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# Sampling design for Queen Conch Stock Assessment in Grenada

GRENADA FISHERIES DIVISION  
St. George's, Grenada  
October 17-18, 2022



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## Goal of queen conch stock assessment

To assess the Queen Conch (*Strombus gigas*) population at two fishing areas in Grenada and estimate the potential yield of the resource.



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## Objectives of queen conch stock assessment

Determine the following:

1. Population structure per Fishing area
2. National population structure
3. Density per fishing area
4. Legal size density
5. Abundance per fishing area
6. National biomass (lbs)
7. National abundance
8. Maximum Sustainable Yield (MSY)
9. Relative age population structure
10. Total Allowable Catch (TAC).



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# Study area



Carriacou

Caliste



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# Determination of potential queen conch habitat / fishing areas.

- Interview fishers, NGOs, Conservation organizations, etc.
- Gather information from staff of Grenada Fisheries Division.
- Ground truthing.
- Use data from other queen conch surveys.



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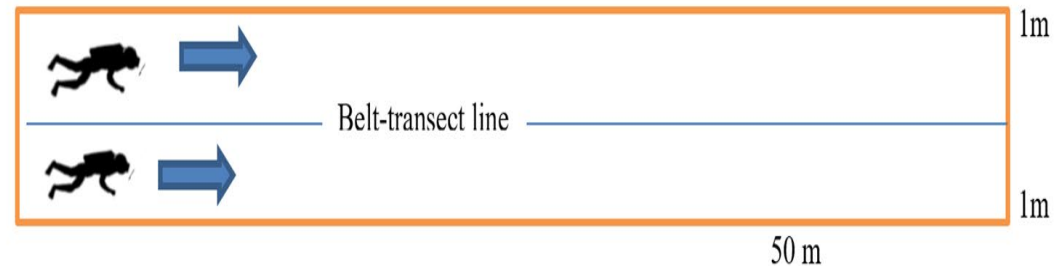
## Sampling unit

- Belt transect: 50 m x 2 m.
- Placed randomly at identified queen conch habitats / fishing grounds with the assistance of GFS staff or fisher divers.

# Materials and methods

## Sampling method

- Two persons normally dive/snorkel along the belt transect at approximately 1 m away from the belt.
- Each transect is recorded using a hand-held GPS.
- Each conch found along the transect is counted and morphometric measurements are recorded.



Queen conch survey using belt transects.



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# Queen conch survey data sets

- A. Number of queen conch found in belt-transects.
- B. Shell length (LTH) (tip of the spire to the siphonal canal) will be measured to the nearest millimeter using a measuring board.
- C. The shell lip thickness (LIP) (mid-lateral region on the lip side of the shell approximately 40 mm in from the edge of the shell) will be measured to the nearest 0.1 mm using Vernier caliper.
- D. Habitat type: sea grass, sand & sea grass, coral, hard bottom, etc





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# Field data collection sheet

## Grenada Fisheries Division

### Queen Conch Underwater Survey Data Collection Sheet 2022

Date: \_\_\_\_\_ Sampling station: \_\_\_\_\_ Transect No. \_\_\_\_\_ Sheet No. \_\_\_\_\_

Team members: \_\_\_\_\_ Transect length & width (m): \_\_\_\_\_

Start GPS Coordinates :16Q					UTM:				
End GPS Coordinates:16Q					UTM:				

No.	Depth (ft)	Shell Length (mm)	Lip Thickness (mm)	Comments and habitat type (note if conch has egg mass or are mating)	No.	Depth (ft)	Shell Length (mm)	Lip Thickness (mm)	Comments and habitat type (note if conch has egg mass or are mating)

A - Algae	C - Coral	CR- Coral Rubble	M - mud	PR – Patch Reef	S - sand	Sl - silt	Sg- sea grass	DnSg – dense Sea grass	SpSg – sparse Sea grass
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# Preparation for field work

## Training workshop

- Theoretical/practical sessions to train the fishers and staff of the Grenada Fisheries Division on the survey method
- Logistics/planning session
- Exchange of experience and local knowledge to improve identification of queen conch habitats/fishing areas
- Data quality and management



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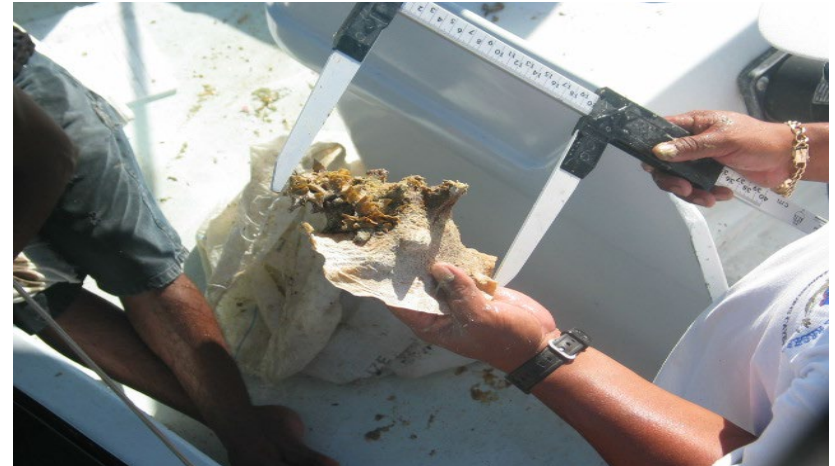


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## Actual field work

- Practical field work will be done during Oct. 18-22, 2022.
- 2 teams participate (min. of two persons per team).





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# Data analysis

## ○ Stratified Mean

- Let  $A$  be the area in the entire study area, and  $A_h$  the area of stratum  $h$ .

$$\bar{\bar{x}} = \sum_k \frac{A_k}{A} \bar{x}_k$$

## ○ Variance

$$S^2 = (S_a^2 / n_a) (\text{area A} / \text{total area})^2 + (S_b^2 / n_b) (\text{area B} / \text{total area})^2 + \dots$$

Where  $S_a^2$  and  $S_b^2$  are the sample variance and  $n_a$  and  $n_b$  are the numbers of sampling units in strata A and B respectively.



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# Example of data organization

TRANSECT NO.	Area	group	Location	DATE (DD/MM/YR)	APPROX.D EPT(ft)	HABITAT	AREA of TRANSECT( m2)	16 Q	UTM	16 Q	UTM
								START	END	START	END
1	1	BCMR		26/09/2016		5CR,SG	400	411930	2011071	411837	2011106
2	1	BCMR		26/09/2016		3.5CR,SG	400	411909	2010890	411810	2010903
3	1	BCMR		26/09/2016		6CR,SG	400	411893	2010820	411795	2010837
4	1	BCMR		26/09/2016		7.5DSG	400	411438	2010591	411339	2010615
5	1	BCMR		26/09/2016		7CR,S,SG	400	411929	2010489	411829	2010498
6	1	BCMR		26/09/2016		7.5S,SSG,	400	411727	2010320	411629	2010302
7	1	BCMR		19/09/2016		7.5S,CR	400	411928	2010478	411831	2010458
8	1	BCMR		19/09/2016		6CR,S,SG	400	411921	2010055	411824	2010026
9	1	BCMR		19/09/2016		6CR,SG	400	411956	2009843	411860	2009816
10	1	BCMR		19/09/2016		10SG	400	411724	2009426	411622	2009412
11	1	BCMR		19/09/2016		10SG	400	412088	2009435	411991	2009421



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# Example of data organization

< 50 mm	50 - 100 mm	101 - 150 mm	151 - 178 mm	> 178(LEGAL)	CONCH W/ LIP	Totconc#	Area in Hectares(m2/10000)	10000
J1	J2	J3	J4	L-1				
0	0	1	12	10	2	0	25	0.040
0	0	0	9	3	1	0	13	0.040
0	0	2	40	10	0	0	52	0.040
0	0	1	10	10	2	3	23	0.040
0	0	0	153	45	5	2	203	0.040
0	0	6	20	17	3	8	46	0.040
0	0	1	48	19	3	0	71	0.040
0	0	10	115	57	7	3	189	0.040
0	0	0	13	6	10	6	29	0.040
0	0	0	1	3	0	0	4	0.040
0	0	1	41	17	2	0	61	0.040



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# Example of data organization

density (Legal-conchs/hectare)	total density	density_J1	density_J2	density_J3	density_J4
50.00	625.00	0.00	25.00	300.00	250.00
25.00	325.00	0.00	0.00	225.00	75.00
0.00	1300.00	0.00	50.00	1000.00	250.00
50.00	575.00	0.00	25.00	250.00	250.00
125.00	5075.00	0.00	0.00	3825.00	1125.00
75.00	1150.00	0.00	150.00	500.00	425.00
75.00	1775.00	0.00	25.00	1200.00	475.00
175.00	4725.00	0.00	250.00	2875.00	1425.00
250.00	725.00	0.00	0.00	325.00	150.00
0.00	100.00	0.00	0.00	25.00	75.00
50.00	1525.00	0.00	25.00	1025.00	425.00



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# Example of data organization

Stratified Total Mean density

	<b>NATIONAL TOTAL DENSITY</b>	
<b>ADMINISTRATIVE STRATA</b>	<b>MEAN DENSITY</b>	<b>STRATA AREA_(Ha)</b>
Area 1	392.1	12,051.9
Area 2	191.9	21,965.5
Area 3	139.9	20,729.5
Area 4	139.6	9,062.0
Area 5	13.0	1,897.5
Area 6	1067.4	9,345.6
Area 7	748.3	12,766.4
Area 8	290.3	6,314.7
		94,133.16
	<b>STRATEFIED TOTAL NATIONAL DENSITY</b>	366.41
	<b>variance</b>	5911.675855
	<b>sd</b>	76.88742326





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# Example of data organization

Stratified Legal Size Mean density

	NATIONAL LEGAL SIZE DENSITY
ADMINISTRATIVE STRATA	MEAN DENSITY
Area 1	33.97
Area 2	79
Area 3	60.76
Area 4	55.83
Area 5	12
Area 6	630.43
Area 7	270.22
Area 8	87.33
Stratified Legal size mean density	146.8
Variance	868.51
sd	29.471



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# Calculation of abundance and biomass

## Stock Abundance:

a = areas sampled in the survey

A = total area surveyed

n= number (or abundance) in the area sampled

then N, the total numbers (or abundance) will be given by

$N = n \times (A/a)$  or

$N = A \times \text{density} = A \times (n/a)$

		BIOMASS (lbs)			
				6	16
<b>LEGAL SIZE</b>	Mean density(95% confidence)	Total area(ha)	Total legal conch	Average size(6-oz)	Biomass(lbs)
Upper Limit	105.99	79265.3	8,401,197.98	50,407,187.90	3,150,449.24
Mean	104.1	79265.3	8,251,186.82	49,507,120.90	<b>3,094,195.06</b>
Lower Limit	102.20	79265.3	8,101,175.65	48,607,053.90	3,037,940.87



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## Estimating MSY from biomass data using Surplus Production Models. Garcia et. al (1989)

- Schaefer Model

$$MSY = \frac{M^2 * \bar{B}^2}{2 * M * \bar{B} - Y}$$

- Fox Model

$$MSY = M * \bar{B} * \exp[Y / (M * \bar{B}) - 1].$$

- Assumptions:  $M = f_{msy}$ .
- $Y(2017) = 734,000$  lbs.



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## Exploitation Rate (E)

$$E = (Y/B_c)/(Y/B_c + M)$$

$$2016: E = 0.34$$

$$2018: E = 0.50$$

Based on the  $E_{opt.} = 0.5$  optimization criterion of Pauly (1984).



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## Total Allowable Catch (TAC)

MEY = 75% of MSY.

TAC = MEY

Virtual meeting will be hosted to present & discuss results and agree on a potential catch quota.



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## Queen conch Performance Indicators and Reference Points

Performance Indicator	Target Reference Point	Limit Reference Point	Data Stream
Average shell length	Running 10-year average	Shell Length <sub>limit</sub> ≤ 0.94 Shell Length <sub>target</sub>	National underwater visual survey
Conch density (total individuals/Ha) of legal and sublegal individuals in suitable conch habitat	Running 10-year average	88 conch/ha to meet the CITES requirement	National underwater visual survey
Total landings from previous year	Running 10-year average	Catch <sub>limit</sub> ≤ 0.75 Catch <sub>target</sub>	Cooperative data
To include in the next iteration of the conch FMP			
Legal/sub-legal	Running 10-year average		National underwater visual survey

### Midseason Conch Reference Points

Total early-season catch (first 3-months)	Running 10-year average	Catch <sub>limit</sub> < 0.9 Catch <sub>target</sub>	Cooperative data
Median early-season CPUE (first 3-months)	Running 10-year average	CPUE <sub>limit</sub> < 0.9 CPUE <sub>target</sub>	Cooperative data



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Thank you