Smolt Production on the Miramichi River 2015

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Introduction

Declining Atlantic salmon runs in the Miramichi River during the 1970's and early 1980's marked the beginning of increased conservation efforts for this species. Actions plans were put in place, including the closure of the commercial fishery and the mandatory release of all large salmon by anglers. From 1984 – 1992 the stocks rebounded and numbers were on the rise. After 1992 however, stocks began declining again and have continued to do so over the last two decades. Over recent years, the Southwest branch has outperformed the Northwest branch for adult returns. During the 17 years from 1998 – 2014, the Northwest system only reached conservation requirements (for sustainability) during two separate years, whereas the Southwest system met requirements for seven of those years. The average conservation requirement from 1998 – 2014 was 103% on the Southwest and 51% on the Northwest.

Electrofishing results from both the Northwest and Southwest branches of the river have typically shown healthy numbers of salmon fry and parr. It has been assumed that smolt production in these rivers would reflect these high juvenile numbers and therefore high smolt numbers should be produced, however adult returns do not reflect this trend. In 2011 angling regulations on the Northwest Miramichi were modified to a catch and release fishery to reduce human harvesting mortality on grilse, and in 2015 all New Brunswick Rivers became mandatory catch and release fisheries of all Atlantic salmon due to the continual decline in stocks. The initial policy change on the Northwest River in 2011 has likely reduced the angling mortality rate on the this system since then, compared to the Southwest, but the large adults returning on the Northwest are still subjected to non-angling mortality from First Nations Fisheries Allocations. The Northwest River is also the site of a striped bass spawning ground where bass spawn at the same time as smolt are migrating to the ocean. This has the potential to increase smolt mortality rates through predation. Striped bass are also present in the Southwest branch but not concentrated in high numbers as at a spawning area like the Northwest branch.

Smolt population estimates have been carried out in recent years on each branch of the Miramichi River system separately. The MSA has conducted ten years of estimates on the Southwest branch (2001-2010) and three years on the Northwest branch (2011-2013). This year marks the second year of a new program that focuses on the river as a whole. The decision to

change the program stemmed from concerns that over the three years fishing occurred on the Northwest River too many smolt were being missed in the Cassilis trap net because of washouts (the smolt estimates would be artificially low in such cases). The net needed to be in a location where it could be fished continuously without being damaged or washed out. Tidal waters offer more security from spring freshets so a location in the estuary in Chatham was chosen as a new trap net location. Since this location would count smolts from both the Northwest and Southwest Branches, the tagging was expanded to include the Southwest system and four smolt wheels were installed: two on the Northwest system and two on the Southwest.

The purpose of this study is to assess smolt production on the Miramichi River to determine if adequate juvenile production is occurring. An accurate estimation of the total smolt population migrating out of the Miramichi River system to the ocean is a key component to understanding and managing Atlantic salmon in this area. Ocean survival rates of smolt can then be observed in subsequent years as adults return as grilse and salmon and will help guide management decisions to conserve this important stock of salmon.

Methods

Study Area

The Miramichi River watershed drainage area is approximately 12,000 km^2. The system is divided into two large branches – the Northwest and the Southwest. The Southwest system encompasses 2/3's of the total drainage area, while the Northwest system is smaller – occupying 1/3 of the total area.

Design

The smolt production estimate for the Miramichi River used a two-sample mark-recapture study design. Four rotary screw traps (RST's) or smolt wheels were installed in early May. Two traps were located on the Northwest system – one on the Northwest River (operated by MSA) and one on the Sevogle (operated by NSPA), and two traps were located on the Southwest system – one on the Cains River (operated by MSA) and one on Rocky Brook

(operated by IP) (Figure 1). The original plan for 2015 was to have a smolt wheel at the mouth of the Dungarvon River on the Southwest system (not the Cains), but due to road damage from ice flows field crews were unable to access this area and the Cains was chosen as a secondary location. The wheels are held in place by a large overhead cable that spans the width of the river. A second cable connects from this main line to the wheel, where two pontoons keep the wheel partially afloat and allow the trap to rotate fully (the current forces the wheel to turn) without hitting the bottom of the river.

Any fish entering the trap were funneled through the rotating wheel into a holding box at the back of the trap. The rotating wheel prevented any fish from escaping the box. All fish caught in the live box were collected and sorted. Each species was identified, counted, and released except for smolts. Fork lengths were taken from 25 fish which were then tagged with small, individually numbered streamer tags. Any remaining unmeasured smolts were also tagged. All fish were released after tagging. For the purpose of this study all juvenile Atlantic salmon greater than 100mm (FL) were considered smolt.

A single large trap net was installed just upstream of the Centennial Bridge on the Chatham side of the Miramichi River to capture smolt leaving the estuary (Figure 1). Tagged smolt captured at the trap net allows us to get an estimate of the number of smolt moving out of the Miramichi River system. The total smolt run is determined by a ratio of the number of smolt tagged upstream at the smolt wheels, the number of tagged smolt that are recaptured in the trap net, and the number of untagged smolt captured in the trap net. The trap net was fished daily, generally at low tide, and the smolt were sorted from the rest of the species caught. Sub-samples of up to 100 smolt were measured, 20 of which were lethally sampled for length, weight, age, and sex information. All smolts captured were counted and checked for streamer tags.

Permits

The Navigable Waters Permit from the Department of Transportation, Instream Data Collection Devices Permit from the local Department of Environment, and the Scientific Collection Permit from the Department of Fisheries and Oceans were all obtained prior to starting this project.

Results

Population Estimate

The Northwest smolt wheel operated from May 10th – June 1st. The smolt wheel on the Sevogle operated from May 13th – 31st. The Cains smolt wheel operated from May 10th – May 21st, on May 22nd the water levels had dropped and the wheel was no longer fishing. It was repositioned and began fishing again from May 23rd – 29th. The Rocky Brook wheel operated from May 8th – June 1st.

A total of 1,965 smolt were tagged in 2015 - Northwest (801), Sevogle (269), Cains (414), and Rocky Brook (481). The peak of the smolt run for each wheel was as follows: Northwest – May 18th (110 fish), Sevogle – May 23rd & 25th (53 fish), Cains – May 17th (103) (Figure 2).

The trap net operated from May 18th – June 5th. High east winds, large swells, and poor weather conditions kept crews from fishing the trap on May 20th, 21st, 23rd, 24th, and June 3rd. The trap net held up against late spring ice and never had to be lifted, nor did it wash out.

A total of 6554 smolt were captured at the trap net, three of which had been tagged upstream. All three tagged fish were from the Southwest River system (one from Rocky Brook and two from the Cains). The fish from Rocky Brook was tagged on May 11th and recaptured in Chatham on May 18th. The Cains smolts were both tagged on May 17th and both recaptured on May 22nd.

Using the survival information from acoustic receivers deployed for our smolt tracking program, the survival rate of smolts to Chatham was 40%. Applying a 60% mortality rate to our population estimate (using the Peterson Model) gives a smolt estimate of 1,717,148 (95% CI 582, 743 – 5,151,444). This equates to 3.18 smolts/100m^2.

Sampling Data

The male to female sex ratio was 1:1.6, respectively. Average fork length for females was 12.9cm (± 0.98cm) and for males was 12.5cm (± 0.99cm) (Figure 3). Average weight for females was 20.3g (± 4.34g) and for males was 19.1g (± 4.58g) (Figure 4).

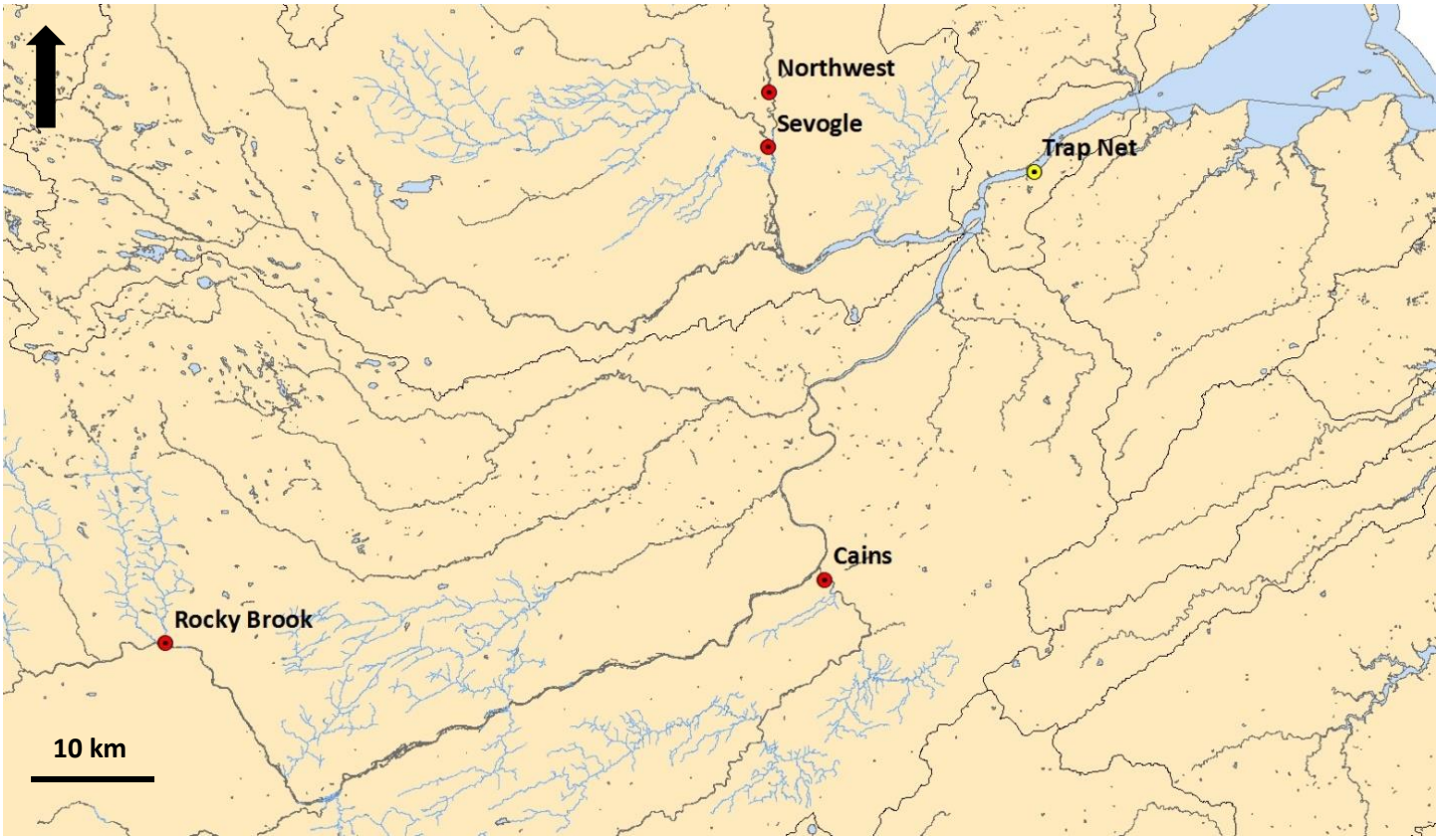

Figure 1. Locations of the four smolt wheels (red dots) operating in 2015 and the trap net in Chatham (yellow dot).

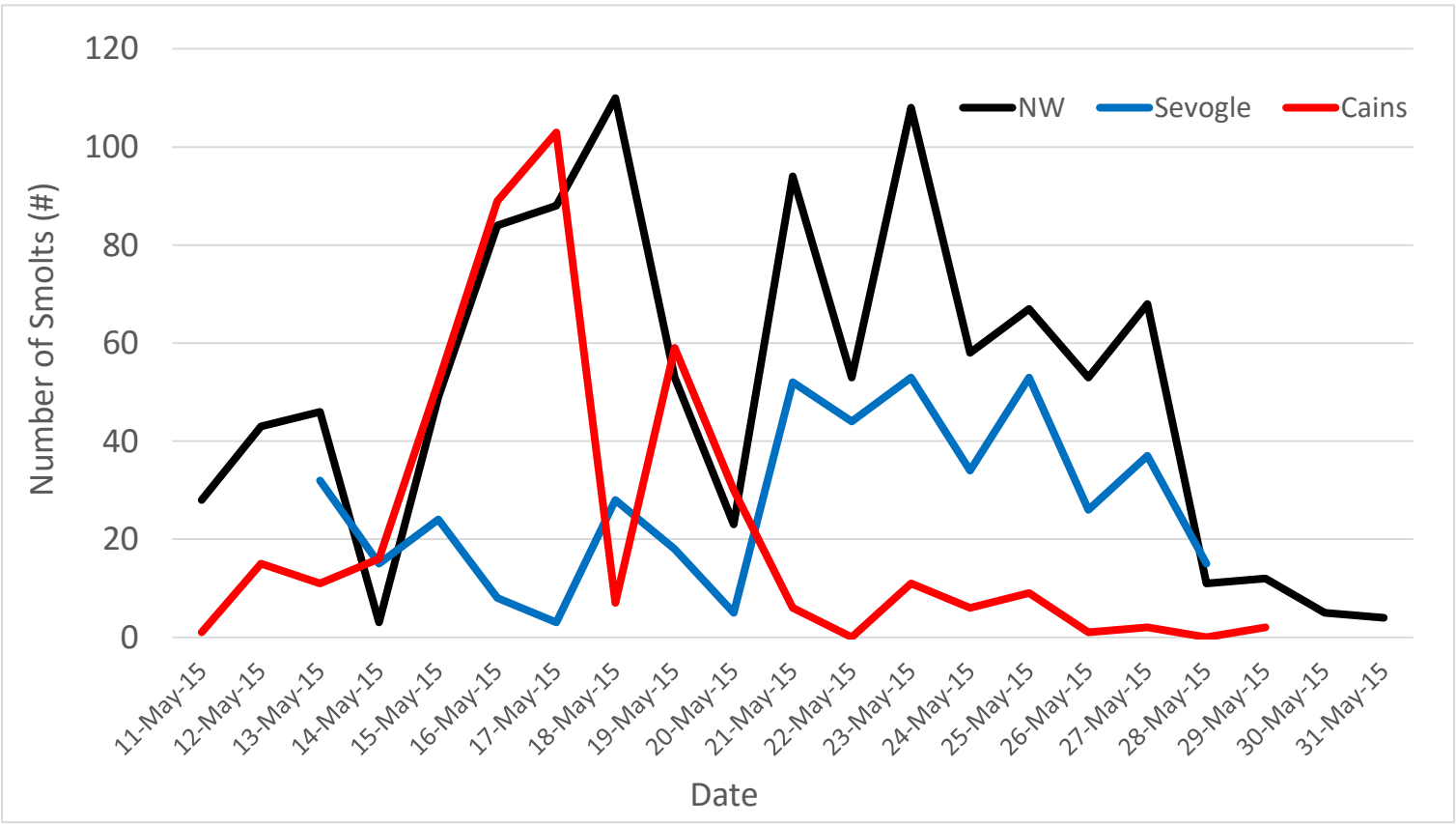

Figure 2. Daily smolt counts at the three wheels operated by MSA and the NSPA during May of 2015. Peak numbers occurred on the Northwest on May 18th, on the Sevogle on May 23rd and 25th, and on the Cains on May 17th.

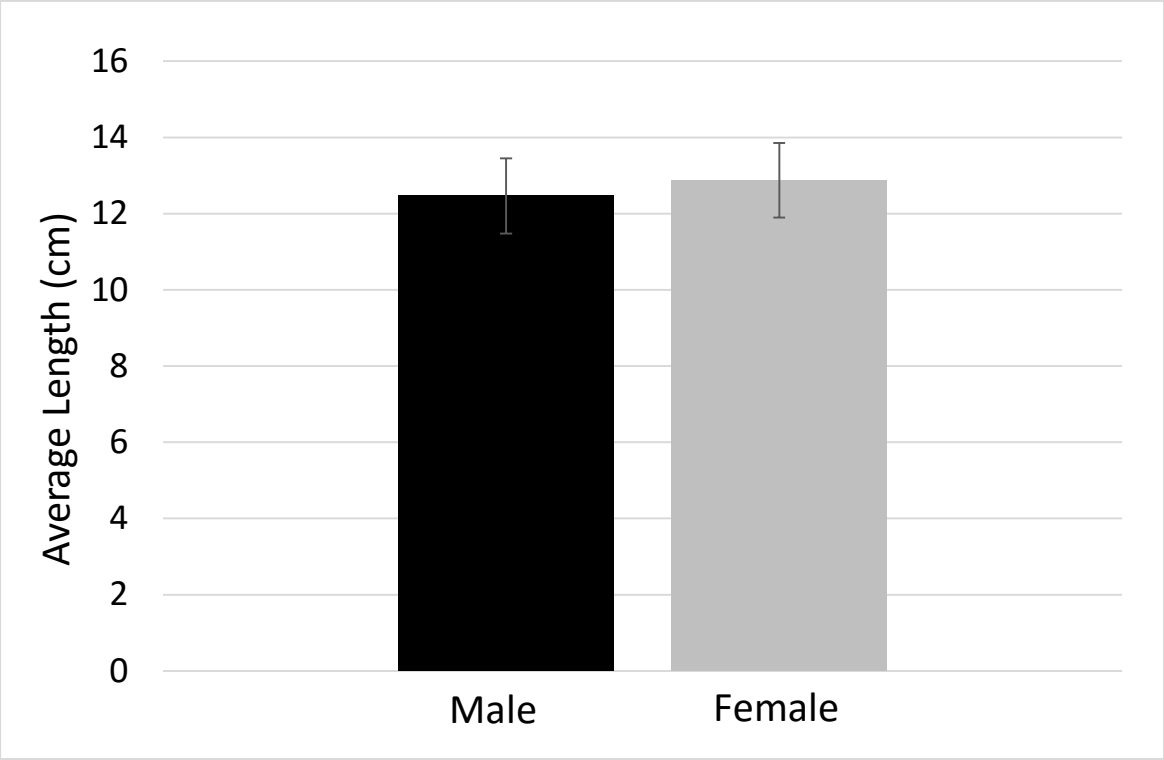

Figure 3. Average fork length (cm) for male and female smolts sampled at the Chatham trap net in the spring of 2015.

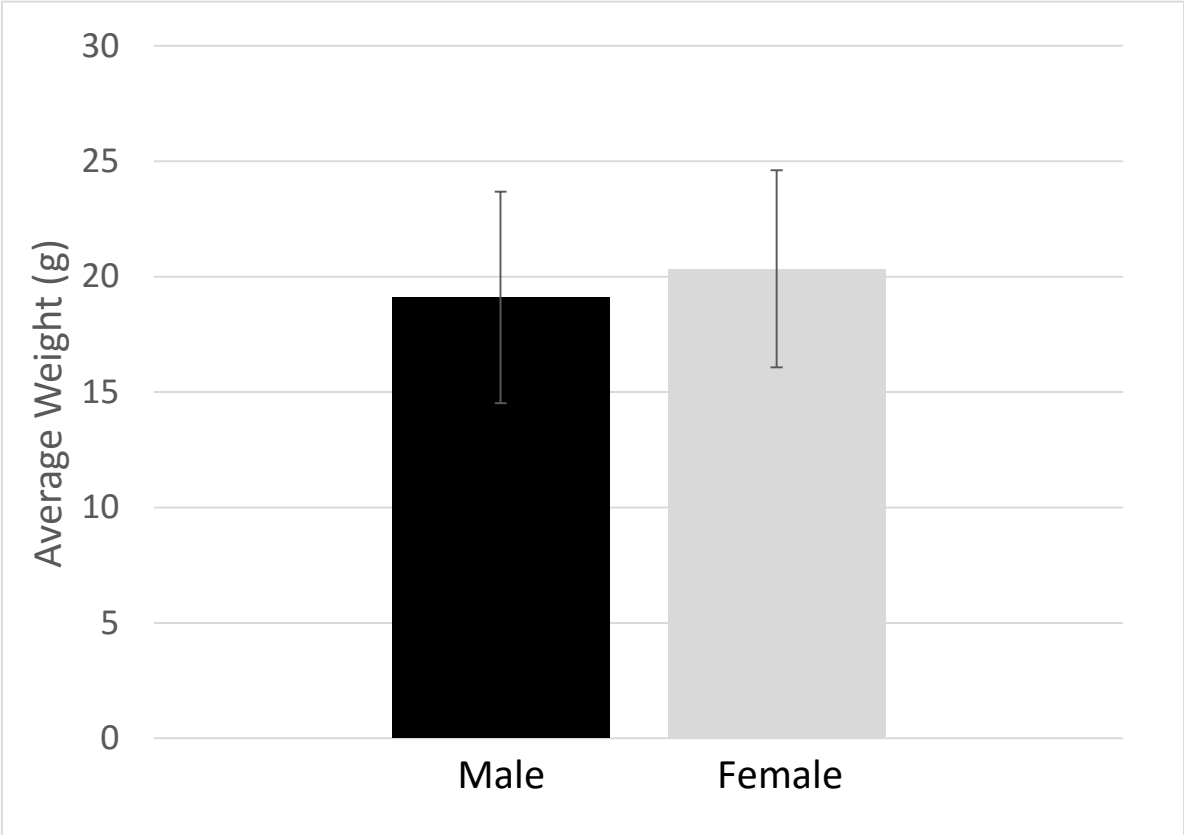

Figure 4. Average weight (g) for males and female smolts sampled at the Chatham trap net in the spring of 2015.

Discussion

The Miramichi River needs 1.8 million smolt migrating to the ocean every year in order to sustain a healthy adult population – roughly 1.2 million from the Southwest branch and 600,000 from the Northwest. The standard estimate is 3.0 smolt/100m^2. In 2014 the trap net was relocated to Chatham, however no estimate could be produced because of the high volume of fish caught – too many for our crews to sample, and the net had to be dumped out. The three years of data from the Northwest system before that have shown variable and sometimes conflicting results; in 2011 and 2013 smolt production exceeded 3.0 smolt/100m^2 and in 2012 was estimated at only 2.0 smolt/100m^2. Difficulties with equipment damage from weather and high water levels occurred during these years and may have impacted estimates. Earlier data from 2006 – 2010 on the Southwest system indicated that smolt production estimates exceeded requirements for all years except 2008. Even with these high smolt estimates the adult returns have continued to decline.

For the 2015 smolt estimate program, alterations were made to our trap net to reduce the volume of fish the net could carry (in the hopes of minimizing the number of fish caught so crews could actually count them all in a day). The leader from shore was also shortened, with only half of the panels dropped in the river. These adjustments were successful, and a much more manageable number of fish were caught this year. Our recapture numbers were very low however (3 tags or 0.15% of total marks), and this caused our estimate to be highly inflated (overestimated). Typically, a 10% mortality is assumed with tagging studies, but with the data available to us from our smolt tracking program, a 60% mortality rate was actually observed to the Chatham area, and that percentage was applied to our estimate, which decreased the number substantially.

We also were not able to fish the trap on five separate days because of high east winds which caused large (>2-3ft) swells, making conditions unsafe for the field crews. The trap net remained fishing during this time, and although the number of fish inside never reached levels similar to 2014, this extra time in the net adds stress to the fish trapped in it for the extended period.

A new strategy is in place for the smolt estimate program in 2016. The MSA plans to relocate the trap net back to the Northwest River because of the problems that have occurred at the Chatham location the last two years. The trap net will be installed at the mouth of Stewart Brook near the Miramichi Salmon Conservation Centre (MSCC), which is downstream of Cassilis, and in an area where trap nets are not impacted by freshets or high winds. This should allow the trap to be fished safely every day and not have to be lifted because of weather conditions. This adjustment in the smolt estimate program is part of a larger project which is seeking funding from the Collaboration for Atlantic Salmon Tomorrow (CAST) initiative to help conserve and improve Atlantic salmon returns on the Miramichi River. The new trap net location will serve as a recapture platform for our smolt estimate program on the Northwest River and also as a collection point for wild smolts to be transferred to the MSCC as part of the adult rearing program also associated with CAST.

Acknowledgements

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Promotion

The NBWTF was promoted through the Miramichi Smolt Production Study by use of stickers on the field kits and the smolt wheels, as well as the MSA office door. Through the MSA website under Programs, the NBWTF will be acknowledged, as well as in the report from this project to be circulated at the Miramichi Watershed Management Committee (MWMC) Science Committee meetings and at MSA board meetings in Freeport, ME and Boston, MA, as well as acknowledged at the joint MWMC/MSA Science Workshop.