

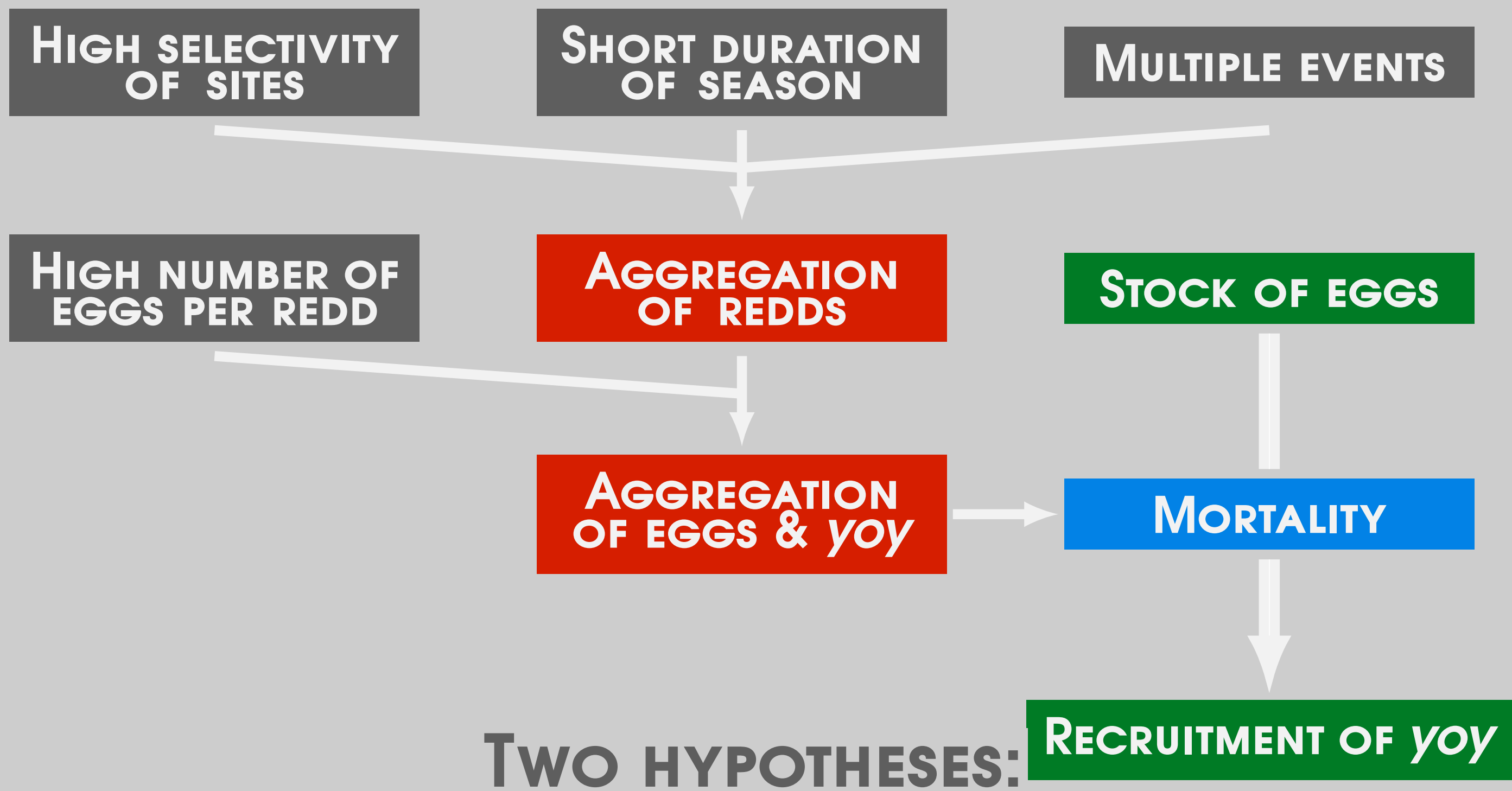
# IMPACTS OF SPATIAL AGGREGATION OF NESTS ON POPULATION PRODUCTIVITY through four different stock-recruitment models



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## INTRODUCTION

ATLANTIC SALMON (*Salmo salar*) DIG NESTS IN THE RIVERBED TO SPAWN IN SITES WITH SPECIFIC CHARACTERISTICS, RESULTING IN NEST AGGREGATION. THIS AGGREGATION MAY EXACERBATE DENSITY-DEPENDENT MORTALITY ACTING ON EGGS AND YOUNG OF THE YEAR (YOY), AND THE EFFECT OF HABITAT QUALITY AND HABITAT VARIABILITY.



TWO HYPOTHESES: **RECRUITMENT OF YOY**

- i. SPATIAL AGGREGATION SHOULD DIMINISH POPULATION RECRUITMENT
- ii. AGGREGATION OF NESTS IN BEST SITES SHOULD DIMINISH RECRUITMENT VARIABILITY BY DAMPENING ENVIRONMENTAL STOCHASTICITY?

## METHODS

- OVER A 31 YEARS STUDY PERIOD ON THE NIVELLE POPULATION

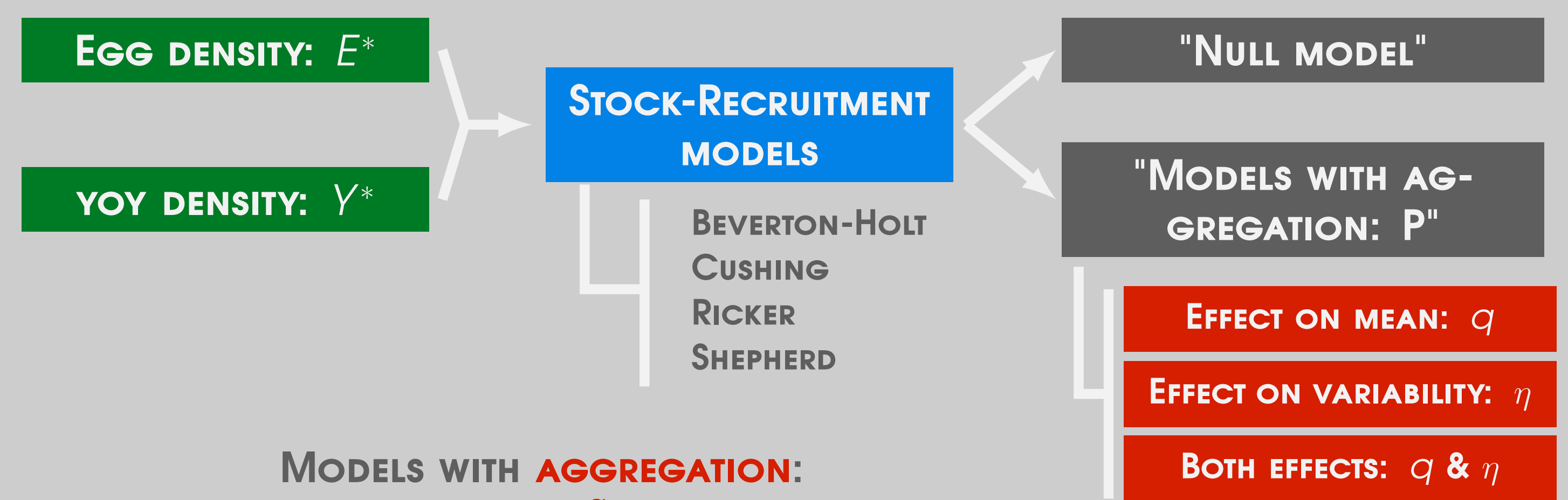
### DATA:

- FEMALES CAUGHT AT FISH PASS → EGG DENSITY
- SUMMER ELECTROFISHING → YOY DENSITY
- WEEKLY VISUAL SURVEY → NEST DISTRIBUTION

- NEST AGGREGATION:  $Patchiness = \frac{\text{mean crowding}}{\text{mean density}} = \frac{\bar{m}}{\bar{m}}$  (LOYD, 1967)

MEAN CROWDING = "Mean number of neighbors per individual in the same patch"

⇒ IMPLEMENT AGGREGATION EFFECT IN STOCK-RECRUITMENT MODELS:



### MODELS WITH AGGREGATION:

$$\mu_i = f(E_i^*) \times P^q$$

$$\tau = \delta \times P^\eta$$

$$Y_i^* \sim \text{LogN} \left( \log(\mu_i), \frac{1}{\tau} \right)$$

## RESULTS

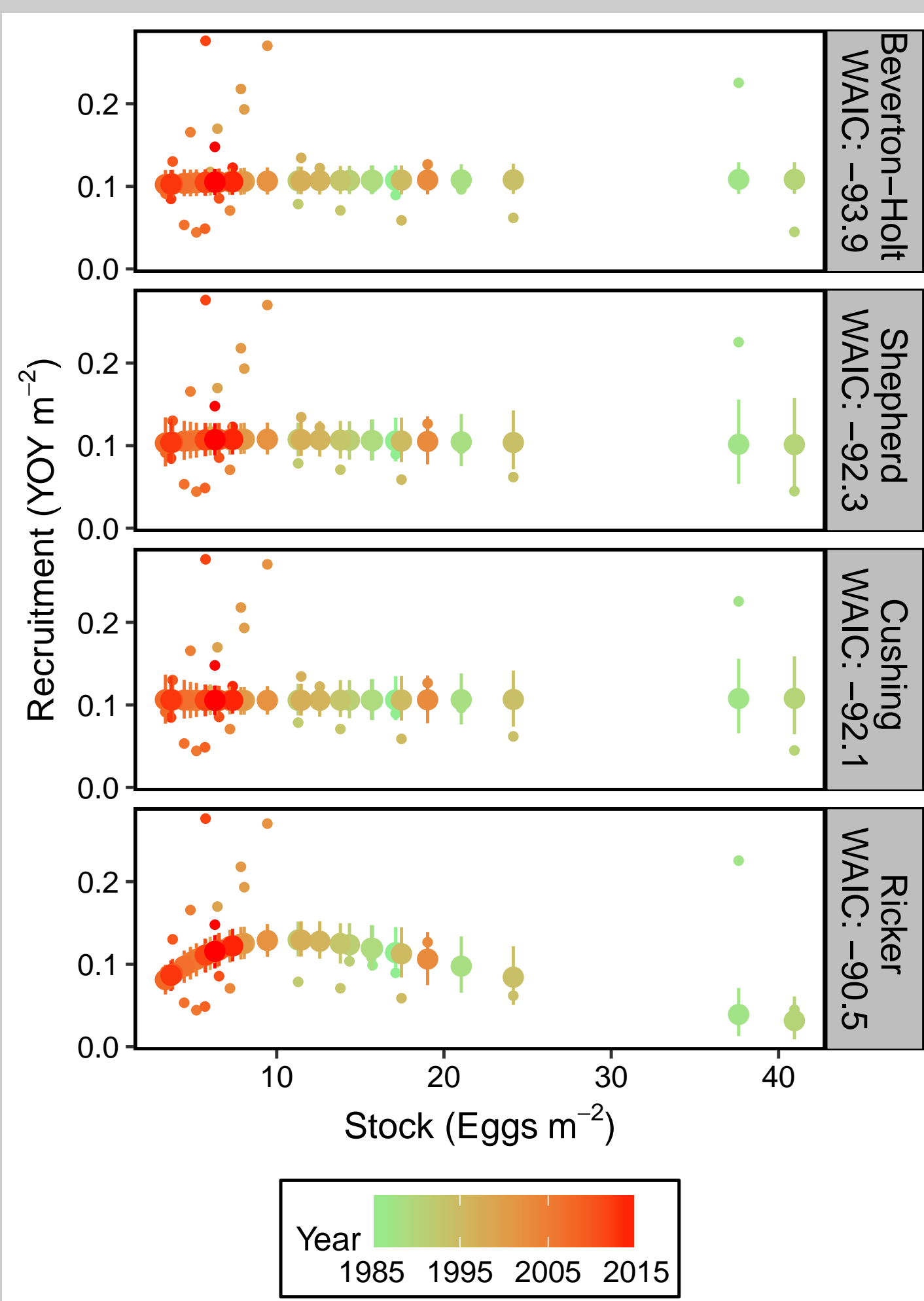


Figure: Plot of estimated recruitment by the four different models with an effect of aggregation. Small points correspond to observed data, and big ones to estimates with the highest posterior density interval.

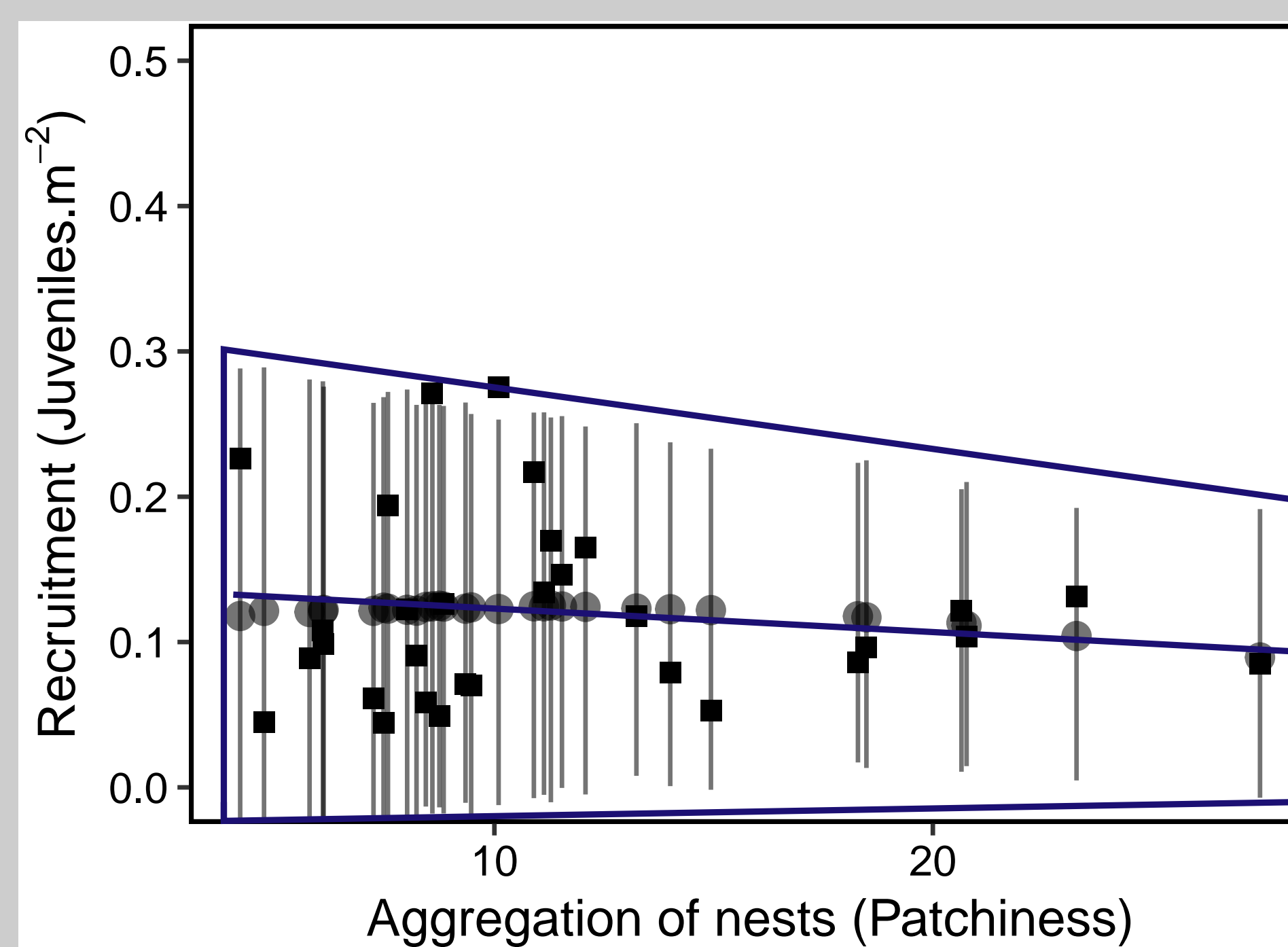
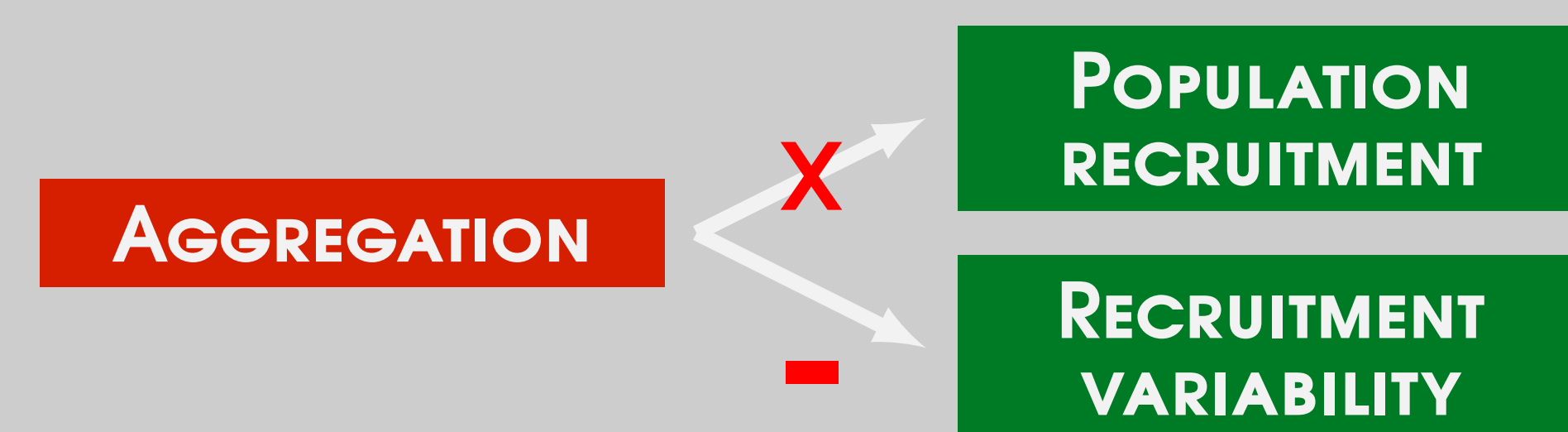


Figure: Plot of recruitment in function of aggregation for the best model. Squares are observed data and points are estimates with the HPD interval.



- BEST MODEL: BEVERTON-HOLT
- SHEPHERD MODEL WHICH IS VERSATILE → BEVERTON-HOLT
- FOUR MODELS ARE RELATIVELY CLOSED TO EACH OTHER
- LOW OBSERVED STOCK = ALREADY AT CARRYING CAPACITY

- ✓ IMPLEMENT AGGREGATION IN FOUR ≠ MODELS OF STOCK-RECRUITMENT

## DISCUSSION

- NO EFFECT OF AGGREGATION ON THE AVERAGE RECRUITMENT
- AGGREGATION OF NEST DECREASED RECRUITMENT VARIABILITY
- ⇒ AGGREGATION IN THE BEST SPAWNING SITES DAMPENED ENVIRONMENTAL STOCHASTICITY



## ACKNOWLEDGMENT

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