Reproductive biology of three Hawaiian goatfishes

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Outline

- Introduction to goatfish
- Methods
- Results
- Conclusions
- Applications

Parupeneus cyclostomus, moano kea

Introduction to Goatfish

- Found in all tropical and semi-tropical seas
- Inhabit sandy bottom, coral reefs, sea grass beds
- 66 species worldwide (family Mullidae)
- Hawaii has 10 species, and 2 are endemic
- Chin barbels defining characteristic

Parupeneus multifasciatus, moano

Introduction to Goatfish

- Can grow up to 50 cm in length
- Change color at night, camouflage
- Live in shallow (less than 3 m) to deep (150 m)
- Feed mostly on invertebrates in the sand (crabs, shrimp, worms, mollusks, and sometimes other fish)

Upeneus arge

Mulloidichthys vanicolensis

Introduction to Goatfish

- School in both small and large groups, vulnerable to gill netting
  - Goatfish are fished and eaten around the world
  - Ex: Mediterranean, Red Sea, Japan, Australia, New Zealand, West Atlantic

Photo by Dave Rezendes

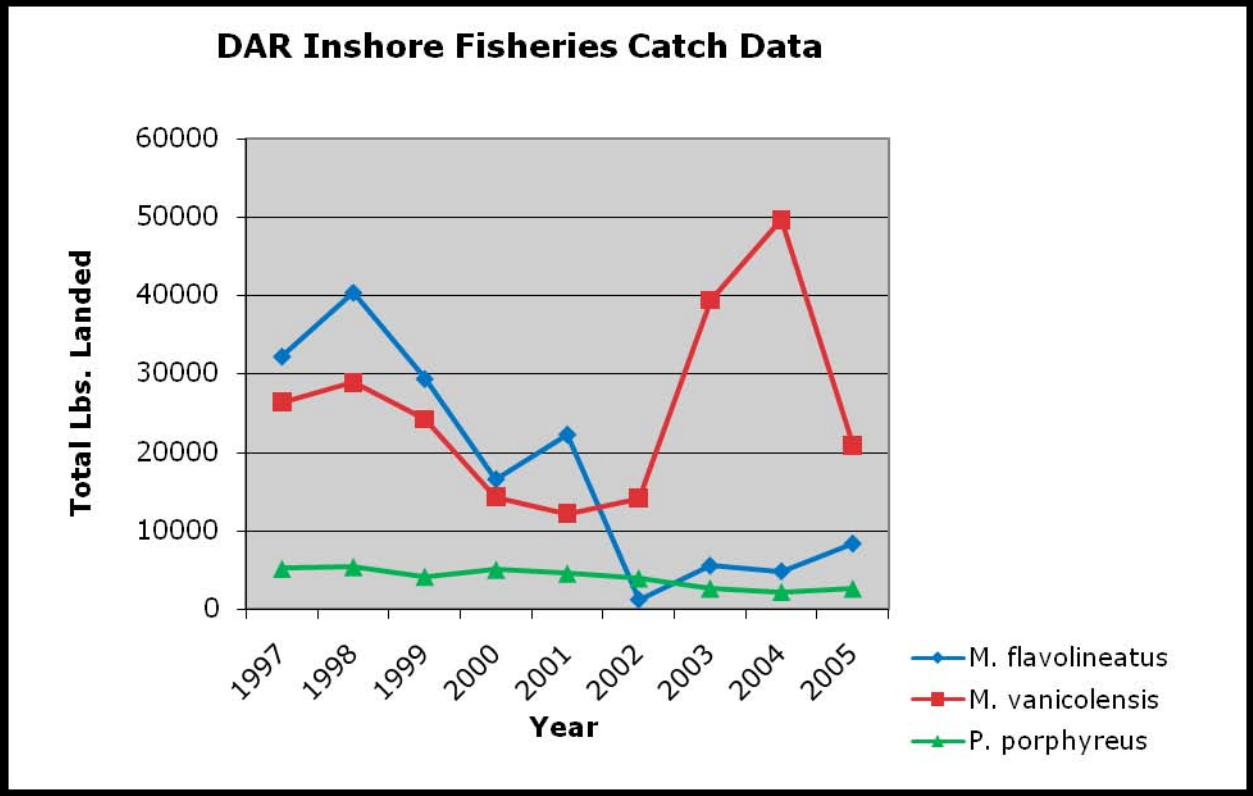
Why are goatfish important?

- Economically: commercial fishery
  - 3 of Hawaii's 10 species make up the bulk of the fisheries catch
  - In 2005: 80% of the total 39,703 pounds of goatfish landed

Blue: weke'a

Red: weke'ula

Green: kumu



Data compiled from DAR annual landings reports, current to 2005

Why are goatfish important?

- Ecosystem engineers (Uiblein, 2007)
- Fisheries indicators (Uiblein, 2007)
- Recreationally and Culturally

Study species: the 3 most caught fish

Mulloidichthys flavolineatus, weke'a

Mulloidichthys vanicolensis, weke'ula

Parupeneus porphyreus, kumu

Project Goals

Life history characteristics crucial for fisheries species:

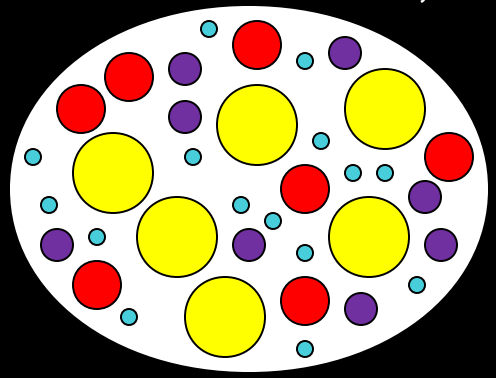
- Ovarian development among the 3 species
- Spawning seasonality (GSI)
- Batch fecundity
- L50 for *M. flavolineatus* and *M. vanicolensis*
- Age at which each species becomes reproductively mature

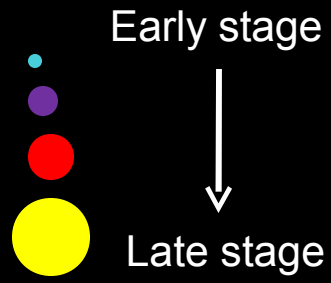
Methods

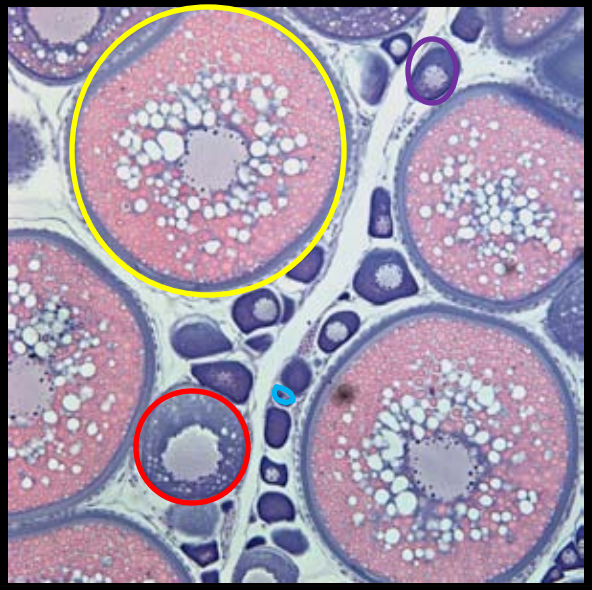
- Fish from Kaneohe Bay or South Shore, Oahu or fish market collections
- Weighed and measured (TL, FL, SL)
- Dissected and preserved: ovaries, testes and otoliths
- Embedded in paraffin or plastic resin and sectioned
- Stained with hematoxylin and eosin, PAS or toluidine blue
- Fecundity taken from sub-sample of one ovary lobe
- L50 calculated for females

Results

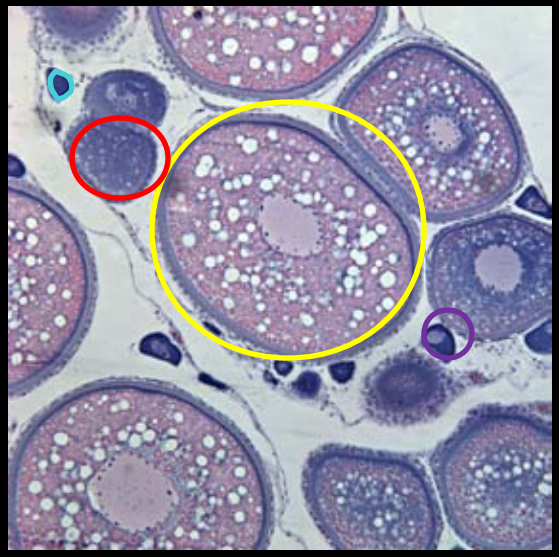
- Ovarian development
  - All 3 species have ASYNCHRONOUS development
  - Supported by Lucano-Ramirez et al., 2006



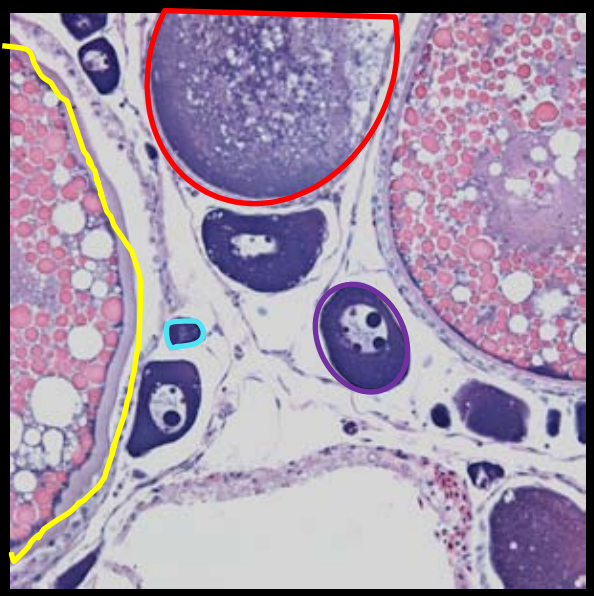




M. vanicolensis



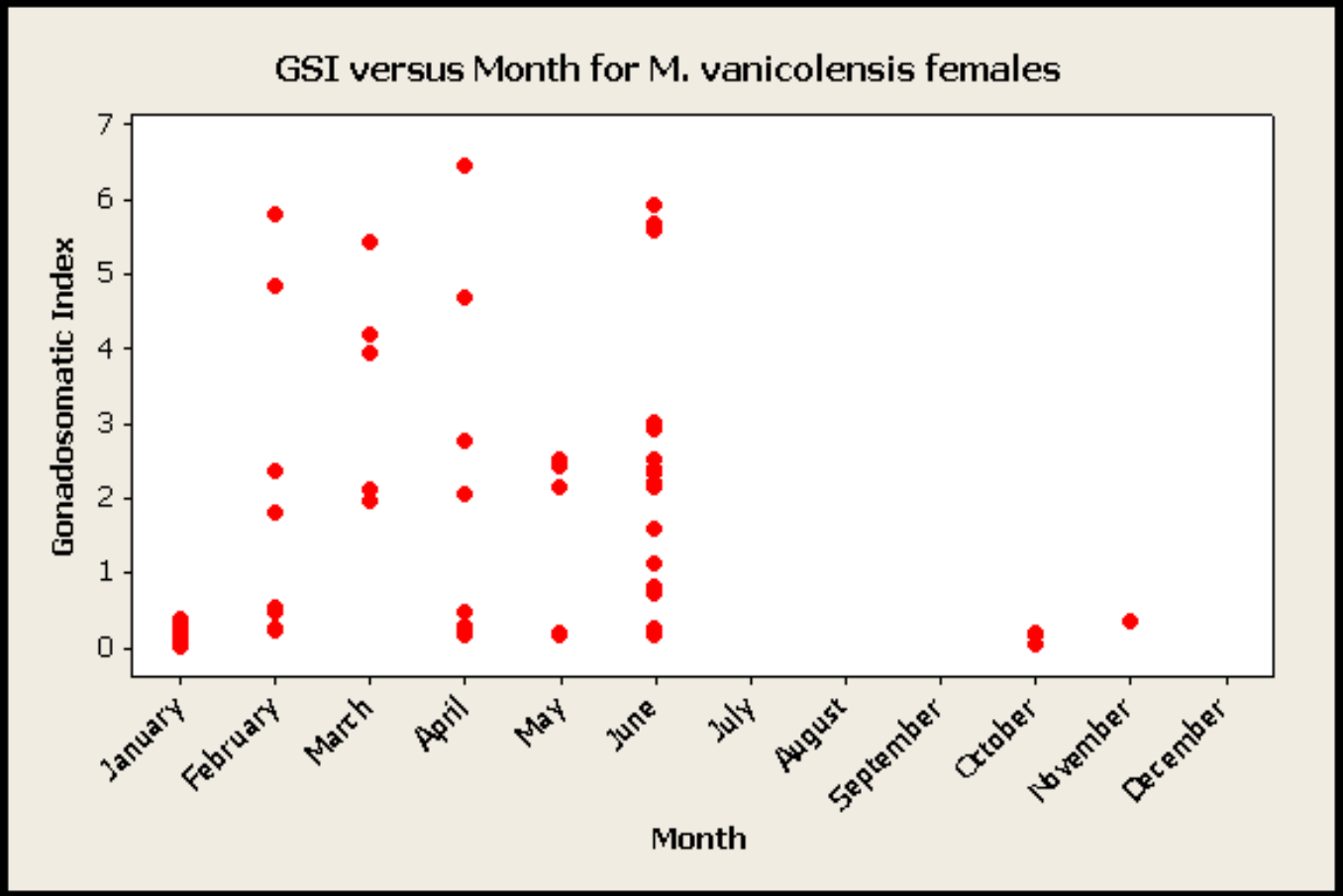
M. flavolineatus



P. porphyreus

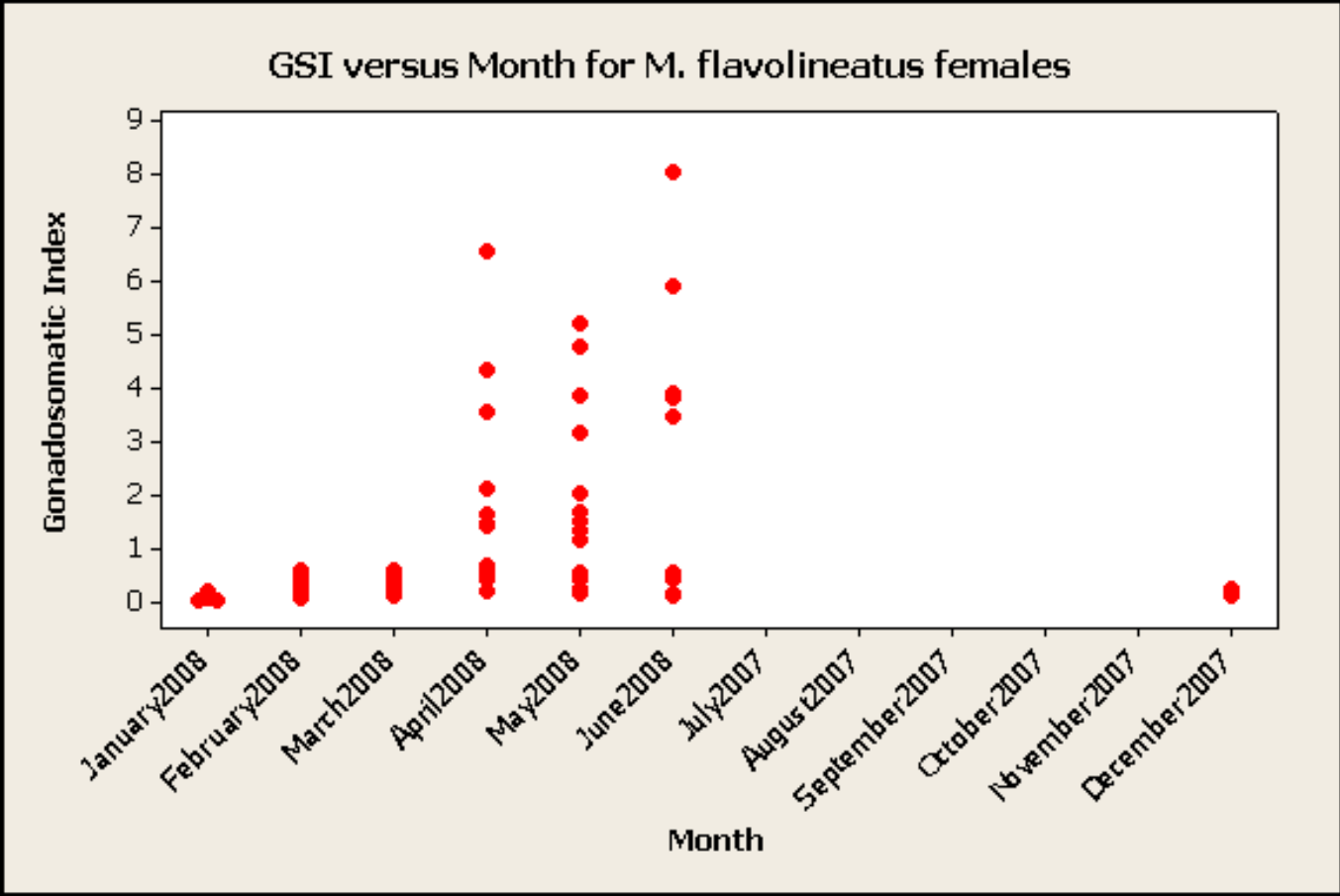
Results

- Spawning seasonality: *M. vanicolensis,* weke'ula
  - Begins in February, continues through June, ends?
  - Low in winter months



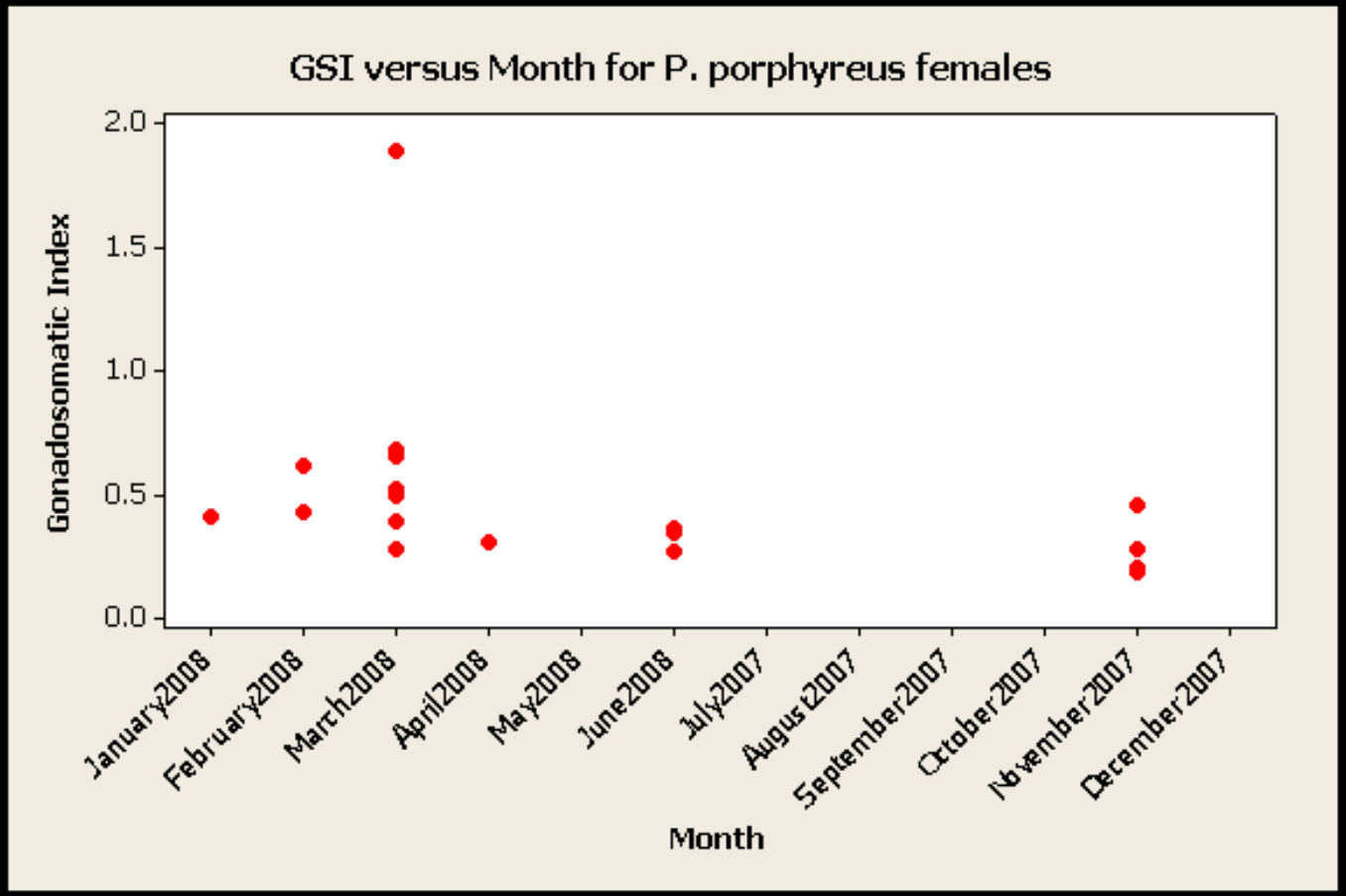
Results

- Spawning seasonality: *M. flavolineatus,* weke'a
  - Begins in March, continues through June, ends?
  - Low in winter months

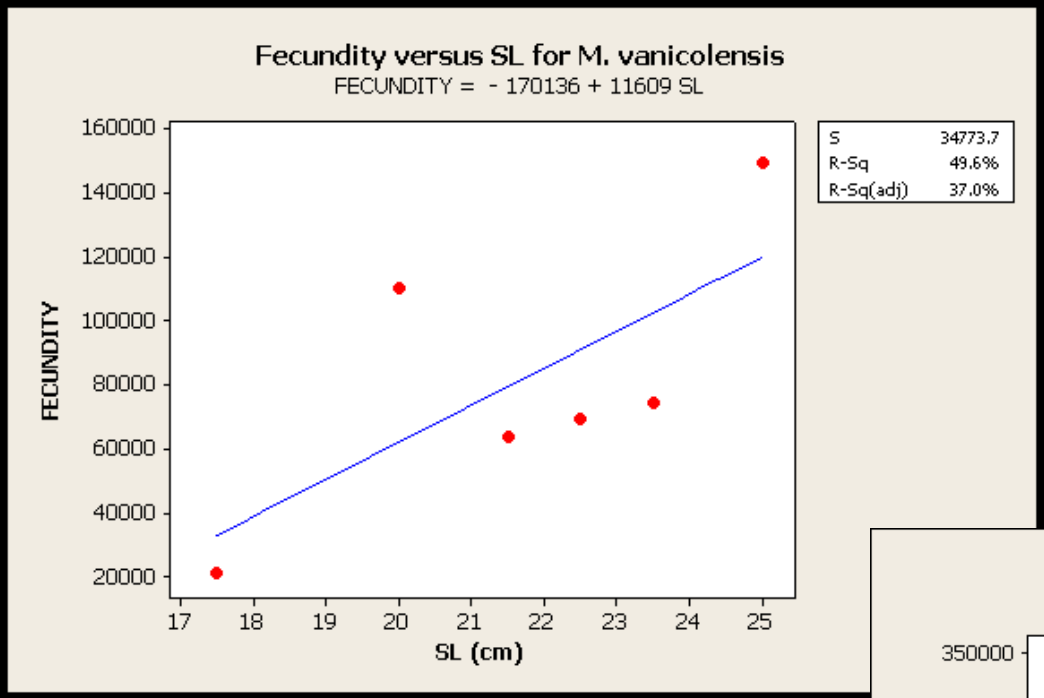


Results

- Spawning seasonality: *P. porphyreus, kumu*
  - Begins in February? , continues through June, ends?
  - Low in winter months
  - Inconclusive due to low sample size

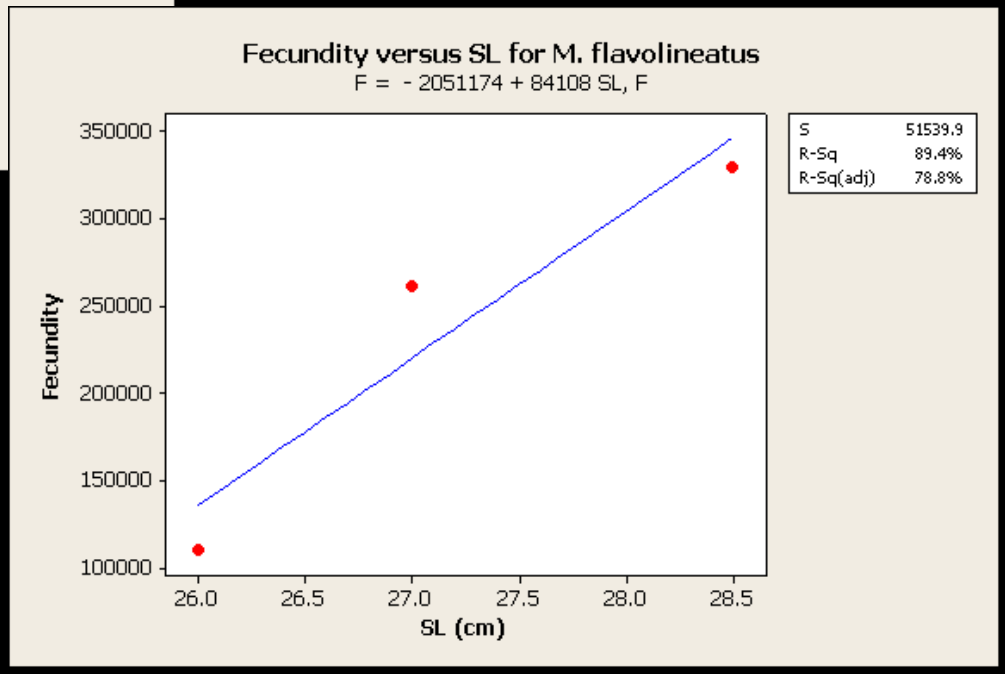


Results



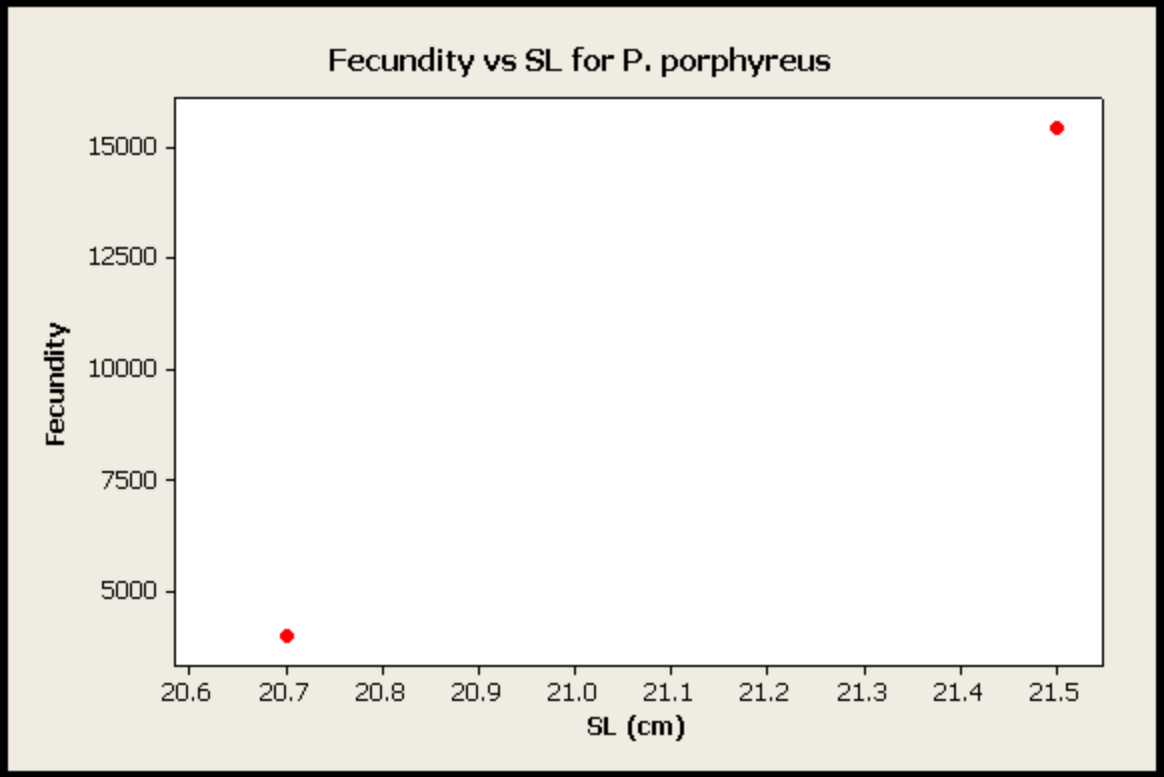
About 150,00 eggs for 25 cm SL female

Over 300,000 eggs for a 28.5 cm SL female!!!



Results

- Very few large mature females
- Low GSI compared to other two species

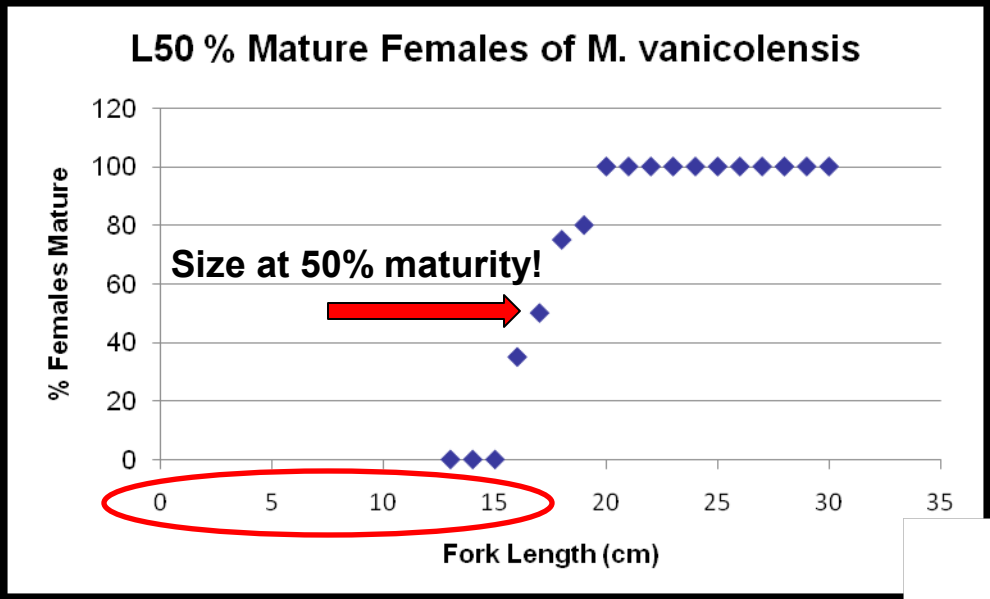


FL (cm)	Batch fecundity
27.6	23,186
33	20, 474
35.6	19, 909
35.6	25, 695
38.7	11, 991

Reproduced from Moffit (1979)

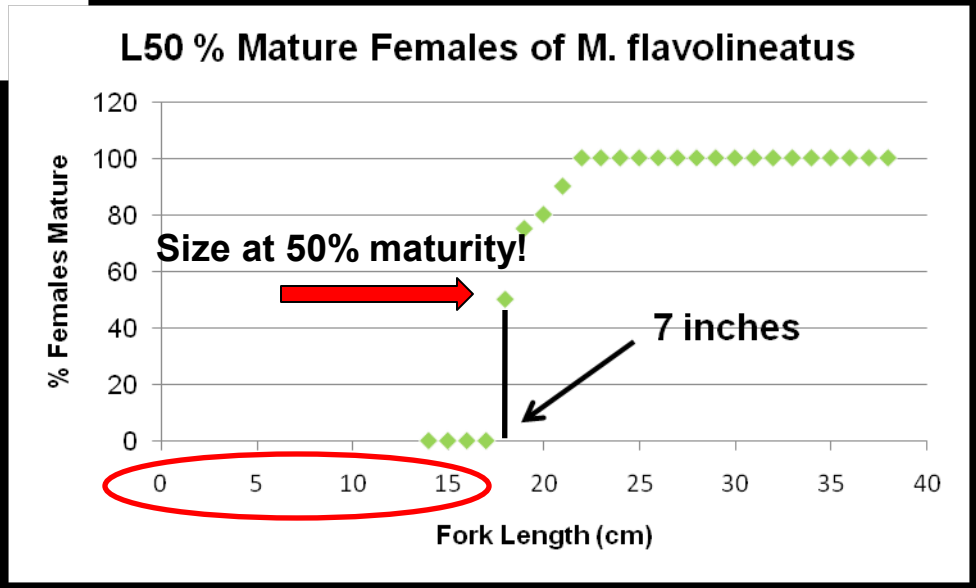
Only about 15, 000 eggs for a 21.5 cm SL female!!!

Results



No DAR size limit!

DAR size limit = 7 inches

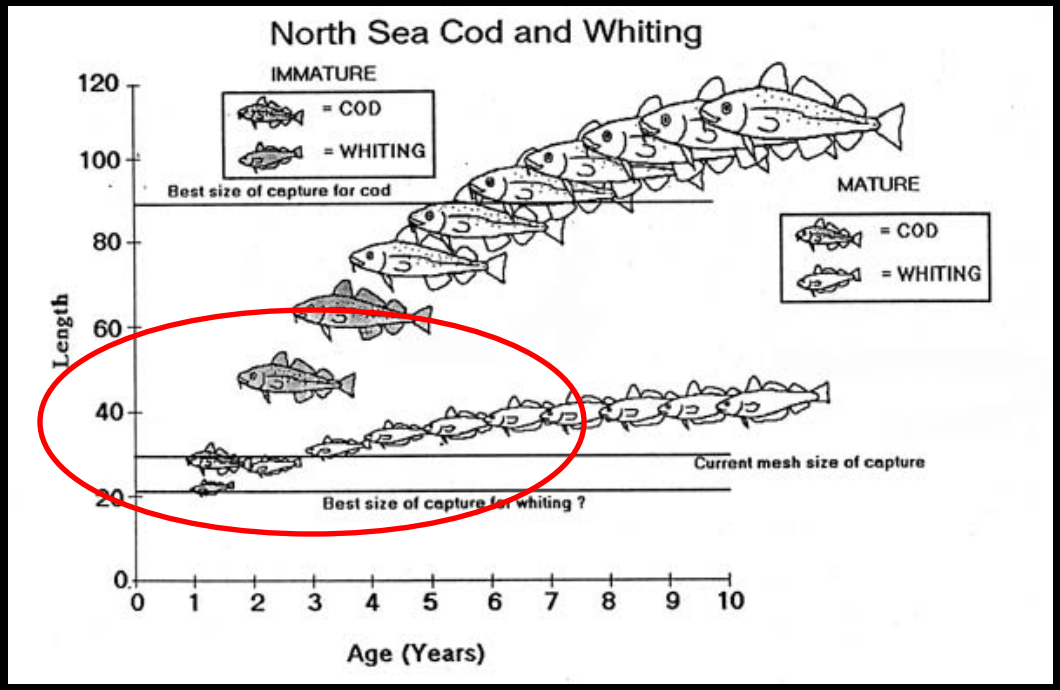


Conclusions

- Females share similar ovarian development (asynchronous)
- Spawning season overlaps for all three species (Feb/Mar- June)
- L50 for *M. vanicolensis* and *M. flavolineatus* are smaller than or at existing minimum size limit
- Fecundity showed a positive, non-significant relationship with SL
- *M. flavolineatus* has the highest fecundity, *P. porphyreus* the lowest

Application: Using the data for conservation

- Establish biologically relevant restrictions
  - L50 about 17- 18 cm (6.69 – 7.08 inches)
  - Minimize take of ‘oama?
  - Fish outside spawning seasons?
  - Leave the really big and really small ones



Pope, 1993

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