Section S1. Data gaps

In 1992 and 1993, 29.6% of females caught were not weighed. An analysis of covariance with the 70.4% of females with weight data was performed *a priori* to determine if the relationship between CW and crab weight was statistically different in 1992 and 1993. Both variables were $\log_e$-transformed for linearity and CW was used as the covariate. There was no notable difference between the slopes of each year ($F =$ 0.2253, p = 0.64) nor the intercept ($F =$ 3.67, p = 0.056). Moreover, the model using both years had a very similar fit (Fig. S1) to those using an individual year, parameter estimates between models were also similar (Table S1). Therefore, one nonlinear least squares model was used to estimate the body weights of 408 crabs (145 in 1992 and 236 in 1993, Fig. 2). To make the modeled weights more realistic of the natural variation of blue crab weight at size, a normal distribution parametrized with the standard deviation of the model residuals was created, sampled at random, and added to the modeled weight estimates. The residuals of the model were assessed visually and met the model assumptions. Models were run in R Studio with the stats package (R Core Team 2022).
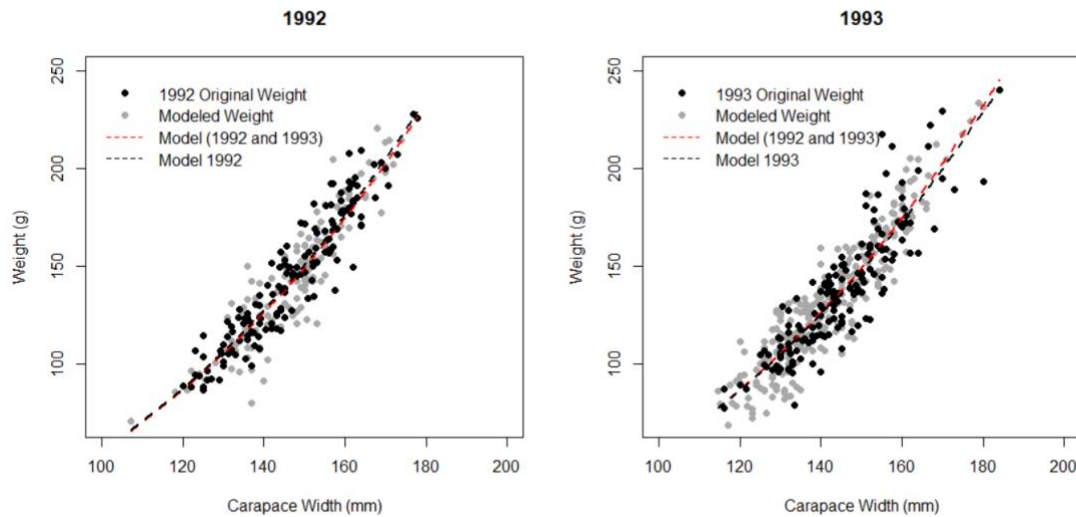

Fig. S1. Relationship between female carapace width and whole-body weight for females in 1992 and 1993, parameter estimates for all models (1992 and 1993, 1992 only, and 1993 only can be found in Table S1).

Table S1. Parameter estimates and standard deviation for modeled weight and carapace width (CW) relationship: $Weight = a * CW^b$

Parameter	Model:		
	Joint	1992 only	1993 only
a (± SD)	0.00078 ± 0.00025	0.00074 ± 0.00029	0.00090 ± 0.00045
b (± SD)	2.43 ± 0.063	2.44 ± 0.076	2.40 ± 0.099

Section S2. Proportion of second year spawners and exploitation, all years.

Table S2. Proportion of second-year spawners by year for females caught below 37.4°N and the prior year's exploitation rate

Year	Proportion ± SE (%)	Count	Exploitation Rate (%)
1992	8.9 ± 1.1	661	28
1993	11.6 ± 1.4	502	37
1994	6.4 ± 1.1	500	28
1995	11.0 ± 2.3	182	35
1996	2.4 ± 0.7	452	32
2020	19.0 ± 3.9	100	14
2021	8.9 ± 1.7	282	19
2022	8.4 ± 2.1	179	26

Section S3. Relationship with size and ovary weight

Data included in the generalized linear models were subsetted to include females with mature ovaries. In years where ovary stage was not documented (i.e. 1992 and 1993), crabs were considered mature if their ovary wet weight was greater than 2.5 g, regardless of CW. This delineation was chosen because the relationship between ovary weight and crab size shows a separation in data around 2.5 g (Fig. S2). Moreover, in 2020 and 2021, the majority (99.3%) of females with mature ovaries had an ovary weight greater than 2.5 g.
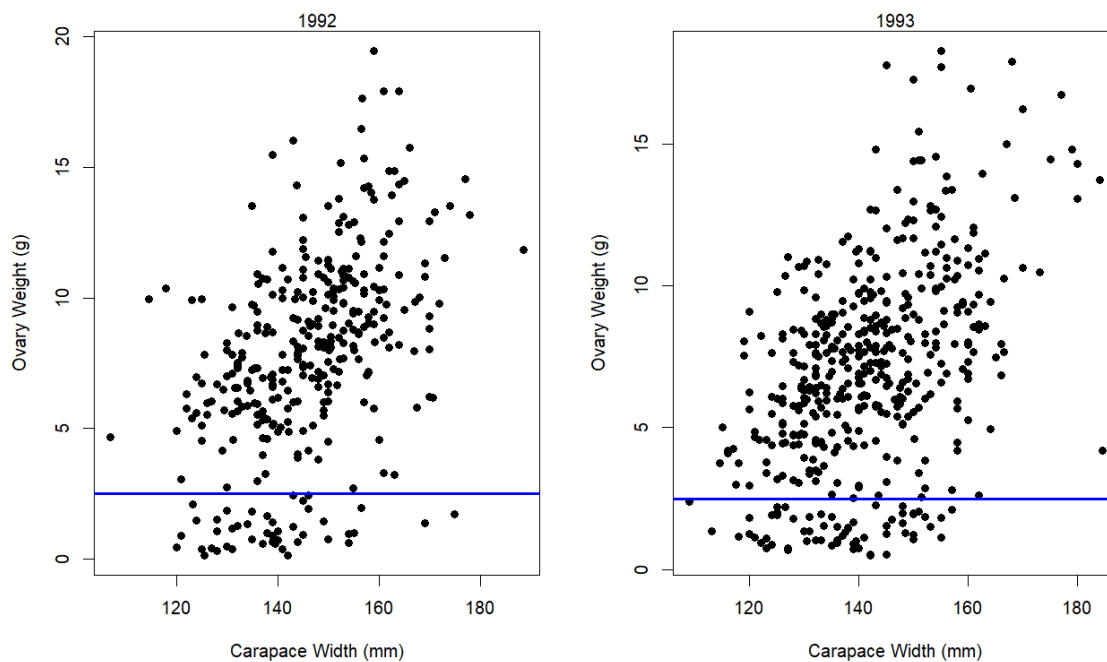

Fig. S2. Relationship between ovary weight (g) and female carapace width (mm) for mature females in 1992 (left) and 1993 (right). The blue horizontal line is set at 2.5 g.

Section S4. Exploring dependence within dredge tows

Concerns about correlation between crabs within the same dredge tow were not explored on the entirety of the model data because a large proportion of dredge tows only caught one crab. The potential correlation within tows was explored by removing tows with 5 or less crabs, running the models sets with a random effect of dredge tow, and calculating the intraclass correlation of the model using the performance package in R (Lüdecke et al. 2021). The conditional interclass correlation was 0.016 for the contemporary models and 0.062 for the GSI models, indicating a low correlation between crab spawning history within dredge tows. Temporal correlation between years was negligible due to low (6–10%) annual survival rates of adult females in the Bay (Lambert et al. 2006). Year was also included as a fixed effect within the model. Within years, females were assumed to be temporally independent of one another because they were in winter dormancy and inactive during the time of sampling (Lambert et al. 2006). Potential spatial autocorrelation was assessed visually with annual spline correlograms of the binary data and modeled residuals using the ncf package in R (Bjørnstad 2020); spline correlograms indicate negligible spatial correlation if the covariance is not significantly different than 0 (Bjørnstad & Falck 2001). Spatial autocorrelation for all years and model sets was considered negligible as 95% confidence interval generally overlapped with 0 for all distances of the residual correlograms.

LITERATURE CITED

Bjørnstad ON (2020) Ncf: spatial covariance functions. 2–9. https://CRAN.R-project.org/package=ncf

Bjørnstad ON, Falck W (2001) Nonparametric spatial covariance functions: Estimation and testing. Environ Ecol Stat 8:53–70

Lambert DM, Hoenig JM, Lipcius RN (2006) Tag return estimation of annual and semiannual survival rates of adult female blue crabs. Trans Am Fish Soc 135:1592–1603

Lüdecke D, Ben-Sachar MS, Patil I, Waggoner P, Makowsk D (2021) Performance: an R package for assessment, comparison and testing of statistical models. J Open Source Softw 6:3139

R Core Team (2022) R: a language and environment for statistical computing. R Foundation for Statistical Computing, Vienna