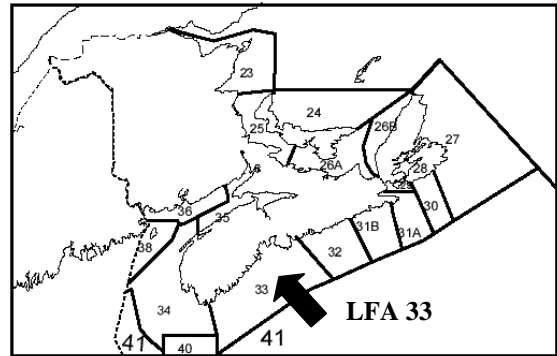




Scotian Shelf (LFA 33) Jonah Crab (*Cancer borealis*)



Background

The Jonah crab, *Cancer borealis*, is found from Nova Scotia to South Carolina and the Bermudas at depths ranging from intertidal to 800m. On the Scotian Shelf they have been observed at depths of a few meters to at least 640 m. The Jonah crab's substrate of preference ranges from rocky to sand, clay and mud.

Jonah crabs resemble rock crab (*Cancer irroratus*) in appearance but are generally larger with a more jagged anterior carapace. Typical of crustaceans, internal fertilization occurs and the female broods her eggs on the swimmerets under the abdomen until hatching as larvae. The larvae develop through five planktonic stages over a period of 40-60 days before settling on bottom. Most male Jonah crabs are mature at 90-100 mm carapace width (CW) and most females mature at 85 mm CW. DFO trapping studies in the early 1980s suggest an increase in CW with depth.

Since the mid 1960's Jonah crab stocks have been exploited at minimal levels as a trap by-catch to the lobster fishery. In 1983 and 1984, an experimental Jonah crab fishery on the Scotian Shelf concentrating in LaHave and Emerald basins was undertaken but short lived. This developing species fishery was renewed in 1997 in LFA 33 and continues today. The fishery is now limited to a 12-50 nm zone. Average catch-rates appear to be higher for the early 1980s fishery, although different fishing methods were used. In both fisheries landings were restricted to male crab only with a minimum CW of 130 mm or 121 mm in 1999.

Summary

- Logbook information indicates from 1997-99 landings averaged 154 t per year, catch per unit effort (CPUE) averaged 2.8 kg per trap haul (kg/th), and effort averaged 51,680 trap hauls.
- Catch rates remained stable across months within years and among years from 1997-99. Male crab size frequencies also remained uniform from 1997 to 1999 and were in close agreement with sizes obtained by a trap fishery in the early 1980s. Assuming catch rates indicate relative abundance and traps are sensitive changes in size composition, these data suggest low fishing impact on the stock to date.
- Bycatch of other species is extremely low due to gear type and geographic location. Less than one lobster, less than one snow crab, 4 red crabs and no cod or haddock were captured per 1,000 trap hauls.
- Not all the potential fishing area has been explored, but because of low profits fleet expansion should be slow until the geographic extent of the resource is better known.

- Sea samples indicate hard shelled males of commercial size (130 mm carapace width [CW] in 1997-98 and 121 mm in 1999) averaged 54 % of crabs caught. Enlarging the size of escape gaps and legalising retention of female crabs larger than the minimum size would reduce discards.
- There is no biological basis for changes in CW, however a trial lowering of the minimum size from 130 to 121 mm CW in 1999 increased the weight of legal catch by only 6 %, but increased discards of females by 78 %. A minimum of 125 to 130 mm CW is recommended to reduce discards.
- Minimising handling and storing crabs on ice can reduce post capture mortality.

The Fishery

A short-lived, directed Jonah crab fishery operated on the Scotian Shelf in 1983-84. The present exploratory fishery in LFA 33 began in 1997 with 13 active participants.

This limited-entry fishery permits the retention of males only, as do all other Canadian crab fisheries. The minimum retainable size was 130 mm CW in the 1980s, 1997, and 1998, but was reduced to 121 mm in 1999.

The present LFA 33 Jonah crab fishing season opens in early June, one week following the closure of the LFA 33 lobster fishing season. The Jonah crab season closes in late November, one week prior to the opening of the lobster season.

Mandatory logs submitted for each fishing trip provide data on landings, effort and fishing locations.

Principal regulations for LFA 33 Jonah crab fishery

	1983-84	1997-99
Fishing Area	12-200 nm offshore	12-50 nm offshore
Minimum Crab Size	130 mm CW	1997-98: 130 mm CW; 1999: 121 mm CW
Crab Sex	No restriction	Male only
Seasons	None	June 15-November 15
Gear Type	Traps only	Top entry traps or lobster traps with maximum 102 mm high entrance
Trap Escape Gaps	None	Minimum of 47.5 mm high in 1997-98; 44.5 mm high in 1999
Trap Limits	None	250 maximum in 1997; 375 maximum in 1998-99
Jonah Bycatch	Unrestricted	Unrestricted to lobster fishery in 1997-98; prohibited in lobster fishery 1999

Landings and total trap hauls from the LFA 33 Jonah crab fishery were comparable in 1998 and 1999. 1997 levels were lower, mainly due to an increase in the trap limit from 250 in 1997 to 375 in 1998 and 1999.

	1983	1984	1997	1998	1999	97-99 Aver.
Landings (t)	93	150	136	167	160	154
No. permits	32	32	15	11	11	12
No. active	10	3	13	9	10	11
Aver. no. days fished	n/a	n/a	23	22	16	20
Total trap hauls	n/a	n/a	44101	57534	53406	51680

There has been little latent effort in inactive permits due to a participation clause, which requires minimum landings of 20,000 lb. in order to have the permit re-issued the following season.

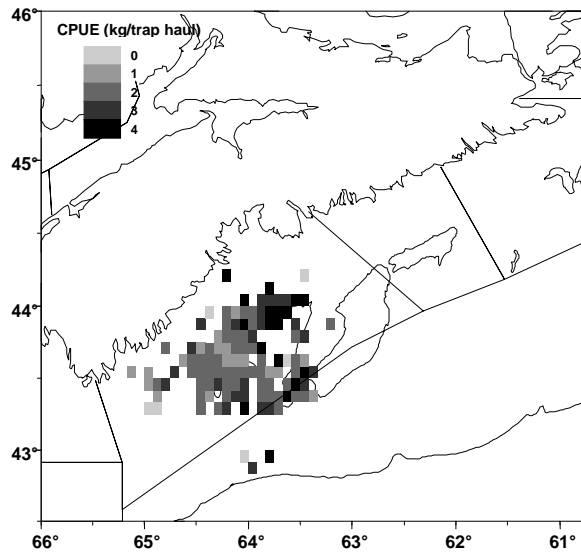
This fishery is limited to a 12 to 50 nautical mile (nm) boundary within LFA 33. However, an additional permit was issued in 1994 for an area in LFA 41 outside LFAs 32 and 33 has shown low effort and landings.

The data from this permit is not included here.

The **effort** to date in LFA 33 has been concentrated along the northern and western portions of LaHave Basin and moved eastward from 1997 to 1999. Geographic distribution of 1997 to 1999 combined landings is similar to that of effort, with the majority of the landings coming from the northern and western portions of LaHave Basin. The combined three year CPUE is more uniformly distributed over LaHave Basin than landings.

Reasonably large areas to the east and south, within the present limits, have not been explored. Potential fishing grounds may also be located outside the 50 nm limit.

Average CPUE, 1997-99 Jonah crab fishery, LFA 33



Catch was sampled on 19 sea trips and 18 occasions at port from 1997 to 1999. Catch breakdown from sea samples indicates the percentage of both hard shelled and soft shelled legal size males to be similar for the three years. The percentage of females and sub-legal males were the same for 1997 and 1998. The decrease in minimum legal size, from 130 mm CW in 1997-98 to 121 mm CW in 1999, and the escape gap size

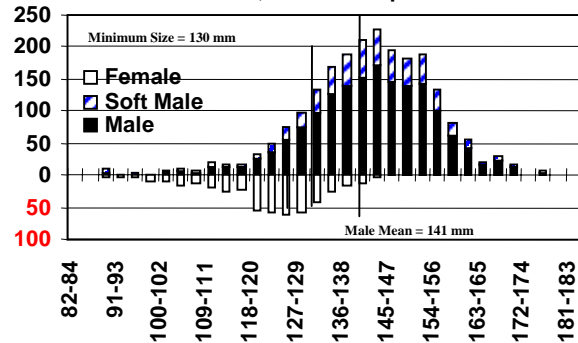
decrease caused the percentage of females in the catch to increase in 1999.

Percentage of total catch (min. size CW)

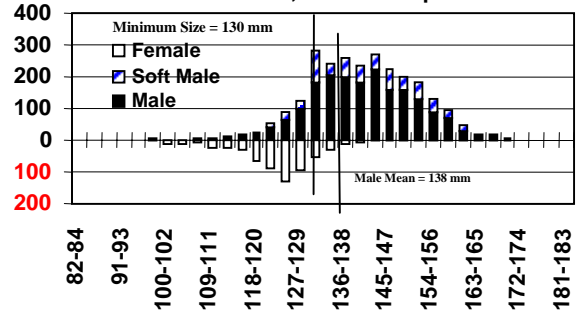
Breakdown from sea samples	1997 (130 mm)	1998 (130 mm)	1999 (121 mm)	97-99 Aver.
Sub-legal Males	11 %	11 %	4.8 %	8.9 %
Females	22 %	23 %	29 %	25 %
Soft-shell legal males	11 %	14 %	13 %	13 %
Hard-shell legal males	56 %	52 %	53 %	54 %

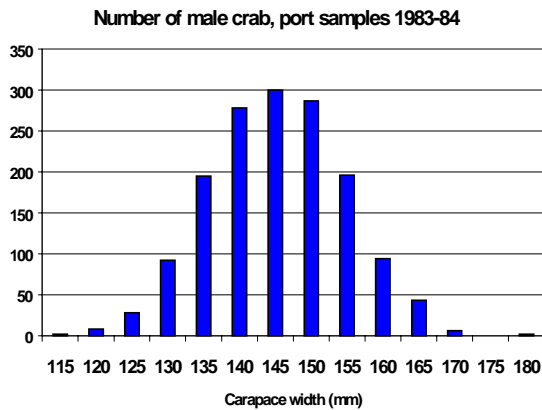
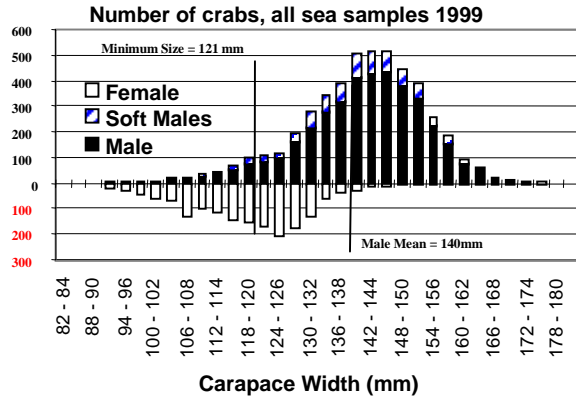
The size frequency distributions of male crab from sea sample data show no change for the three years. The mean and mode of male CW are similar and show little change from 1997 to 1999. The size distribution of male crab from port samples in 1983 and 1984 was similar to the recent sizes.

Number of crabs, all sea samples 1997



Number of crabs, all sea samples 1998





The size frequency distributions of soft-shelled male crabs did not change from 1997 to 1999. The data indicate there is no relationship between CW and soft-shell condition for male Jonah crab.

The increase in the number of small females caught in 1999 is shown in the size frequency distribution. Female sizes were comparable in 1997 and 1998.

Relationships between carapace width on the one hand and carapace height, carapace length and weight were determined from sub-samples. Female Jonah crabs have larger carapace heights and lengths than males of a similar carapace width. The male carapace width to weight relationship matches those found in coastal Maine and the northwest Atlantic.

The bycatch for this trap-only fishery is extremely low due to gear type and geographic location.

Number per 1 000 trap hauls

Bycatch Species	1997	1998	1999
Stone Crab	20	24	2
Red Crab	9	2	<1
Snow Crab	<1	0	0
Lobster	1	0	0
Haddock	0	0	0
Cod	0	0	0
Other fish	11	<1	<1

Temperature recorders were deployed by 4 fishers in 1998 and 3 fishers in 1999. The ranges of temperatures were 3.4 to 7.7°C in 1998 and 6.6 to 9.4°C in 1999. No correlation was found between catch rates and temperature.

Experiments were conducted on trap design and handling mortality between 1997 and 1999.

Results include:

- Entrance restrictions (76 x 150 mm; required as a modification of side entry lobster traps) did not affect catches of Jonah crab or bycatch species.
- Landed mortality could be reduced by holding crabs in large, insulated fish boxes with a ratio of 2/3 crab to 1/3 ice and handling as little as possible.
- In the laboratory, the highest catch rates came from modified lobster traps (currently used) when compared to dome shaped traps, conical traps, and top entry lobster traps. Further experimentation by fishers is required to find a trap type that will provide higher catch rates.

Resource Status

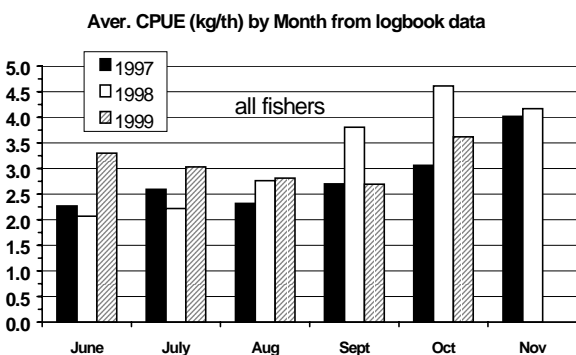
Assessment of the Scotian Shelf Jonah crab stock is based on landings, catch rates and

size composition data from the commercial catch. There are no fishery independent surveys at this time for this species. Traps are highly selective, and crustacean catchability is affected by a variety of factors. The catch rate data have not been standardized by fisher, trap type, location, or season. Standardization would be difficult because important variables are available for only a small subset of data.

The average CPUE of all fishers combined in LFA 33 fluctuated little from 1997 to 1999, and over the season within a single year. The average CPUE from a single fisher in a defined area (30 x 30 minute box) was also similar for the three years, ranging from 1.8 kg/th in 1997 to 2.4 in 1999.

Consistent landings and catch rates, along with stable size frequency distributions, suggest that the fishery has had an undetectable effect on the Jonah crab stock or biomass. This assumes catch rates are an index of abundance and changes in size structure are reflected by catch data from commercial traps.

Year	Mean CPUE (kg/th)
1997	2.6
1998	3.0
1999	2.9
3 - Year Mean	2.8



The catch rates appear unusually low for a Jonah crab fishery. Catch per trap haul in LaHave Basin in 1984 were approximately double the catch rates for the current fishery. 1999 yearly average Jonah crab CPUE from Grand Manan (5.7 kg/th) and LFA 34 (6.3 kg/th) are well above the LFA 33 fishery (2.9 kg per trap haul). These differences may be due to geographic variations in crab density or differing fishing methods.

The **average landings per trip** increased from 725 kg in 1997 to 988 kg in 1999 (fishers that did not meet the 20,000 lb. participation requirement were omitted from this calculation). More effective fishing methods and increases in trap numbers in 1998-99 are probably the causes.

Outlook

Additional effort in the form of increased fleet size should be approached with caution until a better understanding of the geographic extent of the Jonah crab stock is available.

Catch rates need to improve to assure the future of this fishery. The potential fishing area east and south of the present fishing locations require exploration to better determine distribution. There is no evidence of significant impact of fishing on the stock, but the fleet cannot survive with lower CPUE given the current crab price.

Management Considerations

The currently low catch rates and market values observed in this fishery, along with high costs associated with gear maintenance and travel to the fishing grounds indicates low profitability.

Reducing the minimum size from 130 mm CW to 121 mm CW in 1999 was not profitable. It resulted in only a 6 % increase

in the weight of legal catch and the CPUE of females (from sea samples) increased 78 %, from 1.8 crabs per trap haul in 1998 to 3.2 in 1999. This was a significant increase in the amount of discards. A 47.5 mm escape gap size would be suitable for a 127 mm CW minimum size limit. This escape gap size would also be suitable for the present minimum legal size of lobster in LFA 33. An increase in the number of escape vents in each bedroom of a trap may also reduce discards.

The low bycatch observed in this fishery and the results of the entrance restriction experiment indicate the restrictions are not necessary in this fishing area.

There is no biological reason for the start of the Jonah crab season, now set to avoid the lobster fishing season. Jonah crab and lobster fishing grounds do not overlap in LFA 33. Limited information from bycatch of Jonah crab in the lobster fishery suggest no increase in catch of soft shelled crab or berried females prior to the start of the Jonah crab fishing season.

The percentage of the total catch which consists of legal sized female crabs is only 4 % by number (from sea samples) and the female size at maturity (~ 80 mm CW) is well below the minimum legal size. Therefore, there is no conservation advantage to prohibiting the retention of females.

We see no advantage to quota management in this fishery and the gear type should remain trap only. Effort controls (trap number per fisher and season length) can regulate the total landings. The increased handling associated with quota monitoring would increase landed crab mortality. The traps produce very little bycatch and have minimal habitat impact. The discards have a high survival rate.

Other Considerations

The Jonah crab fishery is male only (as are all Canadian crab fisheries), and there are some concerns that this could limit future egg production if large males are needed to mate with females. More research is needed in the area.

The presently low removal rate of crab suggests the fishery has little influence on predator-prey relationships involving Jonah crab. Trap fisheries cause relatively little benthic disturbance. This fishery is expected to have minimal impact on the ecosystem.

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References

Adams, B., A. Reeves and R. Miller. 2000. Status of the LFA 33 Jonah crab fishery, 1997-99. DFO Can. Stock Assess. Sec. Res. Doc. 2000/027.

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