
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	6.3
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	6.6
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	6.9
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	6.1
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	7.1
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	7
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	7
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	6.8
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	6.7
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	7
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	7.3
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	7
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	7
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	7
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	6.9
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	7.6
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	6.9
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	7.1
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	7.3
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	6.5
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	6.9
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	6.4
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	6.9
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	7
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	7
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	6.9
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	6
Third Pond	1999-08-03	11:50am	24.6	23	Westerly/Light	10	BK	1	7.1
Third Pond	1999-08-03	1:10pm	26.3	23	Westerly/Light	10	STB	103	NA
Third Pond	1999-08-03	1:10pm	26.3	23	Westerly/Light	10	SM	1	NA
Third Pond	1999-08-03	1:10pm	26.3	23	Westerly/Light	10	SJ	1	NA
Third Pond	1999-08-03	1:10pm	26.3	23	Westerly/Light	10	BK	1	7.1
Third Pond	1999-08-03	1:10pm	26.3	23	Westerly/Light	10	BK	1	7.5
Third Pond	1999-08-03	1:10pm	26.3	23	Westerly/Light	10	BK	1	6.9

Third Pond	1999-08-03	1:10pm	26.3	23	Westerly/Light	10	BK	1	6.4
Third Pond	1999-08-03	1:10pm	26.3	23	Westerly/Light	10	BK	1	6.8
Third Pond	1999-08-03	1:10pm	26.3	23	Westerly/Light	10	BK	1	6.3
Third Pond	1999-08-03	1:10pm	26.3	23	Westerly/Light	10	BK	1	7.1
Third Pond	1999-08-03	1:10pm	26.3	23	Westerly/Light	10	BK	1	6.3
Third Pond	1999-08-03	1:10pm	26.3	23	Westerly/Light	10	BK	1	7
Third Pond	1999-08-03	1:10pm	26.3	23	Westerly/Light	10	BK	1	6.5
Third Pond	1999-08-03	1:10pm	26.3	23	Westerly/Light	10	BK	1	6.1
Third Pond	1999-08-03	1:10pm	26.3	23	Westerly/Light	10	BK	1	6.6
Third Pond	1999-08-03	1:10pm	26.3	23	Westerly/Light	10	BK	1	7.2
Third Pond	1999-08-03	1:10pm	26.3	23	Westerly/Light	10	BK	1	7.5
Third Pond	1999-08-03	1:10pm	26.3	23	Westerly/Light	10	BK	1	6.9
Third Pond	1999-08-03	1:10pm	26.3	23	Westerly/Light	10	BK	1	7.1
Third Pond	1999-08-03	1:10pm	26.3	23	Westerly/Light	10	BK	1	6.3
Third Pond	1999-08-03	1:10pm	26.3	23	Westerly/Light	10	BK	1	7.1
Third Pond	1999-08-03	1:10pm	26.3	23	Westerly/Light	10	BK	1	7.6
Third Pond	1999-08-03	1:10pm	26.3	23	Westerly/Light	10	BK	1	6.6
Third Pond	1999-08-03	1:10pm	26.3	23	Westerly/Light	10	BK	1	7.2
Third Pond	1999-08-03	1:10pm	26.3	23	Westerly/Light	10	BK	1	6.9
Third Pond	1999-08-03	1:10pm	26.3	23	Westerly/Light	10	BK	1	7
Third Pond	1999-08-03	1:10pm	26.3	23	Westerly/Light	10	BK	1	7.2
Third Pond	1999-08-03	1:10pm	26.3	23	Westerly/Light	10	BK	1	7.1
Third Pond	1999-08-03	1:10pm	26.3	23	Westerly/Light	10	BK	1	7
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light		STB	80	NA
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light		SJ	7	NA
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light		BT	1	NA
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light		BK	1	6.4
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light		BK	1	7
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light		BK	1	6.5
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light		BK	1	7.1
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light		BK	1	6.6
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light		BK	1	10.1
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light		BK	1	10.2
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light		BK	1	11.5
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light		BK	1	9.3
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light		BK	1	9.5

Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	7.6
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	10.7
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	8.5
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	6.5
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	7.4
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	7.1
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	7.1
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	6.8
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	6.9
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	9.9
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	10.1
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	6.6
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	6.7
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	7.1
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	7.8
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	7.6
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	7.2
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	7.1
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	6.8
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	7.3
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	9.6
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	10.7
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	9.5
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	10.6
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	12.2
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	9.9
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	6.8
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	7.2
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	10.6
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	6.5
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	7.1
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	6.5
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	6.7
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	10.2
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	6.8
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	6.9
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	7

Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	6.1
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	7.2
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	7.4
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	6.9
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	7
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	10.1
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	10.6
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	7.3
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	7.3
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	6.7
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	9.9
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	8.9
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	7.5
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	6.8
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	9.4
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	9.6
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	6.2
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	9.1
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	6.6
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	7.1
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	6.8
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	6.8
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	7.1
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	7.5
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	6.5
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	6.5
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	7.5
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	6.9
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	6
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	6.6
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	6
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	7.3
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	6.6
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	6.3
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	6.5
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	7
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	7.4

Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	7.4
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	6.6
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	9.6
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	7
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	7.4
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	7
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	7
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	7.2
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	5.6
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	6.6
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	7
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	7.1
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	8.5
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	6.7
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	9.9
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	6.2
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	7.1
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	6.8
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	6.9
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	7.1
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	6.3
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	9
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	7
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	7.2
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	9.6
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	7
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	6.8
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	6.5
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	7
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	7
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	6.3
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	6.6
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	6.6
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	6.6
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	7
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	7.3
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	6.8

Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	6.5
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	9.3
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	7.1
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	6.6
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	6.6
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	6.5
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	6.6
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	7.2
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	6.6
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	6.6
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	7.6
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	8.1
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	7.1
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	7.3
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	7
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	7.3
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	7.3
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	6.5
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	6
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	6.5
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	7
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	6.8
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	6.1
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	6.9
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	6.5
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	6.7
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	7
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	6.7
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	6.9
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	6.9
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	6.9
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	7
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	6.6
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	6.9
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	6.2
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	6.8
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light	BK	1	7.1

Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light		BK	1	6.8
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light		BK	1	6.6
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light		BK	1	7.3
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light		BK	1	6.7
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light		BK	1	6.9
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light		BK	1	7.2
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light		BK	1	6.7
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light		BK	1	6.6
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light		BK	1	6.8
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light		BK	1	6.6
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light		BK	1	7.1
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light		BK	1	7
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light		BK	1	6.8
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light		BK	1	6.6
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light		BK	1	6.6
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light		BK	1	7.6
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light		BK	1	7
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light		BK	1	6.3
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light		BK	1	7.2
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light		BK	1	6.9
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light		BK	1	6.8
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light		BK	1	7.1
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light		BK	1	6.8
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light		BK	1	7
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light		BK	1	7.1
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light		BK	1	7
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light		BK	1	7.5
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light		BK	1	6.6
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light		BK	1	7.1
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light		BK	1	6.6
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light		BK	1	6.4
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light		BK	1	6.9
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light		BK	1	6.3
Third Pond	1999-08-04	12:00pm	18.7	22	Westerly/Light		BK	1	7.1
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	SJ	2	NA
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	SM	1	NA

Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	STB	201	NA
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	6.1
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	10.3
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	6.3
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	6.9
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	7
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	7
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	7.1
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	6.9
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	7.4
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	7.1
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	6.9
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	7
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	6.4
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	7.5
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	7.4
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	7
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	7
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	6.8
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	6.9
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	7.6
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	7.2
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	7.5
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	9.6
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	7.5
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	6.8
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	7.4
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	7.2
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	7.5
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	9.6
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	6.9
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	6.9
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	7.3
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	6.3
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	6.6
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	6.4
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	6.9

Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	6.1
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	6.6
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	6.6
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	7.3
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	7
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	7.5
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	7.5
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	7.6
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	6.8
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	6.2
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	7.5
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	6.9
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	7.2
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	6.6
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	6.6
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	7.4
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	7
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	6.8
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	7.8
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	7.4
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	7
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	6.9
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	7.1
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	7
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	7
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	9
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	7
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	7
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	9
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	7.5
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	7
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	7
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	8
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	6.9
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	7
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	6.4
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	7

Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	7.1
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	7.2
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	7.5
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	7.5
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	10.4
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	7.5
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	6.9
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	7
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	10
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	7.5
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	6.6
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	6.8
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	6.7
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	10.4
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	6.6
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	7
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	7.6
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	7
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	6.6
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	7.2
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	7
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	7.2
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	7
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	11.6
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	7.2
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	6.6
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	7.2
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	9
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	8
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	9
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	9
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	9
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	9
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	6.4
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	6.4
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	11.4
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	6.8

Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	6.2
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	6.8
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	7.2
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	9
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	11
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	7.2
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	6.9
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	9
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	7
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	7.1
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	6.8
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	6.5
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	11.2
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	6.9
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	10.4
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	11
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	7.2
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	9
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	6.2
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	6.6
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	9
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	11
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	12.8
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	7
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	9.9
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	6.1
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	6.6
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	6.9
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	6.1
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	6.9
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	10.2
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	7.4
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	7.8
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	6.5
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	11
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	6.8
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	10.8

Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	7.3
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	6.9
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	10.6
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	6.4
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	6.9
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	6.8
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	10.4
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	9.9
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	7.2
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	10.4
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	6.4
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	7.3
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	8.6
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	11.8
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	6.1
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	10.8
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	10.4
Third Pond	1999-08-04	1:00pm	20.8	22	Westerly/Light	70	BK	1	10
Third Pond	1999-08-04	1:35pm					STB	7	NA
Third Pond	1999-08-04	1:35pm					BK	1	10.4
Third Pond	1999-08-04	1:35pm					BK	1	6.9
Third Pond	1999-08-04	1:35pm					BK	1	6.4
Third Pond	1999-08-04	1:35pm					BK	1	7.5
Third Pond	1999-08-04	1:35pm					BK	1	6.4
Third Pond	1999-08-04	1:35pm					BK	1	10.9
Third Pond	1999-08-05	11:00am	21.8	22.5	Westerly/Moderate	20	SM	4	NA
Third Pond	1999-08-05	11:00am	21.8	22.5	Westerly/Moderate	20	STB	60	NA
Third Pond	1999-08-05	11:00am	21.8	22.5	Westerly/Moderate	20	SJ	3	NA
Third Pond	1999-08-05	11:00am	21.8	22.5	Westerly/Moderate	20	BK	1	7.6
Third Pond	1999-08-05	11:00am	21.8	22.5	Westerly/Moderate	20	BK	1	7.2
Third Pond	1999-08-05	11:00am	21.8	22.5	Westerly/Moderate	20	BK	1	6.3
Third Pond	1999-08-05	11:00am	21.8	22.5	Westerly/Moderate	20	BK	1	10
Third Pond	1999-08-05	11:00am	21.8	22.5	Westerly/Moderate	20	BK	1	6.4
Third Pond	1999-08-05	11:00am	21.8	22.5	Westerly/Moderate	20	BK	1	7.4
Third Pond	1999-08-05	11:00am	21.8	22.5	Westerly/Moderate	20	BK	1	7

Third Pond	1999-08-05	11:00am	21.8	22.5	Westerly/Moderate	20	B K	1	6.2
Third Pond	1999-08-05	11:00am	21.8	22.5	Westerly/Moderate	20	BK	1	6.6
Third Pond	1999-08-05	11:00am	21.8	22.5	Westerly/Moderate	20	BK	1	7
Third Pond	1999-08-05	11:00am	21.8	22.5	Westerly/Moderate	20	BK	1	7.2
Third Pond	1999-08-05	11:00am	21.8	22.5	Westerly/Moderate	20	BK	1	7.8
Third Pond	1999-08-05	11:00am	21.8	22.5	Westerly/Moderate	20	BK	1	7
Third Pond	1999-08-05	11:00am	21.8	22.5	Westerly/Moderate	20	BK	1	7.6
Third Pond	1999-08-05	11:00am	21.8	22.5	Westerly/Moderate	20	BK	1	7.2
Third Pond	1999-08-05	11:00am	21.8	22.5	Westerly/Moderate	20	BK	1	7.7
Third pond	1999-08-17	9:30am	12.2	16	Northwest/Strong	95	BT	1	NA
Third pond	1999-08-17	9:30am	12.2	16	Northwest/Strong	95	SM	2	NA
Third pond	1999-08-17	9:30am	12.2	16	Northwest/Strong	95	STB	25	NA
Third pond	1999-08-17	9:30am	12.2	16	Northwest/Strong	95	SJ	3	NA
Third pond	1999-08-17	9:30am	12.2	16	Northwest/Strong	95	BK	1	7
Third pond	1999-08-17	9:30am	12.2	16	Northwest/Strong	95	BK	1	7
Third pond	1999-08-17	9:30am	12.2	16	Northwest/Strong	95	BK	1	9.8
Third pond	1999-08-17	9:30am	12.2	16	Northwest/Strong	95	BK	1	7.2
Third pond	1999-08-17	9:30am	12.2	16	Northwest/Strong	95	BK	1	8.8
Third pond	1999-08-17	9:30am	12.2	16	Northwest/Strong	95	BK	1	7.6
Third pond	1999-08-17	9:30am	12.2	16	Northwest/Strong	95	BK	1	7.8
Third pond	1999-08-17	9:30am	12.2	16	Northwest/Strong	95	BK	1	7.2
Third pond	1999-08-17	9:30am	12.2	16	Northwest/Strong	95	BK	1	10.3
Third pond	1999-08-17	9:30am	12.2	16	Northwest/Strong	95	BK	1	7
Third pond	1999-08-17	9:30am	12.2	16	Northwest/Strong	95	BK	1	8
Third pond	1999-08-17	9:30am	12.2	16	Northwest/Strong	95	BK	1	6.7
Third pond	1999-08-17	9:30am	12.2	16	Northwest/Strong	95	BK	1	7.2
Third pond	1999-08-17	9:30am	12.2	16	Northwest/Strong	95	BK	1	7.1
Third pond	1999-08-17	9:30am	12.2	16	Northwest/Strong	95	BK	1	7.2
Third pond	1999-08-17	9:30am	12.2	16	Northwest/Strong	95	BK	1	9
Third pond	1999-08-17	9:30am	12.2	16	Northwest/Strong	95	BK	1	7.1
Third Pond	1999-08-17	9:10am	12	16	Northwest/Strong	95	SM	1	NA
Third Pond	1999-08-17	9:10am	12	16	Northwest/Strong	95	SJ	10	NA
Third Pond	1999-08-17	9:10am	12	16	Northwest/Strong	95	STB	15	NA
Third Pond	1999-08-17	9:10am	12	16	Northwest/Strong	95	BK	1	7.1
Third Pond	1999-08-17	9:10am	12	16	Northwest/Strong	95	BK	1	12.8

Third Pond	1999-08-17	9:10am	12	16	Northwest/Strong	95	BK	1	9
Third Pond	1999-08-17	9:10am	12	16	Northwest/Strong	95	BK	1	7.8
Third Pond	1999-08-17	9:10am	12	16	Northwest/Strong	95	BK	1	10.4
Third Pond	1999-08-17	9:10am	12	16	Northwest/Strong	95	BK	1	7.8
Third Pond	1999-08-17	10:05am	12.7	14.5	Northwest/Strong	100	STB	11	NA
Third Pond	1999-08-17	10:05am	12.7	14.5	Northwest/Strong	100	SM	2	NA
Third Pond	1999-08-17	10:05am	12.7	14.5	Northwest/Strong	100	BK	1	11.2
Third Pond	1999-08-17	10:05am	12.7	14.5	Northwest/Strong	100	BK	1	10
Third Pond	1999-08-17	10:05am	12.7	14.5	Northwest/Strong	100	BK	1	7.6
Third Pond	1999-08-17	10:05am	12.7	14.5	Northwest/Strong	100	BK	1	7.7
Third Pond	1999-08-17	10:05am	12.7	14.5	Northwest/Strong	100	BK	1	7
Third Pond	1999-08-17	10:05am	12.7	14.5	Northwest/Strong	100	BK	1	10.4
Third Pond	1999-08-17	10:05am	12.7	14.5	Northwest/Strong	100	BK	1	7.1
Third Pond	1999-08-17	10:05am	12.7	14.5	Northwest/Strong	100	BK	1	6.6
Third Pond	1999-08-17	10:05am	12.7	14.5	Northwest/Strong	100	BK	1	7.3
Third Pond	1999-08-17	10:05am	12.7	14.5	Northwest/Strong	100	BK	1	6.3
Third Pond	1999-08-17	10:05am	12.7	14.5	Northwest/Strong	100	BK	1	10.4
Third Pond	1999-08-17	10:05am	12.7	14.5	Northwest/Strong	100	BK	1	7
Third Pond	1999-08-17	10:05am	12.7	14.5	Northwest/Strong	100	BK	1	7.6
Third Pond	1999-08-17	10:05am	12.7	14.5	Northwest/Strong	100	BK	1	7.7
Third Pond	1999-08-17	10:05am	12.7	14.5	Northwest/Strong	100	BK	1	7.3
Third Pond	1999-08-17	10:05am	12.7	14.5	Northwest/Strong	100	BK	1	7
Third pond	1999-08-17	9:30am	12.2	16	Northwest/Strong	95	BT	1	NA
Third pond	1999-08-17	9:30am	12.2	16	Northwest/Strong	95	SM	2	NA
Third pond	1999-08-17	9:30am	12.2	16	Northwest/Strong	95	STB	25	NA
Third pond	1999-08-17	9:30am	12.2	16	Northwest/Strong	95	SJ	3	NA
Third pond	1999-08-17	9:30am	12.2	16	Northwest/Strong	95	BK	1	7
Third pond	1999-08-17	9:30am	12.2	16	Northwest/Strong	95	BK	1	7
Third pond	1999-08-17	9:30am	12.2	16	Northwest/Strong	95	BK	1	10.4
Third pond	1999-08-17	9:30am	12.2	16	Northwest/Strong	95	BK	1	7.2
Third pond	1999-08-17	9:30am	12.2	16	Northwest/Strong	95	BK	1	7.3
Third pond	1999-08-17	9:30am	12.2	16	Northwest/Strong	95	BK	1	11.8
Third pond	1999-08-17	9:30am	12.2	16	Northwest/Strong	95	BK	1	7.8
Third pond	1999-08-17	9:30am	12.2	16	Northwest/Strong	95	BK	1	7.9
Third pond	1999-08-17	9:30am	12.2	16	Northwest/Strong	95	BK	1	7.2

Third pond	1999-08-17	9:30am	12.2	16	Northwest/Strong	95	BK	1	7
Third pond	1999-08-17	9:30am	12.2	16	Northwest/Strong	95	BK	1	8.8
Third pond	1999-08-17	9:30am	12.2	16	Northwest/Strong	95	BK	1	6.7
Third pond	1999-08-17	9:30am	12.2	16	Northwest/Strong	95	BK	1	7.2
Third pond	1999-08-17	9:30am	12.2	16	Northwest/Strong	95	BK	1	7.1
Third pond	1999-08-17	9:30am	12.2	16	Northwest/Strong	95	BK	1	7.2
Third pond	1999-08-17	9:30am	12.2	16	Northwest/Strong	95	BK	1	7.8
Third pond	1999-08-17	9:30am	12.2	16	Northwest/Strong	95	BK	1	10.4
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	STB	60	NA
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	SJ	5	NA
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	9.8
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	7.4
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	7.4
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	6.9
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	7.6
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	7.8
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	8.9
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	7.6
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	11.2
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	10.5
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	6.4
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	9.2
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	0
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	8
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	11.9
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	7.1
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	7.4
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	10
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	7.3
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	10.4
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	10.5
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	8
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	6.6
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	8.1
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	7

Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	7
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	7.8
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	7.1
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	7.1
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	7.8
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	7
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	10.4
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	7.8
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	10.3
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	8.2
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	6.9
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	7.5
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	7.8
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	8.8
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	7.3
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	7.4
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	7.6
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	8.8
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	7.2
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	6.7
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	9.8
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	7.2
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	7.1
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	7.6
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	7.1
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	7.2
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	10
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	10.1
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	7.7
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	8.8
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	7
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	7
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	8.8
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	7.3
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	10.1

Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	7.4
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	6.8
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	8
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	6.3
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	11
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	7.6
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	7.8
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	7
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	7.6
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	7.9
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	9
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	9
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	9
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	10.6
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	8
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	7
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	6.8
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	9.9
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	8.8
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	6.8
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	7.6
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	7.6
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	10.3
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	7.1
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	7.2
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	7.4
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	7.7
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	6.8
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	7
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	8
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	7.3
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	9
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	11
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	7.6
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	7.5
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	9.9
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	7.3

Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	7.2
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	9.9
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	8.1
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	7.5
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	9
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	7.7
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	7
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	7.6
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	7.6
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	9
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	7.8
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	7.8
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	8
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	7.9
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	10.7
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	7.8
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	7
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	10.2
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	7.6
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	11.3
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	6.9
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	8
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	7.6
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	8
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	10.2
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	7
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	6.7
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	8
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	8.8
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	9.8
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	7.4
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	8
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	6.5
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	10.6

Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	7.4
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	8
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	6.9
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	6.8
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	12.4
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	6.9
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	6.6
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	
Third Pond	1999-08-18	9:41am	18.1	17	Southwest/Moderate	70	BK	1	7.1
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	SJ	7	NA
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	7
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	7.3
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	6.9
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	7.1
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	7.2
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	6.5
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	7.9
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	12.2
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	7.2
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	8
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	10.4
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	7
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	10
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	10.4
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	7.6
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	8.1
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	7.1
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	10.6
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	7.2
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	7.9
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	9.8
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	7.8
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	10.8
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	9
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	7.5
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	9

Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	7.9
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	9
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	7.4
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	7.1
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	10.8
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	7.6
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	7.8
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	7.2
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	11
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	9.8
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	7.5
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	7.1
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	6.4
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	10.8
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	7.1
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	7
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	9.9
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	12.5
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	7.5
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	10.4
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	8.6
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	7.8
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	7.4
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	7.5
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	10.4
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	7.5
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	7.7
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	11
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	8.4
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	7.1
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	9.8
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	7.2
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	6.5
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	6.9
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	10.2
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	7.2
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	10.8

Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	8.9
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	8
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	6.6
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	7.2
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	11.2
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	9.6
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	10.6
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	8.8
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	10.2
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	7.1
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	7.4
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	9
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	7.6
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	10
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	9.2
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	10
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	10.2
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	9
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	7.6
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	8
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	10.2
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	7.3
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	6.9
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	8
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	9.8
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	8
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	6.9
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	8.8
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	10.6
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	6.8
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	11.8
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	7.5
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	9.9
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	7

Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	11
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	8.8
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	7.2
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	12.6
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	6.8
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	7.4
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	10.4
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	7.3
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	7.3
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	11.2
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	7.5
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	11.5
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	6.6
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	7.4
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	7.3
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	10.6
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	7.1
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	8
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	7.1
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	12.4
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	7.2
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	10
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	11
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	7.5
Third Pond	1999-08-18	10:40am	21.5	18.5	Southwest/Moderate	50	BK	1	7.5
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	STB	70	NA
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	8.8
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	8
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	6.7
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	10.9
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	7.6
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	6.9
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	7.3
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	8
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	7.2
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	7.8

Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	9.6
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	8
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	7.1
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	6.9
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	9
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	7.6
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	7.8
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	10.6
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	7
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	6.8
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	10.2
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	7.4
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	10.2
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	10.2
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	8
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	7.6
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	6.6
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	6.9
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	11.4
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	10.6
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	10.8
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	7.4
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	7.2
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	7.1
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	11.5
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	10.4
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	7.3
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	7.2
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	8.7
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	7.6
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	9.8
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	7.5
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	6.5
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	9.3
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	7.1
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	7.5

Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	8
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	6.6
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	7.6
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	10.4
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	11.5
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	6.8
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	10.4
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	9.8
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	7.4
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	7
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	6.8
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	7.8
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	8
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	11.2
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	6.6
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	12
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	11.9
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	9.6
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	6.6
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	8.9
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	6.6
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	7.5
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	6.9
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	10.5
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	7.2
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	10
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	7.1
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	9.8
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	8.9
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	6.8
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	11.6
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	8.1
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	6.9
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	7
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	9.4
Third Pond	1999-08-18	11:55am	23.5	19	Southwest/Moderate	60	BK	1	11

Third Pond	1999-09-14	9:20am	14	16	Southeast/Light	60	SJ	1	NA
Third Pond	1999-09-14	9:20am	14	16	Southeast/Light	60	STB	15	NA
Third Pond	1999-09-14	9:20am	14	16	Southeast/Light	60	BK	1	11
Third Pond	1999-09-14	9:20am	14	16	Southeast/Light	60	BK	1	8
Third Pond	1999-09-14	9:20am	14	16	Southeast/Light	60	BK	1	11
Third Pond	1999-09-14	9:20am	14	16	Southeast/Light	60	BK	1	7.9
Third Pond	1999-09-14	9:20am	14	16	Southeast/Light	60	BK	1	9.9
Third Pond	1999-09-14	9:20am	14	16	Southeast/Light	60	BK	1	7.8
Third Pond	1999-09-14	9:20am	14	16	Southeast/Light	60	BK	1	10.3
Third Pond	1999-09-14	9:20am	14	16	Southeast/Light	60	BK	1	7.4
Third Pond	1999-09-14	9:20am	14	16	Southeast/Light	60	BK	1	8
Third Pond	1999-09-14	9:20am	14	16	Southeast/Light	60	BK	1	10.4
Third Pond	1999-09-14	9:45am	15	16	Southeast/Light	60	STB	8	DEAD
Third Pond	1999-09-14	9:45am	15	16	Southeast/Light	60	STB	36	NA
Third Pond	1999-09-14	9:45am	15	16	Southeast/Light	60	SJ	1	NA
Third Pond	1999-09-14	9:45am	15	16	Southeast/Light	60	BK	1	9.8
Third Pond	1999-09-14	9:45am	15	16	Southeast/Light	60	BK	1	8.5
Third Pond	1999-09-14	9:45am	15	16	Southeast/Light	60	BK	1	9.9
Third Pond	1999-09-14	9:45am	15	16	Southeast/Light	60	BK	1	7.6
Third Pond	1999-09-14	9:45am	15	16	Southeast/Light	60	BK	1	12.8
Third Pond	1999-09-14	9:45am	15	16	Southeast/Light	60	BK	1	8.1
Third Pond	1999-09-14	9:45am	15	16	Southeast/Light	60	BK	1	11.4
Third Pond	1999-09-14	9:45am	15	16	Southeast/Light	60	BK	1	8.2
Third Pond	1999-09-14	9:45am	15	16	Southeast/Light	60	BK	1	8.3
Third Pond	1999-09-14	9:45am	15	16	Southeast/Light	60	BK	1	10.4
Third Pond	1999-09-14	9:45am	15	16	Southeast/Light	60	BK	1	8.9
Third Pond	1999-09-14	9:45am	15	16	Southeast/Light	60	BK	1	12
Third Pond	1999-09-14	9:45am	15	16	Southeast/Light	60	BK	1	8.7
Third Pond	1999-09-14	9:45am	15	16	Southeast/Light	60	BK	1	9.6
Third Pond	1999-09-14	9:45am	15	16	Southeast/Light	60	BK	1	8.3
Third Pond	1999-09-14	9:45am	15	16	Southeast/Light	60	BK	1	10.4
Third Pond	1999-09-14	9:45am	15	16	Southeast/Light	60	BK	1	10.6
Third Pond	1999-09-14	9:45am	15	16	Southeast/Light	60	BK	1	8.8
Third Pond	1999-09-14	9:45am	15	16	Southeast/Light	60	BK	1	11.4
Third Pond	1999-09-14	9:45am	15	16	Southeast/Light	60	BK	1	8.6

Third Pond	1999-09-14	9:45am	15	16	Southeast/Light	60	BK	1	10.4
Third Pond	1999-09-14	9:45am	15	16	Southeast/Light	60	BK	1	10.6
Third Pond	1999-09-14	9:45am	15	16	Southeast/Light	60	BK	1	8.4
Third Pond	1999-09-14	9:45am	15	16	Southeast/Light	60	BK	1	11.1
Third Pond	1999-09-14	9:45am	15	16	Southeast/Light	60	BK	1	12.4
Third Pond	1999-09-14	9:45am	15	16	Southeast/Light	60	BK	1	8.3
Third Pond	1999-09-14	9:45am	15	16	Southeast/Light	60	BK	1	11.6
Third Pond	1999-09-14	9:45am	15	16	Southeast/Light	60	BK	1	8.7
Third Pond	1999-09-14	9:45am	15	16	Southeast/Light	60	BK	1	8.1
Third Pond	1999-09-14	9:45am	15	16	Southeast/Light	60	BK	1	8.3
Third Pond	1999-09-14	9:45am	15	16	Southeast/Light	60	BK	1	11
Third Pond	1999-09-14	9:45am	15	16	Southeast/Light	60	BK	1	9.8
Third Pond	1999-09-14	9:45am	15	16	Southeast/Light	60	BK	1	8.2
Third Pond	1999-09-14	9:45am	15	16	Southeast/Light	60	BK	1	8.2
Third Pond	1999-09-14	9:45am	15	16	Southeast/Light	60	BK	1	9.3
Third Pond	1999-09-14	9:45am	15	16	Southeast/Light	60	BK	1	12.1
Third Pond	1999-09-14	9:45am	15	16	Southeast/Light	60	BK	1	11.1
Third Pond	1999-09-14	9:45am	15	16	Southeast/Light	60	BK	1	8.3
Third Pond	1999-09-14	9:45am	15	16	Southeast/Light	60	BK	1	12
Third Pond	1999-09-14	9:45am	15	16	Southeast/Light	60	BK	1	7.6
Third Pond	1999-09-14	9:45am	15	16	Southeast/Light	60	BK	1	7.4
Third Pond	1999-09-14	9:45am	15	16	Southeast/Light	60	BK	1	8.6
Third Pond	1999-09-14	9:45am	15	16	Southeast/Light	60	BK	1	12
Third Pond	1999-09-14	9:45am	15	16	Southeast/Light	60	BK	1	9
Third Pond	1999-09-14	9:45am	15	16	Southeast/Light	60	BK	1	8.4
Third Pond	1999-09-14	9:45am	15	16	Southeast/Light	60	BK	1	12
Third Pond	1999-09-14	9:45am	15	16	Southeast/Light	60	BK	1	9
Third Pond	1999-09-14	9:45am	15	16	Southeast/Light	60	BK	1	7.9
Third Pond	1999-09-14	9:45am	15	16	Southeast/Light	60	BK	1	12
Third Pond	1999-09-14	9:45am	15	16	Southeast/Light	60	BK	1	8.8
Third Pond	2000-07-12	3:00pm			Nil	40	BK	184	Not Measured
Third Pond	2000-07-12	3:00pm			Nil	40	BK	154	Not Measured
Third Pond	2000-07-12	3:00pm			Nil	40	BK	191	Not Measured

(Done for distribution
purposes only)

APPENDIX III DATA – Biological data collected on banded killifish taken from the three Newfoundland study sites: Indian Bay Watershed (IBW); Loch Leven (LL); Freshwater Pond (FWP). Data reported include the total length (mm) of specimens from the three populations versus number of eggs per specimen and weight (grams).

Population	Length	Eggs	Population	Length	Eggs	Population	Length	Eggs
IBW	78.4	144	LL	68.9	129	FWP	77.9	128
IBW	90.4	176	LL	84.2	163	FWP	83.6	144
IBW	81.8	134	LL	76.5	131	FWP	92.6	176
IBW	96.4	176	LL	78.6	134	FWP	98.3	190
IBW	104.3	295	LL	109.5	372	FWP	111.8	350
IBW	72.8	119	LL	78.9	142	FWP	78.9	143
IBW	64.8	120	LL	96.3	190	FWP	88.8	184
IBW	63.2	122	LL	75.3	144	FWP	69.9	132
IBW	86.4	137	LL	68.5	109	FWP	91.3	176
IBW	76.1	133	LL	68.2	116	FWP	77.4	125
IBW	73.2	104	LL	76.5	123	FWP	75.9	132
IBW	61.2	110	LL	78.6	174	FWP	86.4	136
IBW	102.7	239	LL	78	154	FWP	98.6	187
IBW	116.4	420	LL	107.5	290	FWP	107.3	294
IBW	78.3	116	LL	88.6	176	FWP	99.7	212
IBW	91.6	129	LL	65.7	122	FWP	65.2	99
IBW	67.5	126	LL	64.8	156	FWP	64	121
IBW	64.8	115						
IBW	100.6	246						
IBW	110.7	337						
IBW	97.5	177						
IBW	86	132						
IBW	106.4	302						
IBW	100.3	255						
IBW	96.5	165						
IBW	113.5	345						
IBW	89.4	138						
IBW	103.7	278						
IBW	99.5	184						
IBW	65.8	93						

Population	Length	Weight	Population	Length	Weight	Population	Length	Weight
IBW	7.5	5.6	LL	6.1	2.8	FWP	10.9	16.7
IBW	7.3	4.78	LL	7.8	5.1	FWP	10.8	14.6
IBW	10.6	14.7	LL	7.6	5.5	FWP	7.6	4.9
IBW	10.8	13.6	LL	9.8	10.5	FWP	7.3	4.6
IBW	10.3	13.3	LL	9.9	11.8	FWP	10.3	13.6
IBW	5.2	2.3	LL	5.8	2.6	FWP	5.3	2.5
IBW	7.1	4.5	LL	7.6	5.6	FWP	7.6	5.7
IBW	9.8	10.8	LL	10.9	15	FWP	9.9	12.5
IBW	9.9	12.3	LL	7.6	5	FWP	9.8	11.1
IBW	10.9	16.1	LL	9.4	9.1	FWP	8	6.3
IBW	8.4	6.96	LL	6.6	3.3	FWP	8.6	6.7

IBW	8	5.99	LL	10	8	FWP	7.6	5.3
IBW	7.6	5	LL	11.4	17.6	FWP	9.7	10.1
IBW	8.9	9.23	LL	7.6	5.5	FWP	9	8.4
IBW	9.1	9.08	LL	9	8.9	FWP	9	8.8
IBW	9.8	10.1	LL	9.7	9.9	FWP	6.9	3.8
IBW	9.5	10.4	LL	9	8.2	FWP	10.4	14.3
IBW	9	8.52	LL	7.9	5.2	FWP	6.4	3.2
IBW	11.7	18.1	LL	6.9	4.2	FWP	6.9	4.1
IBW	10.4	12.9	LL	9.8	9.9	FWP	9.3	8.94
IBW	10	7.7	LL	5.6	2.6	FWP	5.5	2.4
IBW	9.8	10	LL	6.4	3.2	FWP	7	3.9
IBW	6.8	3.65	LL	10.6	15	FWP	10.6	15.3
IBW	7.9	5	LL	10.3	13.9	FWP	10	9.2
IBW	9	8	LL	9.3	8.85	FWP	8.1	7.3
IBW	6.9	4	LL	7.2	4	FWP	8.4	8.14
IBW	7.2	4.03	LL	9.2	8.78			
IBW	6.3	3.43	LL	8.2	7.5			
IBW	5.8	2.83	LL	7.3	4.68			
IBW	6.6	3.4	LL	7	3.8			
IBW	6.4	3.04	LL	8.2	7.43			
IBW	10.6	17	LL	8.2	7.9			
IBW	10.3	13.8	LL	8.8	8.38			
IBW	9.2	8.79	LL	7.3	4.5			
IBW	7.3	4.72	LL	6.6	3.2			
IBW	7	3.8	LL	8.8	8.76			
IBW	6.6	3.4	LL	10	8			
IBW	7.1	4.09	LL	10.1	9			
IBW	6.4	2.8						
IBW	6.6	4						
IBW	5.6	2.3						
IBW	7.2	3.5						
IBW	8.2	7.5						
IBW	10.2	12.5						
IBW	10.6	14.2						
IBW	11.2	18.5						
IBW	9.9	11.2						
IBW	10.6	14.4						
IBW	10.9	16.8						
IBW	8.8	8.5						
IBW	9.9	13.1						
IBW	8.2	8.2						