ASSESSMENT OF GREEN SEA URCHIN IN LFA 38

Context

A sea urchin drag fishery in LFA 38 has been in operation since the early 1990s. To date, total allowable catch (TAC) for this fishery has been based on the results of a survey conducted by DFO Science without the benefit of an assessment framework or annual peer review. In November 2007, DFO Science was asked to provide science advice on the green sea urchin fishery through submission of a "Request for Science Information and/or Advice Form" through the Maritimes Centre for Science Advice. The question posed by Resource Management was: "what does the 2007 urchin dive survey, in comparison with the surveys from 2005 and 2006, indicate about the current status and trends of the green sea urchin population in LFA 38, and is a further reduction in TAC advised for the 2007/08 season?" A response was requested by December 4, 2007. Given the very short timeframe for response, the Special Science Response process was used to produce this Science Response Report. This is considered to be an interim measure, and it is expected that advice on the 2008-09 fishery will be provided through the standard peer review process.

Background

The Fishery

The commercial green sea urchin (*Strongylocentrotus droebachiensis*) fishery along the coast of south-western New Brunswick, in the Bay of Fundy has been in operation since the early 1990s. The sea urchin fishery was divided into two management areas with the same boundaries as Lobster Fishing Areas (LFA) 36 and 38 (Figure 1).

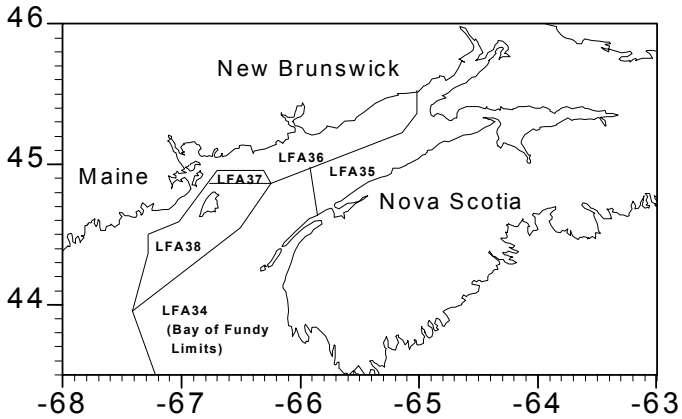

Figure 1. Bay of Fundy LFAs with approximate boundaries. LFA 37 is a buffer zone between LFAs 36 and 38 where fishermen from both areas can fish for lobsters.

In 1996, a TAC for green sea urchin was set at 979 t, based on 1992 survey estimates of a 3.3% harvesting rate of an estimated legal biomass of 29,879 t (Robichaud unpublished report). Since then, the TAC has been voluntarily reduced three times by the industry. The original TAC was reduced voluntarily to 778 t during the 2000-01 fishing season and to 590 t during the 2004-

05 fishing season. Based on 2006 survey results and low catch rates during the previous fishing season, the industry voluntarily reduced the TAC to 176.9 t (or 13.6 t individual non transferable quota) in 2006-07. This was an actual reduction of 69 t (or 28%) below the previous year actual landings (Table 1). During the 2006-07 season, an additional TAC of 176.9 t was allocated to urchin fishing areas situated on the back side of Grand Manan called Zone 2. Fishing in Zone 2, was only allowed after individual quota on the traditional fishing ground had been caught. However, only 6.7 t of urchins were caught by diving in Zone 2 and none were landed by dragging. The short term result of these changes was a reduction of effort and a reduction in the amount of urchin landed during the 2006-07 fishing season.

Table 1. Landings statistics for sea urchins landed in LFA 38.

LFA 38	
Season	**Landings (t)**
1996-1997	872
1997-1998	883
1998-1999	581
1999-2000	830
2000-2001	743
2001-2002	718
2002-2003	623
2003-2004	447
2004-2005	285
2005-2006	246
2006-2007	178

Logbook information indicates that the overall seasonal catch rate for the 2006-07 season has declined to an historical low of 761 kg/trip (Figure 2). However, some of the more experienced fishermen were surprised by this result as they felt that they had higher daily catch rates this year than the previous year. This was confirmed through more detailed analysis of the logbook data, as it was determined that 4 of the most experienced fishermen had reached their individual boat quota of 13,607 kg within 12 to 16 days of fishing. This translates into daily catch rates varying between 850 and 1134 kg/trip. Sixty-one percent of the seasonal landings were caught during the first five weeks of the fishing season (December 11th to January 15th). The remaining 39% of the landings were caught during the last eight weeks of the season.

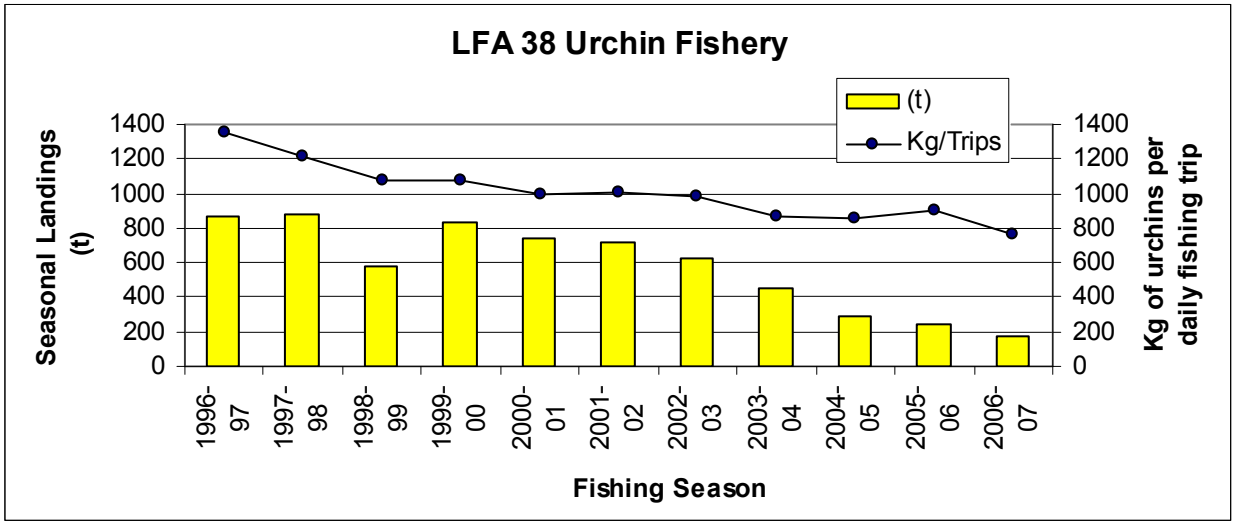

Figure 2. Urchin fisheries landings in metric tons (t) and daily catch rate in kilograms per day trip from logbook information collected seasonally since the 1996-97 fishing season.

Dive Surveys

In 2005 and 2006, urchin dive surveys were conducted off Grand Manan (LFA 38) in order to update and reassess the status of the urchin population. In 2007, Grand Manan Urchins Inc. funded an urchin dive survey following DFO Science protocol and the data were analysed by DFO Science. The 2007 study was designed to resurvey specifically selected transects where high fishing effort occurred during the 2005-06 and 2006-07 winter fishing seasons by urchin drags. For comparison, two transect were resurveyed on urchin grounds where no fishing had ever occurred, with the goal of documenting possible changes in the density of urchins that may occur independent of fishing impact. In addition, two transect were surveyed in Cheney Passage and Cow Passage, areas that have been closed to urchin dragging during the last two years in order to prevent conflict with dulse harvesting.

Analysis

Size Structure

In fished areas, there was no change in the overall size structure of the survey catch from 2005 to 2007 (Table 2). In the **closed areas**, the proportion of legal size urchins in the population decreased from 93% in 2006 to 75% in 2007, and the proportion of sub-legal urchins increased from 7% in 2006 to 25% in 2007. Along one transect in an **area that had never been fished**, the proportion of legal size urchins decreased from 50% in 2005 to 44% in 2007, and there was little change in the proportion of sub-legal urchins. No urchins were found along the other transect in 2007.

Table 2. Sea urchin survey catch composition in different areas.

Areas Surveyed	Year	No. of Sections Sampled	Number of Urchin	% Legal Urchin	% Sub-Legal Urchin	% Juvenile Urchin
*Total Area Fished (2006)	2005	161	2785	36%	61%	3%
	2006	160	2426	36%	59%	5%
	2007	165	2951	37%	57%	6%
Total Area Fished (2005-07)	2005	243	4371	37%	58%	5%
	2007	246	5021	35%	58%	7%
G50 (Area not Fished)	2005	15	306	20%	49%	31%
	2006	15	321	32%	65%	3%
	2007	15	0			
G23 (Area not Fished)	2005	15	308	50%	50%	0%
	2007	15	373	44%	53%	3%
G103-G104 (Closed Areas)	2006	21	378	93%	7%	0%
	2007	21	718	75%	25%	0%

**Only includes transects that were surveyed all three years.*

Density

The 2007 survey results showed that the overall density of **urchins of all sizes** located in the **fished areas** have decreased significantly from 17.4 and 11.0 urchins/m^2 in 2005 and 2006, respectively, to 6.4 urchins/m^2 in 2007. When data from the extra transects that were done in 2007 are included, the overall density of urchins located in the fished areas showed a significant decline from 19.9 urchins/m^2 in 2005 to 10.0 urchins/m^2 in 2007. The density of urchins of all sizes in the **closed areas** significantly decreased from 22.1 urchins/m^2 in 2006 to 15.0 urchins/m^2 in 2007. In the **areas never fished**, the overall density of urchins along one transect also declined (20.7 urchins/m^2 in 2005 compared to 13.5 urchins/m^2 in 2007). However this decline was not significant. No urchins were found along the other transect in 2007 where

urchins densities of 15.9 urchins/m^2 and 20.7 urchins/m^2 were reported in 2005 and 2006, respectively.

The 2007 survey results indicated that the overall density of **legal size urchins** (≥ 51 mm test diameter (TD)) located in the **fished areas** was significantly lower in 2007 (2.4 urchins/m^2) as compared to 2005 (6.3 urchins/m^2) and 2006 (4.0 urchins/m^2). When data from the extra transects were included, the overall density of legal size urchins located in the fished areas showed a significant decline from 7.3 urchins/m^2 in 2005 to 3.5 urchins/m^2 in 2007. When comparing individual transects located in the fished areas, the densities of legal size urchins between transects surveyed during 2007 and those surveyed during 2005 and 2006, were mostly significantly lower or not significantly different to those surveyed in 2007. The density of legal size urchins in the **closed area** significantly declined from 20.5 urchins/m^2 in 2006 to 11.3 urchins/m^2 in 2007. However, as in 2006, the density of legal size urchins in 2007 in the closed area was significantly higher (11.3 urchins/m^2) than the overall density of legal size urchins located in the fished areas (2.4 urchins/ m^2). The density of legal size urchins **in areas never fished** decreased from 10.3 in 2005 to 6.0 in 2007. However, this decline was not significant.

The overall density of **sub-legal size urchins** (25-50 mm TD) located in the **fished area** was significantly lower in 2007 (3.6 urchins/m^2) as compared to 2005 (10.7 urchins/m^2) and 2006 (6.5 urchins/m^2). When comparing individual transects in fished areas, the density of sub-legal urchins between individual transects surveyed during 2007 and those surveyed in 2005 and 2006, were mostly significantly lower or not significantly different to those sampled in 2007. The density of sub-legal urchins in the **closed area** significantly increased from 1.6 urchins/m^2 in 2006 to 3.7 urchin/m^2 in 2007. In the **areas never fished**, the density of sub-legal urchins along one transect declined from 10.4 in 2005 to 7.1 in 2007. However, this decline was not significant.

Table 3. Comparison of mean densities (#/m^2) of sea urchins between the 2005, 2006 and 2007 dive surveys (95% confidence limits in brackets).

Areas Surveyed	**Legal urchin (≥ 51 mm TD) Mean #/m^2 (95% Conf. Limit)**		
	2005	**2006**	**2007**
*Total Area Fished (2006	6.3 (± 1.2)	4.0 (± 0.9)	2.4 (± 0.5)
Total Area Fished (2005-2007)	7.3 (± 1.2)		3.5 (± 0.5)
G50 (Area not Fished)	3.2 (± 2.1)	6.6 (± 4.6)	
G23 (Area not Fished)	10.3 (± 2.8)		6.0 (± 2.8)
G103-G104 (Closed Areas)		20.5 (± 2.4)	11.3 (± 2.1)
	Sub-Legal Urchins (25-50 mm TD)		
*Total Area Fished (2006)	10.7 (± 2.0)	6.5 (± 1.5)	3.6 (± 0.7)
Total Area Fished (2005-2007)	11.6 (± 1.9)		5.8 (± 1.0)
G50 (Area not Fished)	7.7 (± 5.2)	13.5 (± 9.4)	0
G23 (Area not Fished)	10.4 (± 2.9)		7.1 (± 3.3)
G103-G104 (Closed Areas)		1.6 (± 0.2)	3.7 (± 0.7)

**only includes transects that were surveyed all three years.*

Conclusions

The 2007 survey showed a decline of 39-41% in the overall density of legal size urchins (≥ 51 mm TD) in comparison to the 2006 survey. The 2006 survey showed a reduction of 35-39% in the density of legal size urchins in comparison to the 2005 survey. Including the additional transects surveyed in 2007 and 2005, the density of legal size urchins has declined by 51-52%. However, there has been no change in survey size structure in the fished areas.

The 2007 survey also indicated a decline of 42-46 % in the densities of sub-legal urchins (25 to 50 mm TD) in comparison to the 2006 survey. The 2006 survey showed a reduction of 37-43% in the densities of sub-legal urchins (25 to 50 mm TD) in comparison to the 2005 survey. Including the additional transects surveyed in 2007 and 2005, the density of sub-legal urchins had declined by 50-51%. The decline in sub-legal size urchins could be attributed to mortality caused by the dragging operations. However, divers observed no obvious drag marks on the bottom and, at most transects sites, the bottom was covered by a thick layer of macrophytes.

The 2007 survey results have shown a further decline in the density of legal and sub-legal urchins from 2006 and 2005 in fished areas. However, a decline in the density of legal size urchins was also seen in the closed area in Cheney Passage and Cow Passage. An increase in the density of sub-legal urchins was observed in these closed areas.

Based on the 2007 survey results, last season's reduction of the TAC and the overall reduction of effort do not seem to have had any positive impact on the resource. However, fishermen stated that individual boat quotas were caught in a shorter time period and with less effort than the previous season, and that their best catches were caught in fishing areas that were previously abandoned because of low catches during previous years. These areas were not surveyed during 2007.

The total fishable biomass was estimated during the 2005 survey and covered all the fishing areas. Based on the 2005 survey, the present TAC (2.6%) is below the recommended 3.3% harvesting rate of the total harvestable biomass. The 2007 dive survey was a relatively short survey (totally funded by industry) designed to compare trends in urchin size structure and densities with selected survey sites that were surveyed in 2005 and 2006. The 2007 survey was not designed, and did not cover enough fishing area, to be able to estimate a total fishable biomass. Therefore, a reduction in the total TAC is not required. Because of the change in distribution of total biomass, it is recommended that management measures be taken that reduce the catch in previously fished areas to those with increasing catch rates as indicated by the fishery catch rates in 2007.

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