Shediac Bay Watershed Green Crab (C*arcinus maenas)* Monitoring in Coastal Waters of the Southeast Gulf of St. Lawrence: Shediac Bay 2022

Report prepared by:

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INTRODUCTION

The European green crab is ranked among the '100 worst alien invasive species' in the world (Lowe, Browne, & Boudjelas, 2000). Originating from the eastern Atlantic coast of Europe and Africa, the European green crab has been invading North American Atlantic waters for over a century (Klassen & Locke, 2007). This species is of concern in Canadian Atlantic waters due to its impact on native species and ecological communities through competition with other crustaceans and direct predation on clams, bay scallop, and juvenile lobsters, as well as impacting eel fisheries and shellfish aquaculture (Vercaener & Stephton, 2016). European green crabs are known as "ecosystem engineers", their activities such as digging in soft sediment can disturb and even destroy eelgrass beds (*Zostera marina*) (Vercaener & Stephton, 2016 & Klassen & Locke, 2007).

In 2010, the European green crab was first recorded by the Shediac Bay Watershed Association (SBWA) through the Community Aquatic Monitoring Program (CAMP). In 2012, CAMP surveys recorded an exponential increase in the numbers of green crabs collected in the Shediac bay area. In 2013, due to this significant increase and its potential negative impacts on local fisheries and biodiversity, the SBWA implemented a green crab population monitoring programme.

The purpose of this monitoring programs is to collect data relevant to future management decisions and strategies regarding the European green crab, local fisheries, and sensitive ecosystems.

METHODS AND MATERIALS

Study site

Green crabs were monitored in the Shediac bay; a tidal 20.16 km^2 embayment of the Northumberland Strait. The Shediac bay is mostly shallow and dominated by eel grass beds. Large areas have depths shallower than 2 m, this makes for warm water temperature. With the inclusion of both the Shediac and Skull islands, the Shediac bay has approximately 44 km of coastline.

Sampling Protocol

A total of 10 green crab monitoring sites have been established (Table 1 & Figure 2.). Sites were chosen to represent a valid cross-section of the inner bay. The sites are all placed in eelgrass beds and close to shore. The monitoring sites are sampled once a month from June to October.

Fukui traps (Polyethylene Fish Trap Nets Model FT-100) are used as fishing gear during the surveys (Figure 1.). The lack of water velocity in the bay meant that no extra weight is needed to keep the traps in place. In channels close to the two rivers, the traps are placed just off channel to avoid drift caused

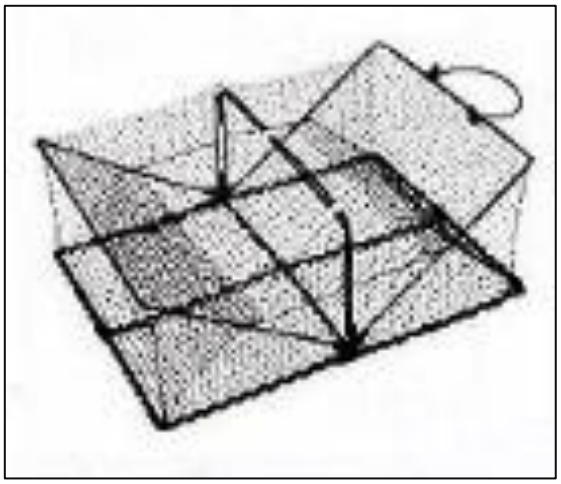

Figure 1. Fukui trap used in the green crab sampling

by tidal flow and river flow currents. A buoy is tied to the traps to mark their location in the water. Canned sardines are used as bait as they have been found to yield the best results.

The traps are deployed using a small boat and placed for a 24h period. Weather, especially wind conditions, usually determine the exact date of sampling. Sampling usually occurs in the later half of the month. Once collected the traps are emptied of their contents. The green crabs are counted, sexed and retained. All other species found in the trap are immediately released back into the water. The green crabs caught are placed in a freezer for a 48h period and then placed in the trash for disposing.

Table 1. Site details and coordinates for green crab monitoring stations

Site	Green Crab – Site details	Coordinates	
A	Pass Under the Bridge Chez Leo	46º 16' 17.52"	64º 34' 32.44"
B	Bridge Chez Leo, left of boat launch point	46º 16' 19.18"	64º 34' 329.01"
C	In front of CAMP site (Oak Point)	46º 16' 22.52"	64º 33' 48.07"
D	Shediac Island (middle) off line of oyster lease buoys	46º 15' 53.72"	64º 33' 00.20"
E	Yellow House, shore before Friars	46º 15' 15.87"	64º 34' 02.86"
F	flag St Martins in Woods Rd	46º 14' 06.84"	64º 33' 38.09"
G	Before crossing bridge Scoudouc River Lobster from Marina	46º 13' 10.98"	64º 33' 16.69"
H	After crossing bridge opposite Shediac Lobster inside next to channel	46º 13' 04.65"	64º 33' 11.76"
I	Outer Shediac marina opposite crane	46º 13' 34.70"	64º 33' 43.45"
J	Pointe-du-Chêne inner South Cove (eelgrass site)	46º 14' 06.62"	64º 31' 26.75"

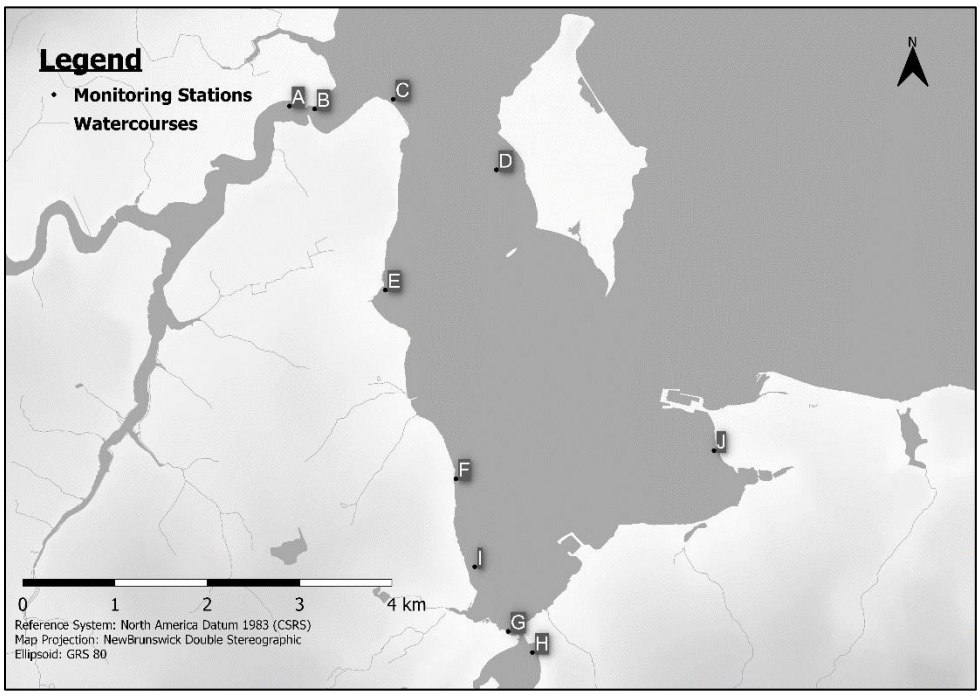

Figure 2. Location of sampling stations in the Shediac bay

RESULTS

2022 Sampling

The 2022 sampling for green crab was carried out from June to August and in October (Appendix A). Male crabs were the most abundant sex across all monitoring months. A total of 403 crabs were caught (Figure 4.). The month of August had the highest count of female to male ratio (Table 2.). The highest counts of green crab were recorded in June at site C (Figure 3.). Sampling sites experienced fluctuations of green crab populations throughout the sampling period. High numbers of green crabs were caught at B, C, and F (Figure 3.). These three sites are located in both the Shediac and Scoudouc River estuaries. The sites with the lowest amount of caught crabs through the 2022 monitoring period were sites E and J (Figure 3.).

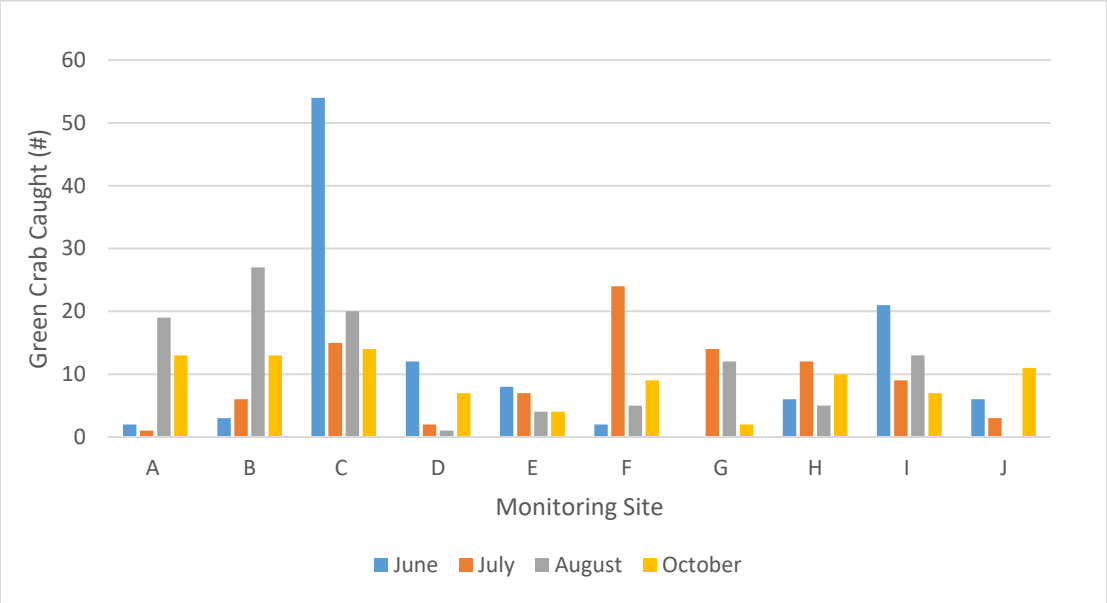

Figure 3. Number of green crabs caught per month for all monitoring stations in 2022

Table 2. Ratio of male to female caught per month for the 2022 sampling period

	June	July	August	October
Ration of males to female	2/1	3/1	9/1	5/1

Historical Data

Since 2013, the amount of green crabs caught has fluctuated. The largest fluctuation occurred from 2015 to 2016; the total yearly catch went from 73 to 817 crabs. The total green crab yearly catches decreased from 2016 to 2019, however, it has been increasing since 2019 (Figure 4.). The sex ratio of green crabs caught during sampling has been approximately 3 males to 1 female across the entire monitoring program (Figure 5.) (Appendix B).

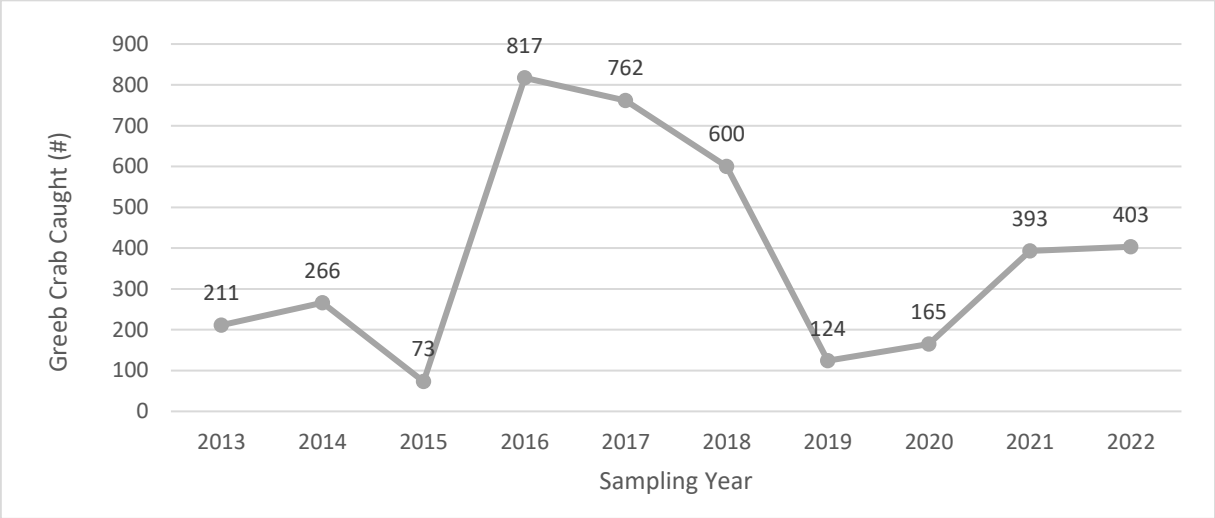

Figure 4. Total amount of green crab caught per year

CONCLUDING REMARKS

The results from the green crab monitoring program show that there is a significant population present in the Shediac bay. With the potential negative impacts on local fisheries, a more comprehensive monitoring program could prove beneficial. Implementing population assessment surveys could lead to more informed management decisions.

Figure 5. Green crab caught during monitoring program (left) including male and female (right)

REFERENCES

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APPENDIX A

Trap tag	Location name	GPS	Coord	Trap type	Dat in	Time in	Dat out	Time out	#Green	Crabs	Bottom	disposal	By-catch		tag
		Lat	Long		2022		2022		male	female	type	method	Species	Numb	number
A	Chez Leo In	46.27289	64.37857	Fukui	27-Jun	938	28-Jun	1001	2	0	eel grass/mud	freeze/garbage			5971
B	Chez Leo Out	46.27251	64.57436	Fukui	27-Jun	944	28-Jun	1005	3	0	eel grass/mud	freeze/garbage			5972
C	corner	46.27169	64.56221	Fukui	27-Jun	953	28-Jun	1010	33	21	eel grass/mud	freeze/garbage			5973
D	island	46.26233	64.54694	Fukui	27-Jun	922	28-Jun	945	9	3	eel grass/mud	freeze/garbage			5974
E	St Martins	46.25661	64.56678	Fukui	27-Jun	1020	28-Jun	1025	5	3	eel grass/mud	freeze/garbage	juv flounder	1	5975
F	house	46.23637	64.55993	Fukui	27-Jun	1030	28-Jun	1035	2	0	eel grass/mud	freeze/garbage			5976
G	Lobster In	46.22024	64.55611	Fukui	27-Jun	1040	28-Jun	1042	0	0	eel grass/mud	freeze/garbage			5977
H	Lobster Out	46.21716	64.55288	Fukui	27-Jun	1044	28-Jun	1048	6	0	eel grass/mud	freeze/garbage			5978
I	Shediac Marina	46.22611	64.54548	Fukui	27-Jun	1051	28-Jun	1057	10	11	eel grass/mud	freeze/garbage			5979
J	South Cove	46.23509	64.52436	Fukui	27-Jun	1100	28-Jun	1108	3	3	eel grass/mud	freeze/garbage			5980

Figure A 1. Green crab log sheet June 2022

Trap tag	Location name	GPS	Coord	Trap type	Date in	Time in	Date out	Time out	#Green	Crabs	Bottom	disposal	By-catch		tag
		Lat	Long		2022		2022		male	female	type	method	Species	Numb	number
A	ChezLeo In	46.27289	64.37857	Fukui	28-Jul	946	29-Jul	1028	0	1	eel grass/mud	freeze/garbage			5971
B	ChezLeo Out	46.27251	64.57436	Fukui	28-Jul	948	29-Jul	1032	5	1	eel grass/mud	freeze/garbage	mud crab	1	5972
C	corner	46.27169	64.56221	Fukui	28-Jul	953	29-Jul	1040	14	1	eel grass/mud	freeze/garbage			5973
D	island	46.26233	64.54694	Fukui	28-Jul	935	29-Jul	1014	2	0	eel grass/mud	freeze/garbage			5974
E	St Martins	46.25661	64.56678	Fukui	28-Jul	1001	29-Jul	1055	4	3	eel grass/mud	freeze/garbage			5975
F	house	46.23637	64.55993	Fukui	28-Jul	1006	29-Jul	1104	18	6	eel grass/mud	freeze/garbage			5976
G	Lobster In	46.22024	64.55611	Fukui	28-Jul	1012	29-Jul	1111	13	1	eel grass/mud	freeze/garbage			5977
H	Lobster Out	46.21716	64.55288	Fukui	28-Jul	1018	29-Jul	1118	5	7	eel grass/mud	freeze/garbage	mummichog	1	5978
I	Shediac Marina	46.22611	64.54548	Fukui	28-Jul	1025	29-Jul	1128	7	2	eel grass/mud	freeze/garbage			5979
J	South Cove	46.23509	64.52436	Fukui	28-Jul	1031	29-Jul	1135	3	0	eel grass/mud	freeze/garbage			5980

Figure A 2. Green crab log sheet July 2022

Trap tag	Location name	GPS	Coord	Trap type	Date in	Time in	Date out	Time out	#Green	Crabs	Bottom	disposal	By-catch		tag
		Lat	Long		2022		2022		male	female	type	method	Species	Numb	number
A	ChezLeo In	46.27289	64.37857	Fukui	29-Aug	1017	30-Aug	1020	18	1	eel grass/mud	freeze/garbage			5971
B	ChezLeo Out	46.27251	64.57436	Fukui	29-Aug	1020	30-Aug	1023	27	0	eel grass/mud	freeze/garbage			5972
C	corner	46.27169	64.56221	Fukui	29-Aug	1025	30-Aug	1028	19	1	eel grass/mud	freeze/garbage			5973
D	island	46.26233	64.54694	Fukui	29-Aug	1002	30-Aug	1005	1	0	eel grass/mud	freeze/garbage			5974
E	St Martins	46.25661	64.56678	Fukui	29-Aug	1032	30-Aug	1035	3	1	eel grass/mud	freeze/garbage			5975
F	house	46.23637	64.55993	Fukui	29-Aug	1038	30-Aug	1041	4	1	eel grass/mud	freeze/garbage			5976
G	Lobster In	46.22024	64.55611	Fukui	29-Aug	1042	30-Aug	1045	7	5	eel grass/mud	freeze/garbage			5977
H	Lobster Out	46.21716	64.55288	Fukui	29-Aug	1046	30-Aug	1049	4	1	eel grass/mud	freeze/garbage			5978
I	Shediac Marina	46.22611	64.54548	Fukui	29-Aug	1055	30-Aug	1058	12	1	eel grass/mud	freeze/garbage			5979
J	South Cove	46.23509	64.52436	Fukui	29-Aug	1105	30-Aug	1108	0	0	eel grass/mud	freeze/garbage			5980

Figure A 3. Green crab log sheet August 2022

Trap tag	Location name	GPS	Coord	Trap type	Date in	Time in	Date out	Time out	#Green	Crabs	Bottom	disposal	By-catch		tag
		Lat	Long		2022		2022		male	female	type	method	Species	Numb	number
A	ChezLeo In	46.27289	64.37857	Fukui	06-Oct		07-Oct		9	4	eel grass/mud	freeze/garbage			5971
B	ChezLeo Out	46.27251	64.57436	Fukui	06-Oct		07-Oct		10	3	eel grass/mud	freeze/garbage			5972
C	corner	46.27169	64.56221	Fukui	06-Oct		07-Oct		14	0	eel grass/mud	freeze/garbage			5973
D	island	46.26233	64.54694	Fukui	06-Oct		07-Oct		5	2	eel grass/mud	freeze/garbage	mud crab	1	5974
E	St Martins	46.25661	64.56678	Fukui	06-Oct		07-Oct		4	0	eel grass/mud	freeze/garbage	rock crab	1	5975
F	house	46.23637	64.55993	Fukui	06-Oct		07-Oct		9	0	eel grass/mud	freeze/garbage	rock crab	1	5976
G	Lobster In	46.22024	64.55611	Fukui	06-Oct		07-Oct		1	1	eel grass/mud	freeze/garbage	juv white perch	1	5977
H	Lobster Out	46.21716	64.55288	Fukui	06-Oct		07-Oct		7	3	eel grass/mud	freeze/garbage	juv white perch	1	5978
I	Shediac Marina	46.22611	64.54548	Fukui	06-Oct		07-Oct		6	1	eel grass/mud	freeze/garbage	rock crab	2	5979
J	South Cove	46.23509	64.52436	Fukui	06-Oct		07-Oct		11	0	eel grass/mud	freeze/garbage			5980

Figure A 4. Green crab log sheet October 2022

APPENDIX B

Table B 1. Summary of European green crab catch for all monitoring months for all sites, 2013

Site	July 17th	July 31th	August 15th	August 30th	September 16th	September 29th	October 15th
A	0	4	0	1	3	4	0
B	10	10	7	2	19	0	0
C	0	2	4	0	15	15	3
D	0	0	1	1	3	2	0
E	4	1	3	19	16	4	2
F	0	0	0	10	1	1	0
G	0	2	3	1	1	2	3
H	1	1	1	1	1	0	0
I	0	8	2	2	2	1	0
J	0	0	1	6	0	1	4
Total	**15**	**28**	**22**	**43**	**61**	**30**	**12**

Table B 2. Summary of European green crab catch for all monitoring months for all sites, 2014

Site	June 28th	July 30th	August 27th	September 25th
A	0	4	5	10
B	0	0	42	4
C	11	5	12	1
D	0	12	8	1
E	27	9	5	6
F	7	4	5	5
G	0	21	18	6

H	0	0	2	3
I	2	8	0	7
J	0	4	9	3
Total	**47**	**67**	**106**	**46**

Table B 3. Summary of European green crab catch for all monitoring months for all sites, 2015

Site	July 30th	August 27th	September 29th
A	2	0	3
B	0	2	8
C	3	2	1
D	0	0	0
E	0	2	4
F	0	0	0
G	0	2	10
H	0	0	27
I	0	0	6
J	0	1	0
Total	**5**	**9**	**59**

Table B 4. Summary of European green crab catch for all monitoring months for all sites, 2016

Site	June 23rd	July 20th	August 31th	September 21th
A	13	8	23	14
B	34	41	11	33
C	15	24	49	25

D	13	8	7	5
E	25	27	57	14
F	10	8	30	14
G	2	17	8	3
H	6	103	68	3
I	29	35	9	4
J	7	6	7	2
Total	**154**	**277**	**269**	**117**

Table B 5. Summary of European green crab catch for all monitoring months for all sites, 2017

Site	June 28th	July 25th	August 27th	September 29th	October 23rd
A	5	17	9	7	19
B	4	41	33	31	62
C	13	13	27	20	16
D	0	5	12	2	3
E	14	15	27	8	23
F	10	3	24	24	21
G	8	11	24	19	22
H	7	5	20	23	39
I	5	2	17	19	10
J	6	4	5	5	3
Total	**72**	**116**	**198**	**158**	**218**

Table B 6. Summary of European green crab catch for all monitoring months for all sites, 2018

Site	June 21st	July 25th	August 29th	September 29th	October 30th
A	1	5	8	6	5
B	4	35	19	37	21
C	11	7	2	56	12
D	1	10	17	1	2
E	1	10	4	13	2
F	2	12	3	10	5
G	17	33	16	14	0
H	4	95	20	15	14
I	8	4	6	8	6
J	0	11	4	2	1
Total	**49**	**222**	**99**	**162**	**68**

Table B 7. Summary of European green crab catch for all monitoring months for all sites, 2019

Site	June 19th	July 25th	August 19th	September 30th	October 29th
A	0	0	3	7	1
B	0	8	4	8	0
C	0	0	0	1	3
D	0	0	0	5	1
E	0	6	5	4	0
F	4	4	2	1	5
G	2	1	8	7	7
H	0	3	1	1	1

I	3	1	3	3	5
J	0	0	3	3	0
Total	**9**	**23**	**29**	**40**	**23**

Table B 8. Summary of European green crab catch for all monitoring months for all sites, 2020

Site	June 23rd	July 28th	August 25th	September 28th	October 27th
A	0	3	1	4	5
B	3	2	6	23	4
C	1	0	0	5	3
D	0	0	5	0	0
E	2	2	5	5	2
F	1	5	2	4	1
G	1	2	2	8	3
H	1	8	6	0	8
I	0	12	1	11	3
J	1	0	2	2	0
Total	**10**	**34**	**30**	**62**	**29**

Table B 9. Summary of European green crab catch for all monitoring months for all sites, 2021

Site	June 24th	July 29th	August 25th	September 24th	October 26th
A	0	0	5	17	4
B	36	15	4	15	0
C	15	1	1	5	3
D	10	3	6	4	7

E	5	10	5	5	0
F	0	3	2	6	5
G	14	18	8	5	41
H	3	2	23	32	15
I	7	12	5	5	5
J	1	1	1	0	3
Total	**91**	**65**	**60**	**94**	**83**

Table B 10. Summary of European green crab catch for all monitoring months for all sites, 2022

Site	June 28th	July 29th	August 30th	October 7th
A	2	1	19	13
B	3	6	27	13
C	54	15	20	14
D	12	2	1	7
E	8	7	4	4
F	2	24	5	9
G	0	14	12	2
H	6	12	5	10
I	21	9	13	7
J	6	3	0	11
Total	**114**	**93**	**106**	**90**