Population connectivity of coral reef fishes along the Florida Keys Shelf: an integrated field & modeling analysis

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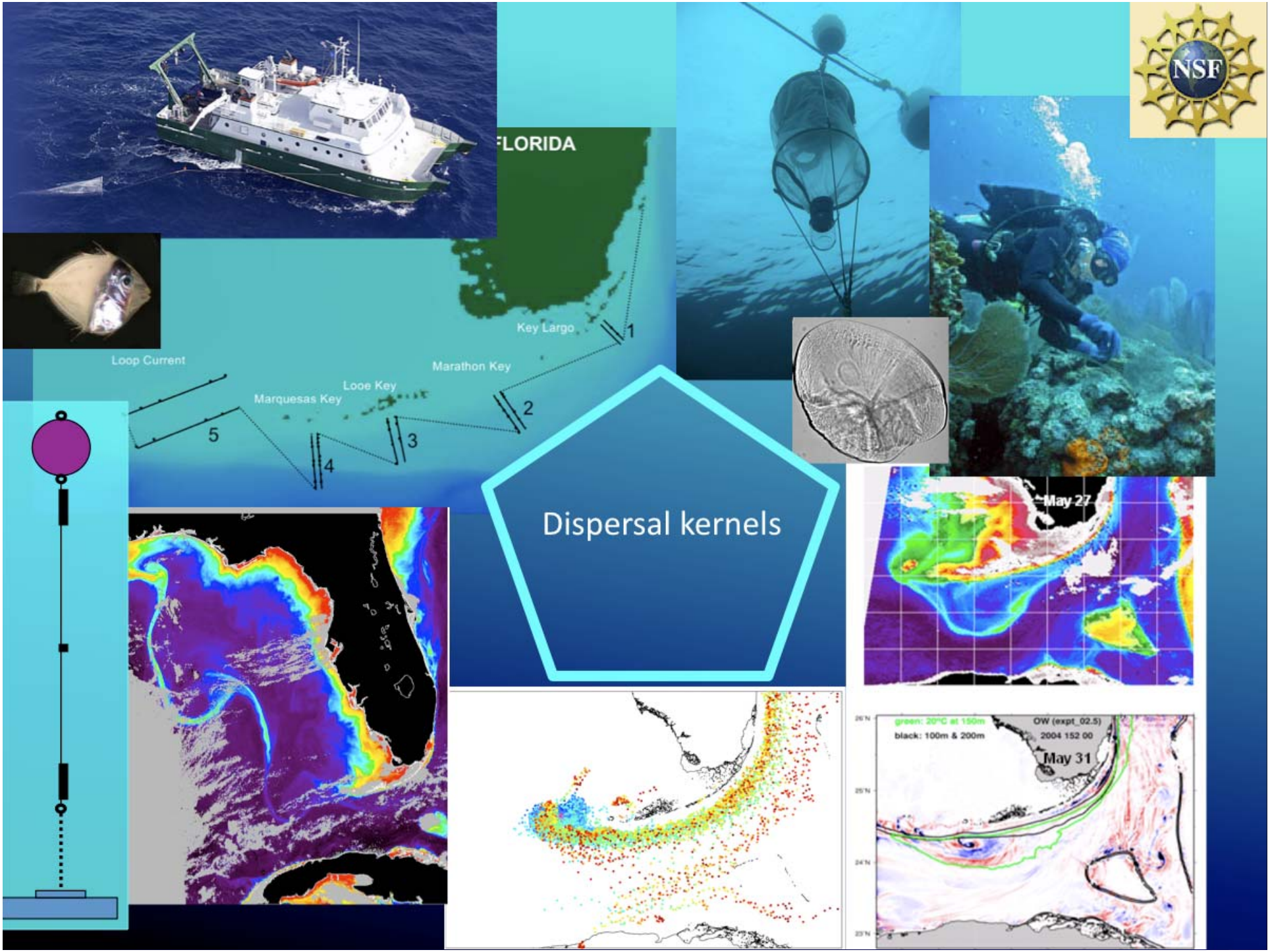
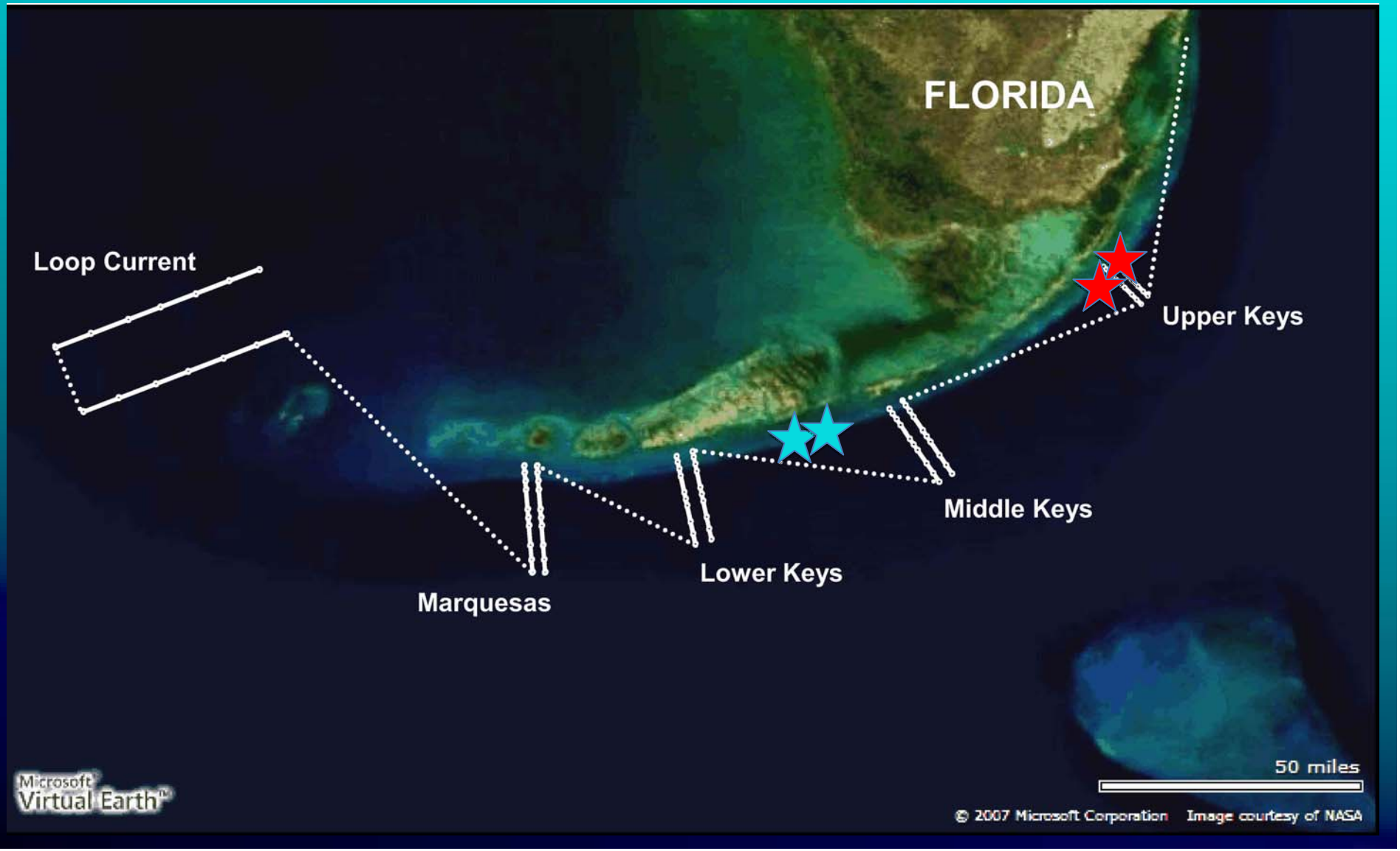

FLORIDA
Key Largo
Marathon Key
Looe Key
Marquesas Key
Loop Current
1
2
3
4
5
Dispersal kernels
May 27
green: 20°C at 150m
black: 100m & 200m
OW (expt_02.5)
2004 152 00
May 31

Larval supply & juvenile recruitment to the upper & lower FK

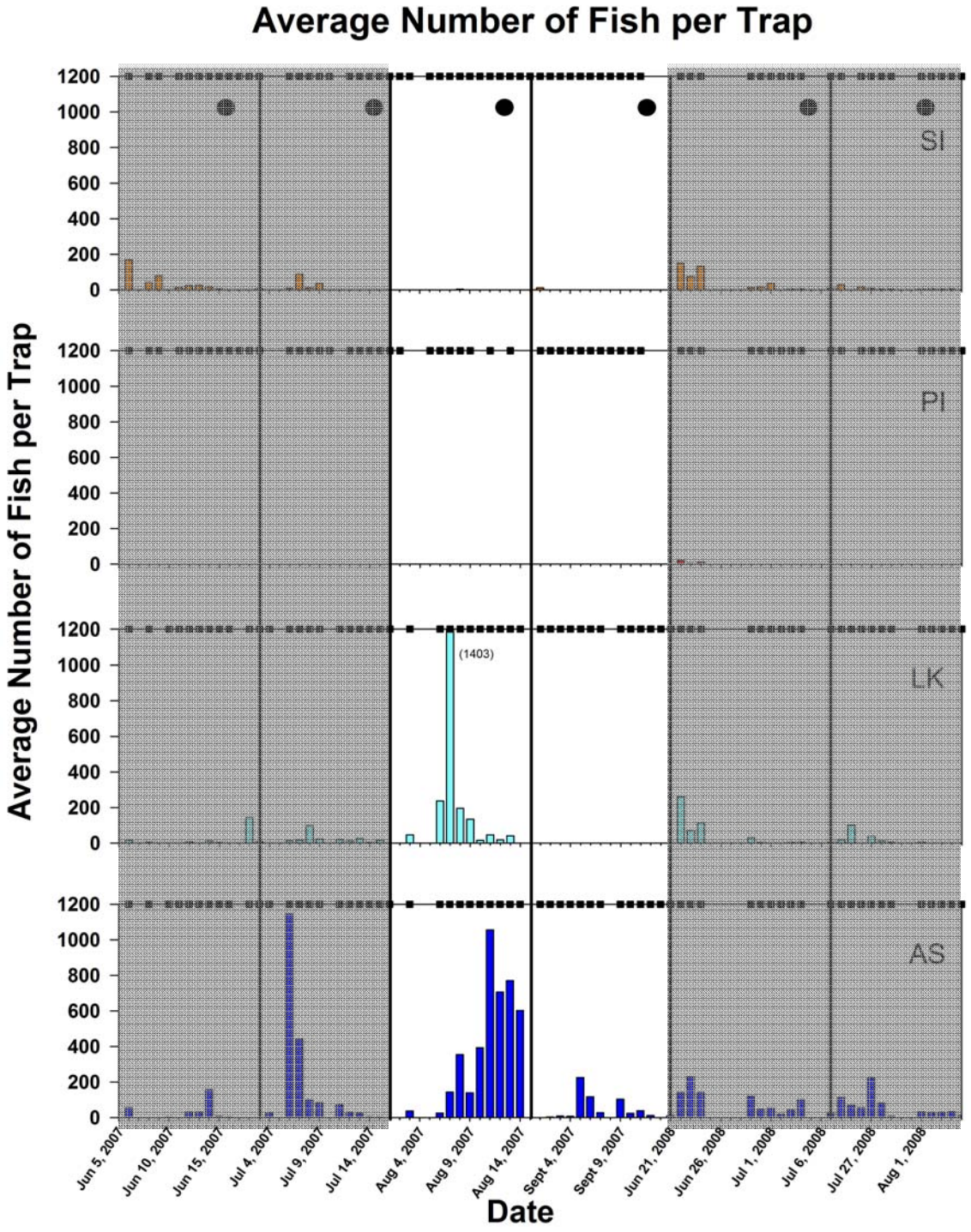
2 sites at each location: Replicate light trap sampling; UW visual census & collection

Sampling timed to lunar cycles & cruises: **6 2-wk periods around the 3rd qtr & new moons**

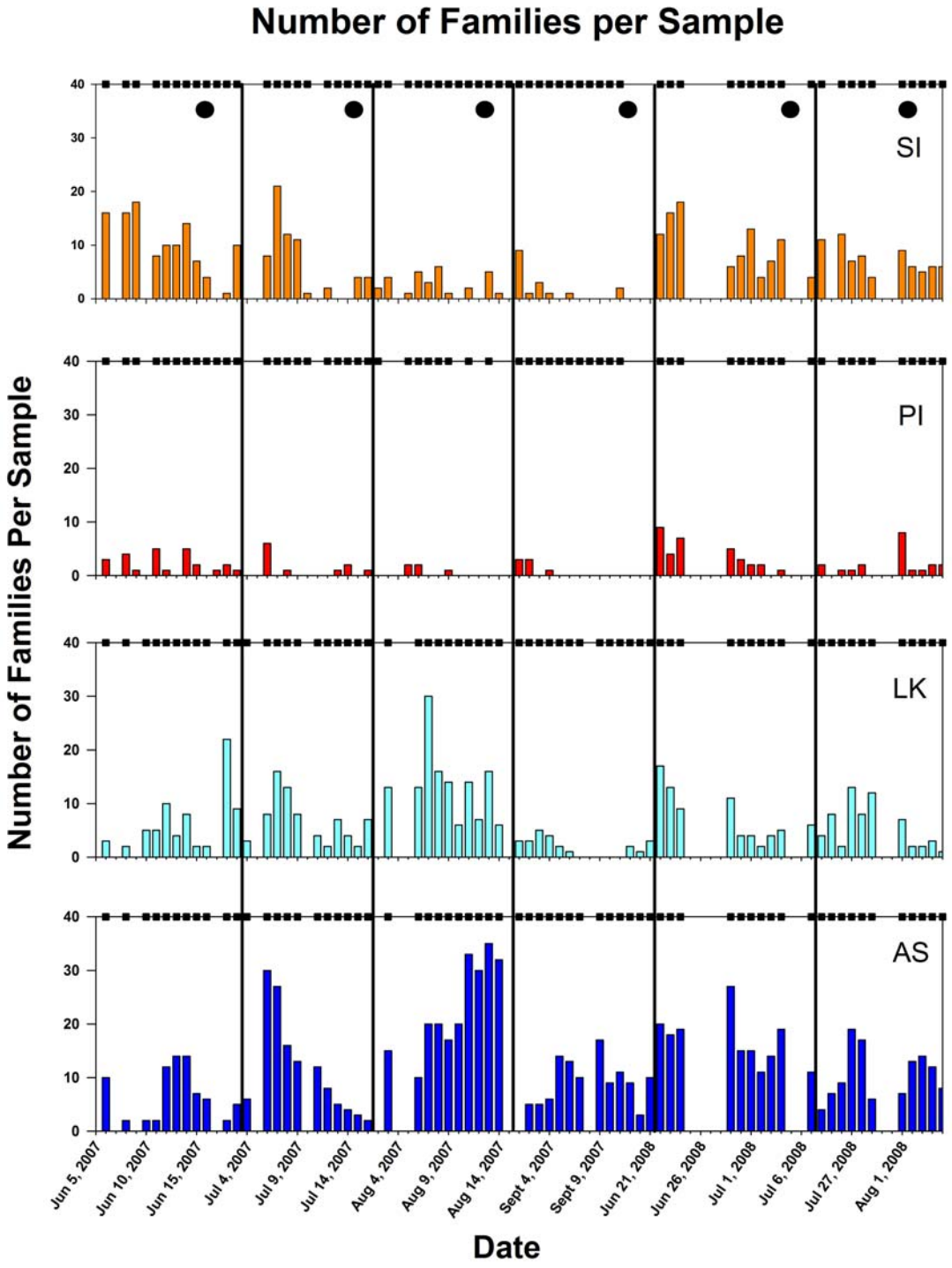


Larval supply to reefs: Light traps

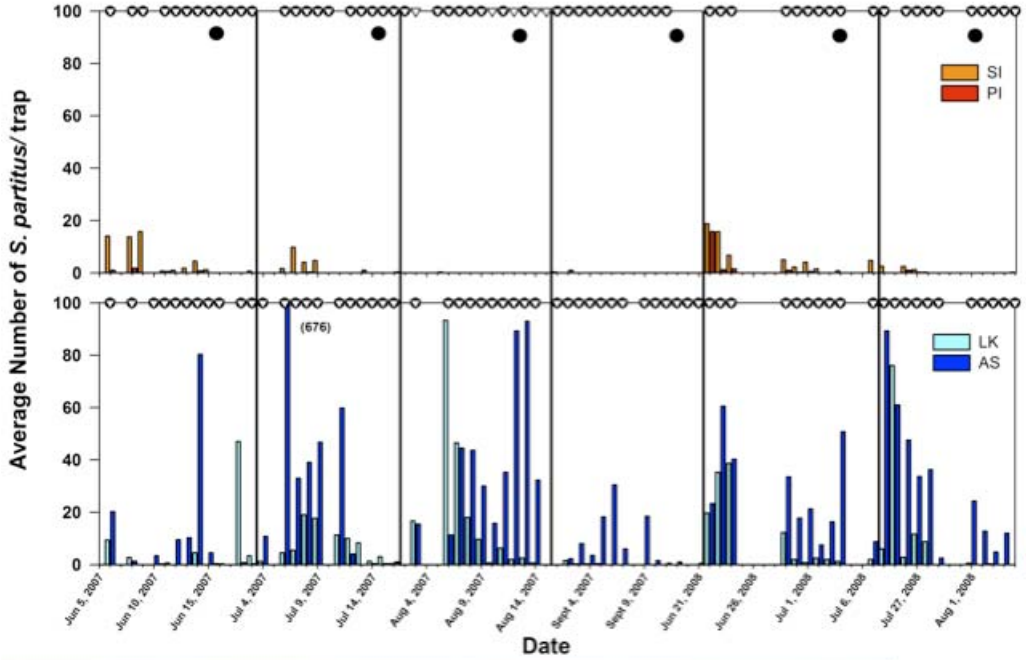
- Two sites in UK & LK
- Six 2-wk nightly sampling periods
- Four replicate traps per site

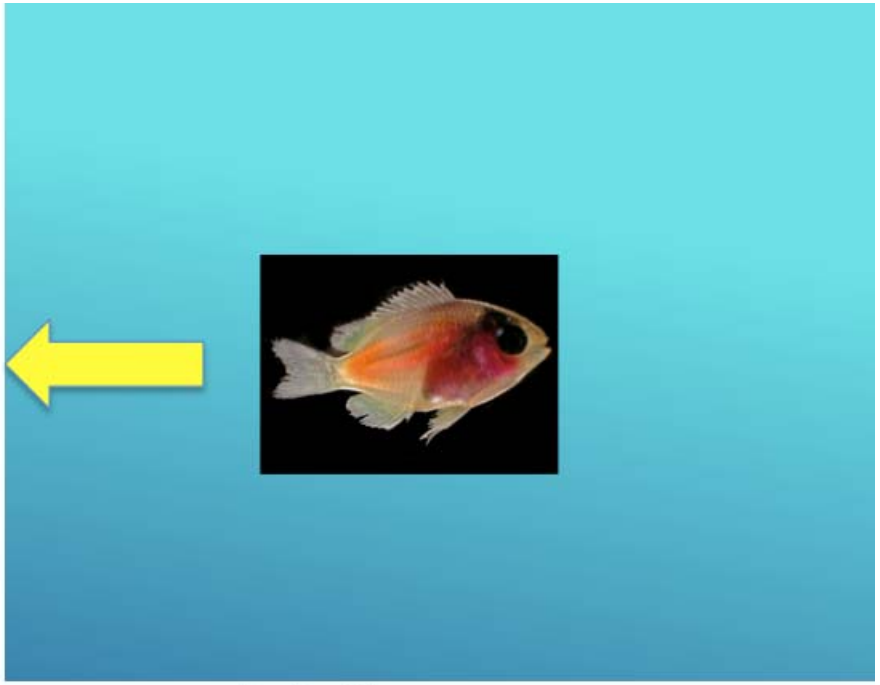


Higher abundance & diversity of larval fish arriving to Lower Keys than Upper Keys

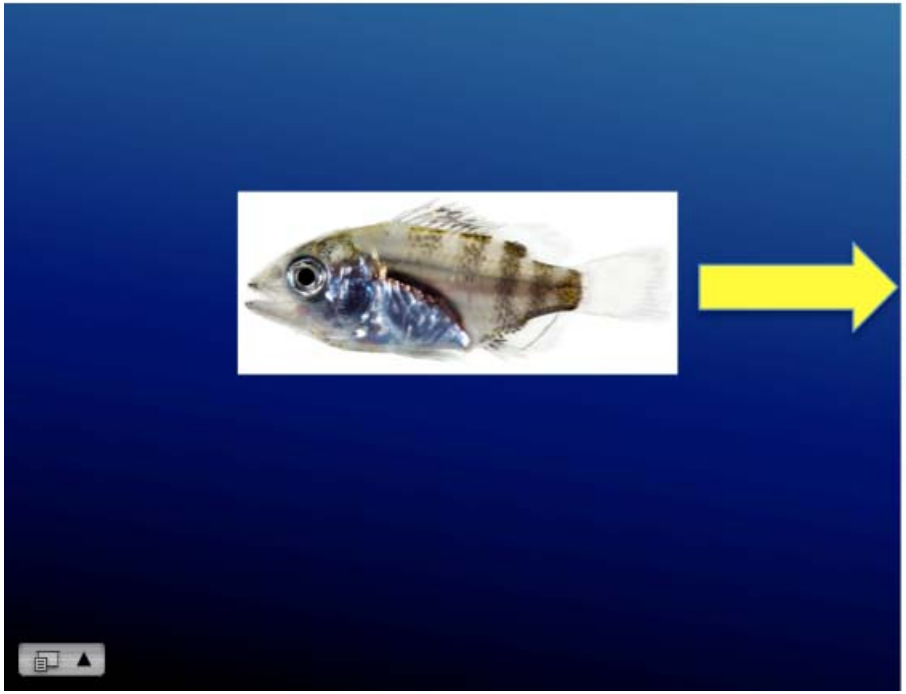


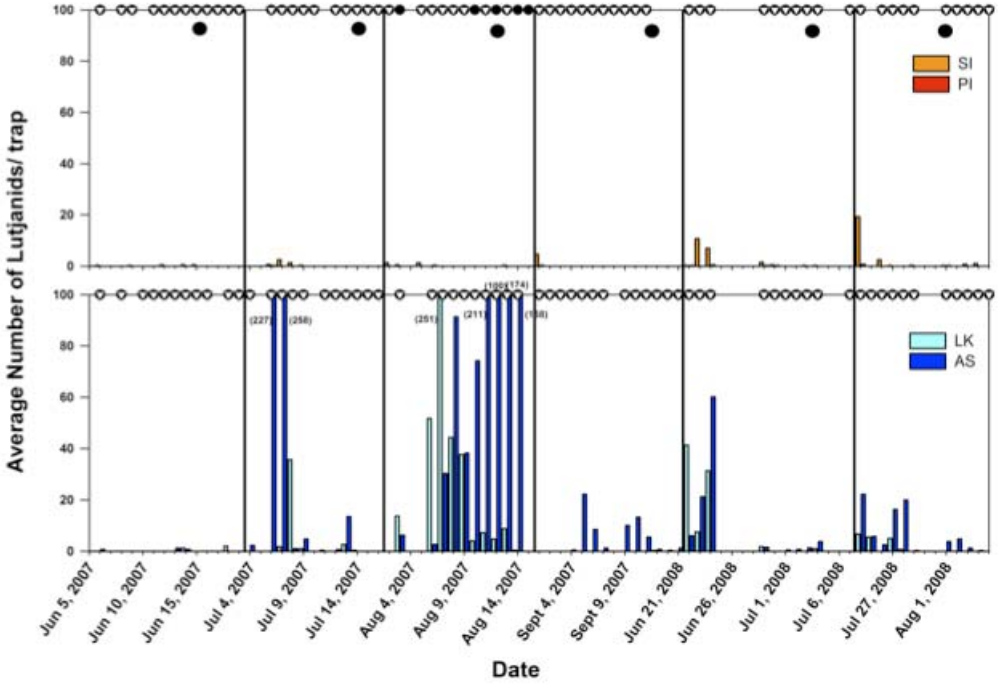
Stegastes partitus





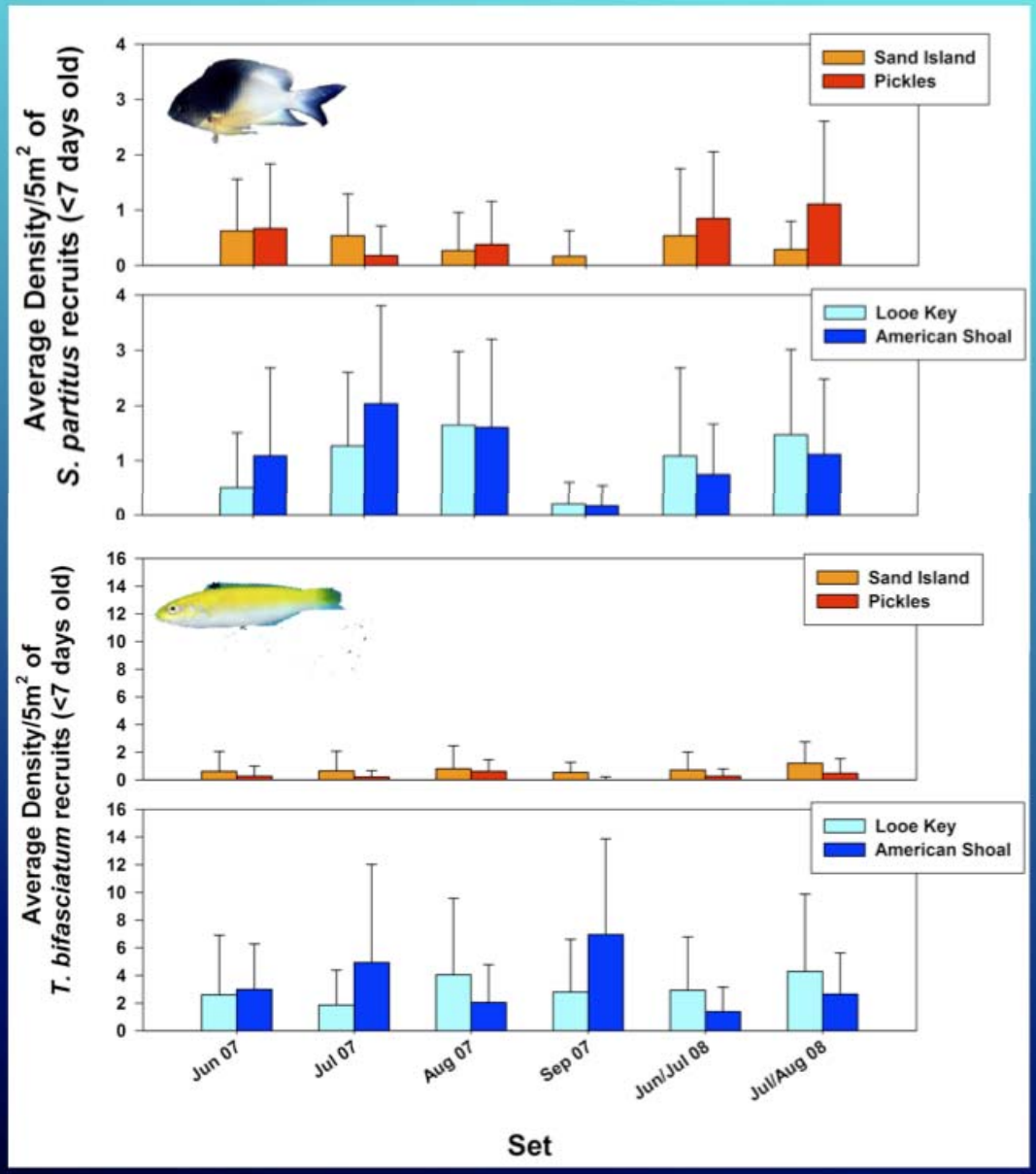
Lutjanidae spp.



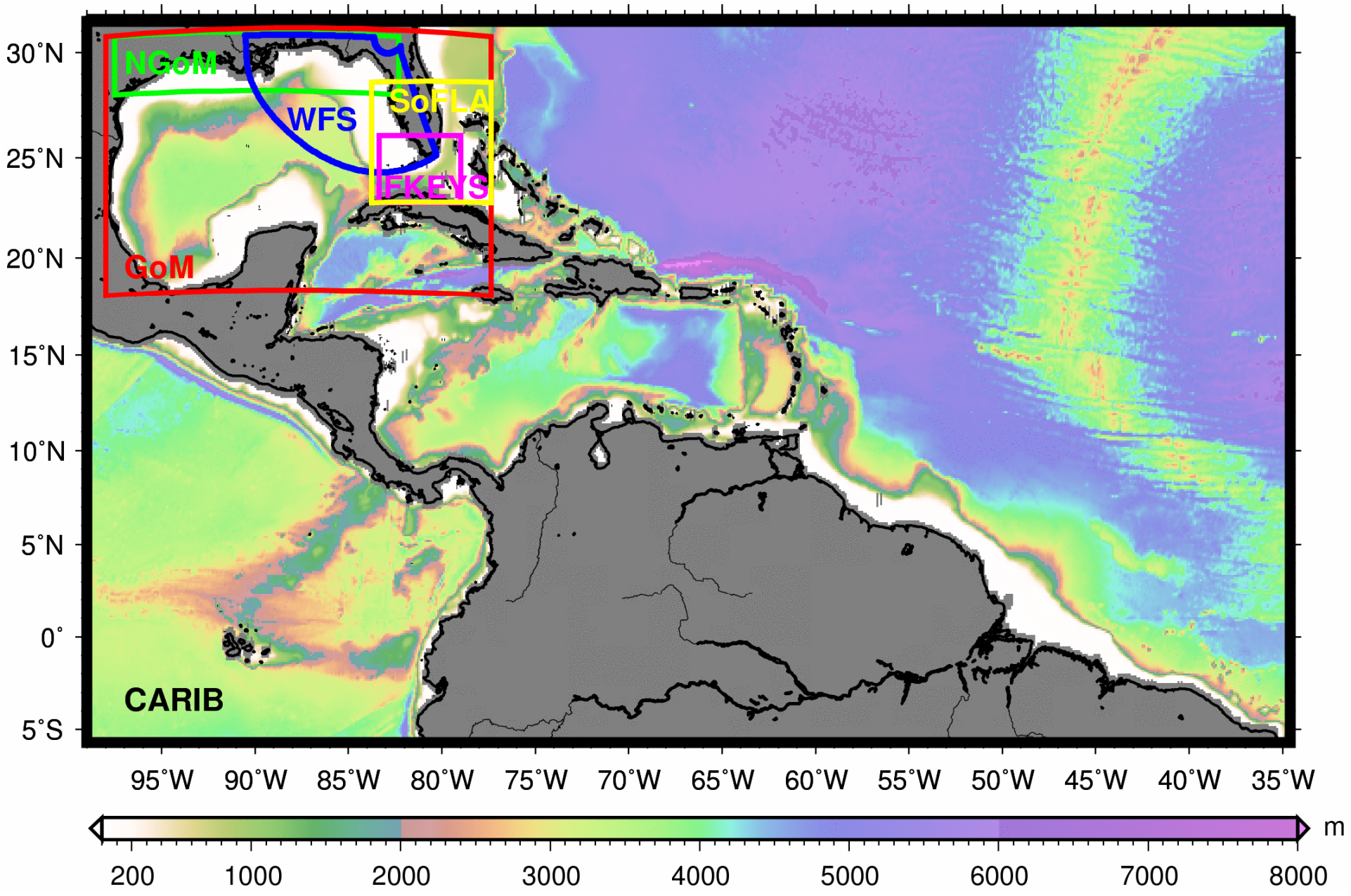


Recruitment of juveniles

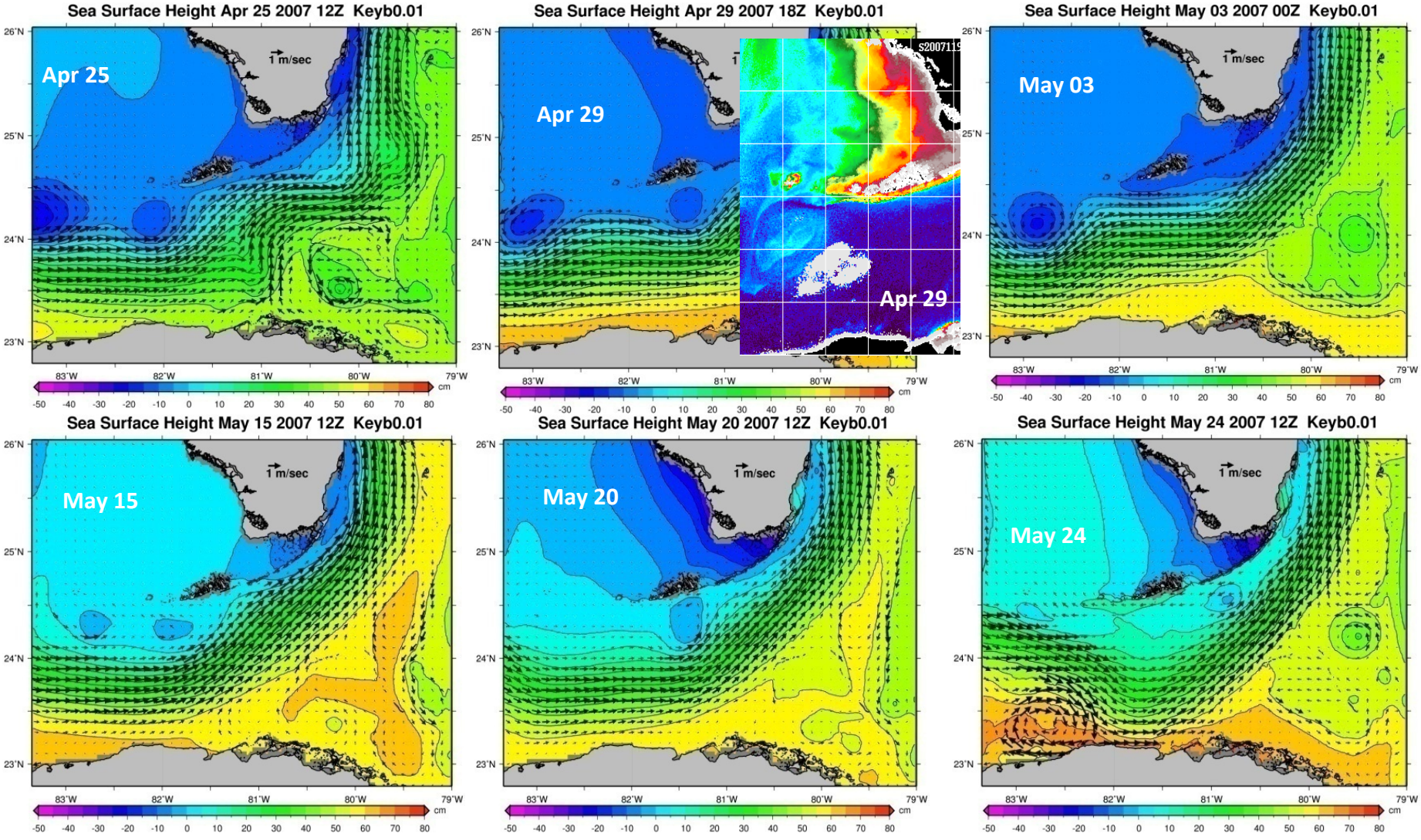
Underwater census & collection of new recruits



Regional and coastal modeling with the Hybrid Coordinate Ocean Model

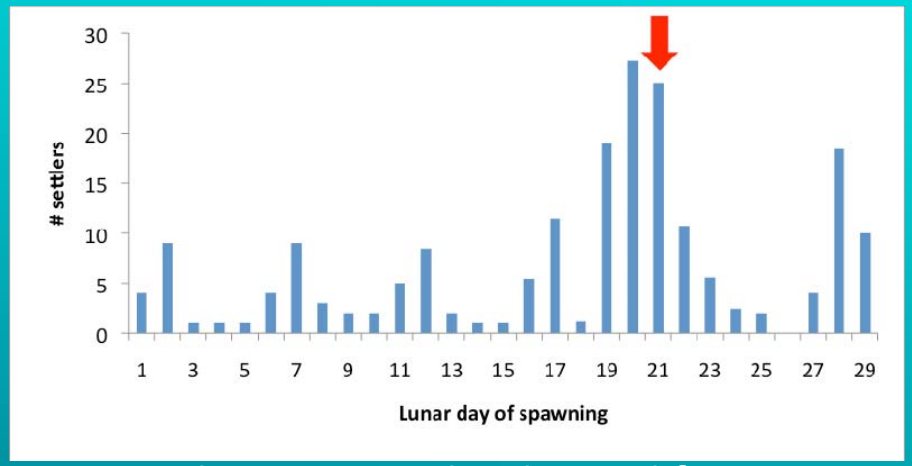


Eddy evolution captured by FL Keys model (SSH & CURRENT)

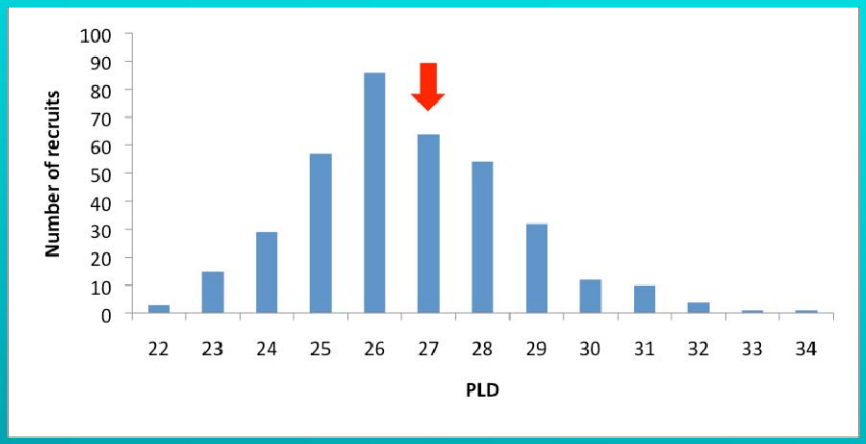


Eddy propagation ~ 8 km /day

Incorporation of species-specific empirical data into biophysical model



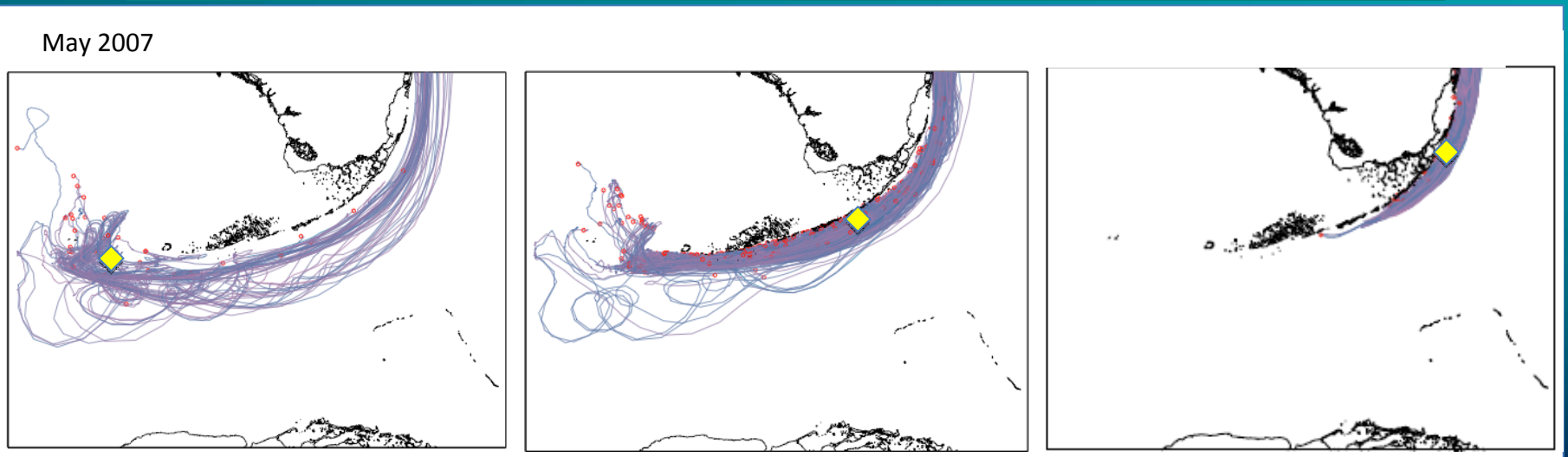
Lunar-cyclic spawning hindcasted from settlers



Back-calculated PLD from recruits

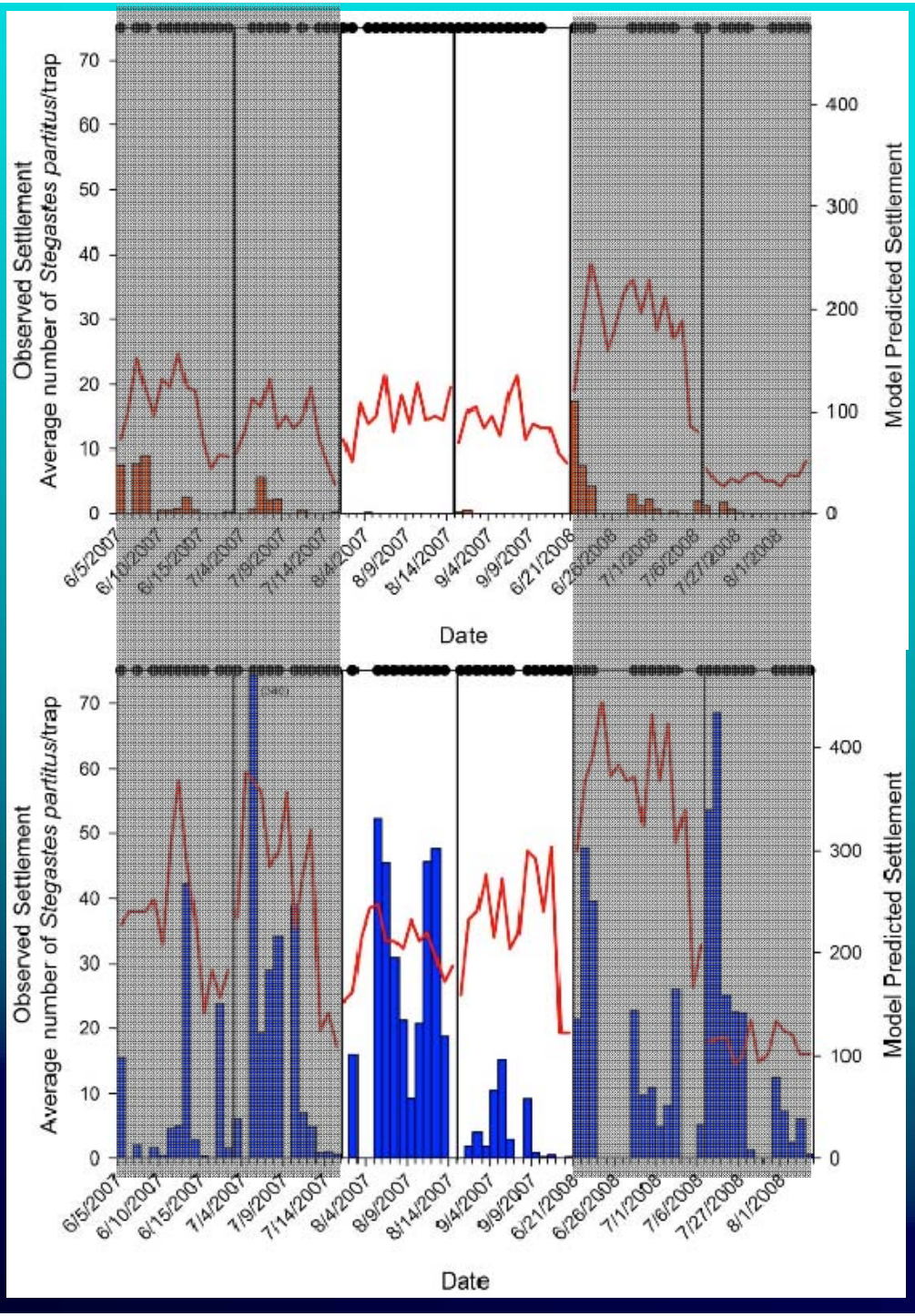
BiOlogical Lagrangian Transport System (BOLTS) coupled with FK-HYCOM

May 2007

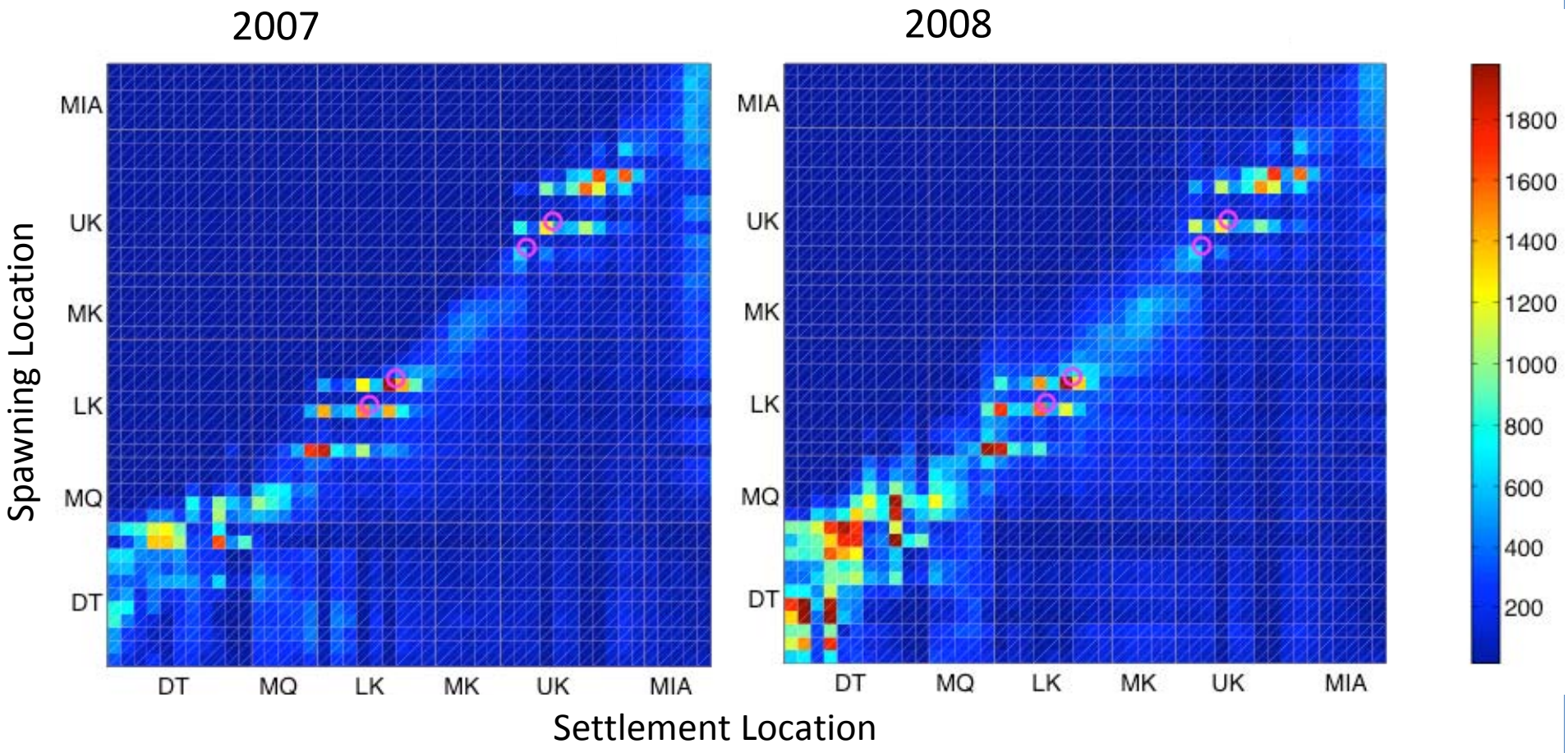


UPPER KEYS

LOWER KEYS

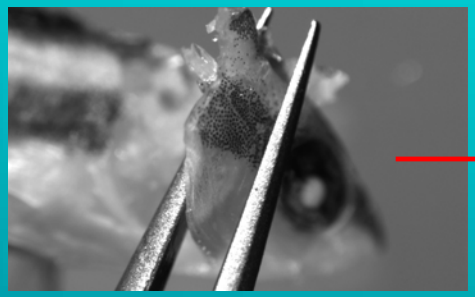


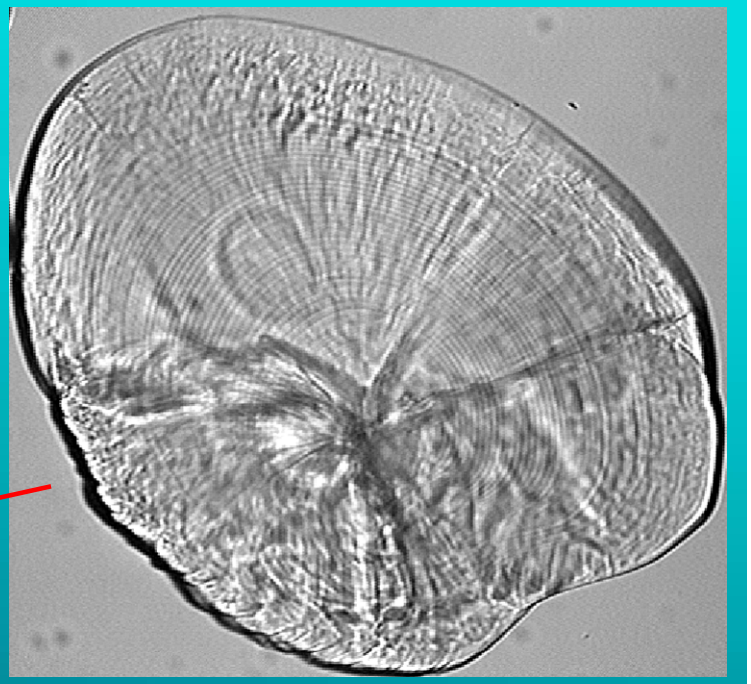
Connectivity matrices



General SW→NE transport tracks FC;
More counter-current effect in 2008
Recirculation/self-recruitment 'hot-spots' in UK, LK, Marquesas

Early survival & selective mortality

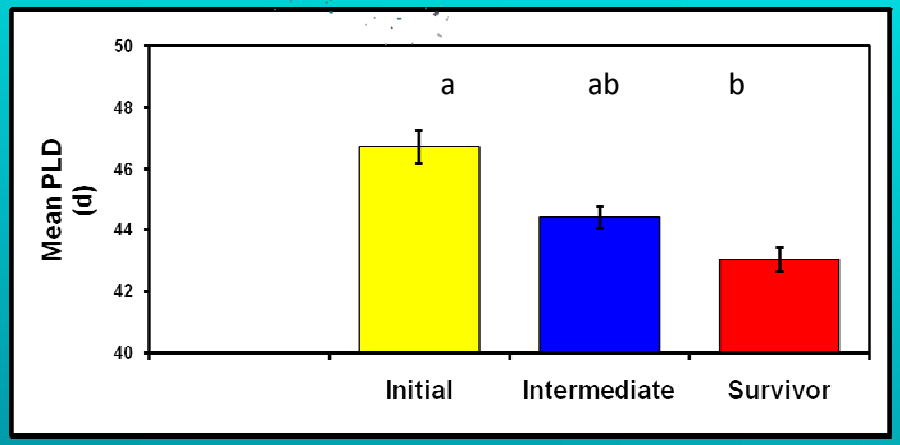


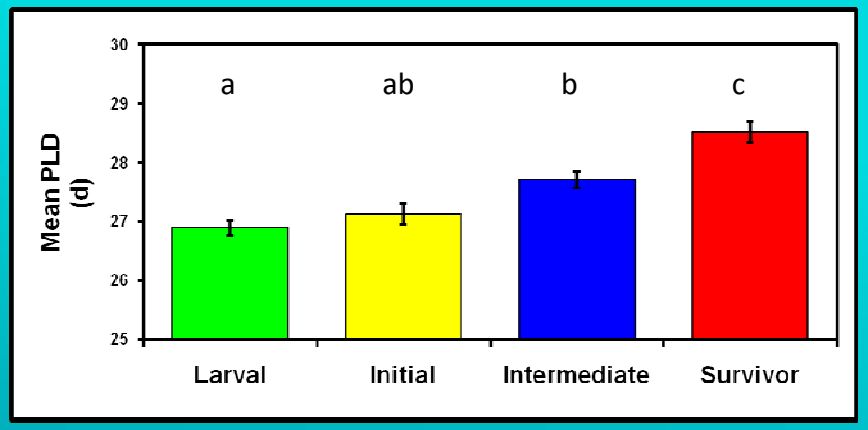


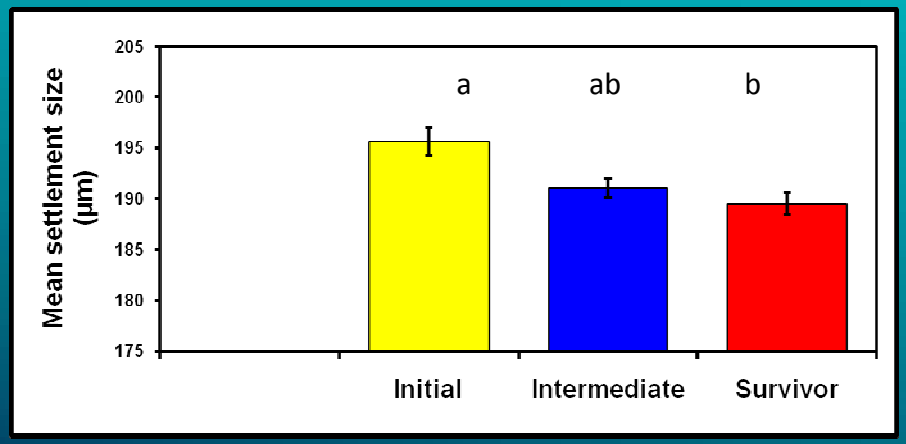
Larval growth
Pelagic larval duration
Size-at-settlement
Condition at settlement
Early juvenile growth

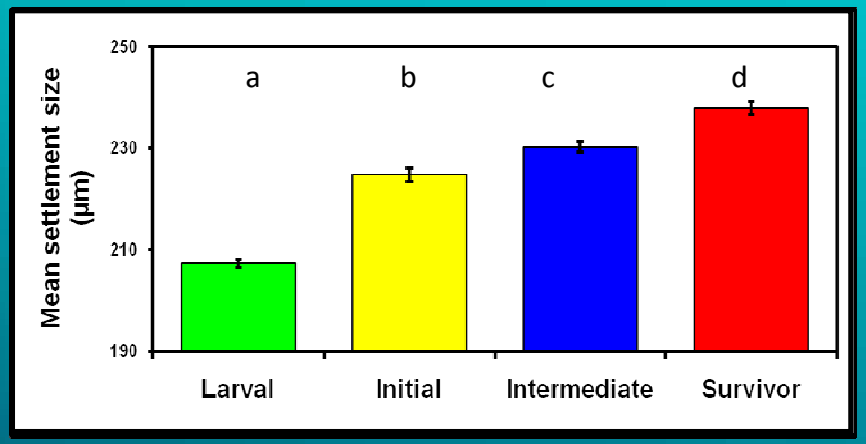
T. bifasciatum

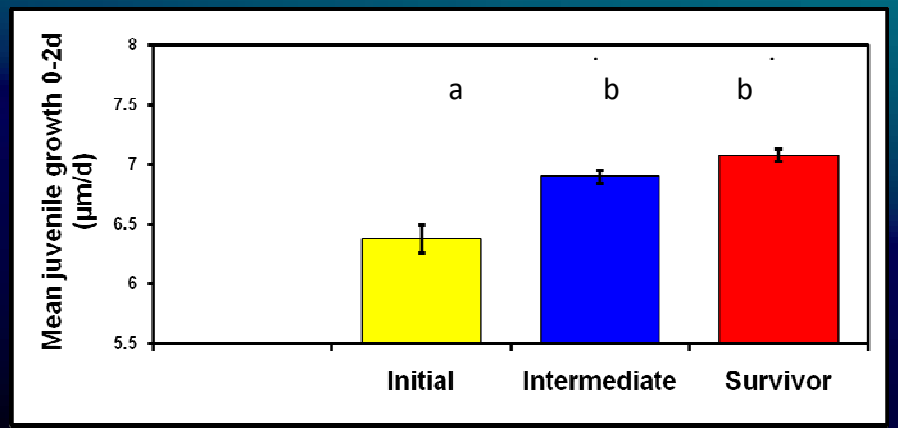
S. partitus

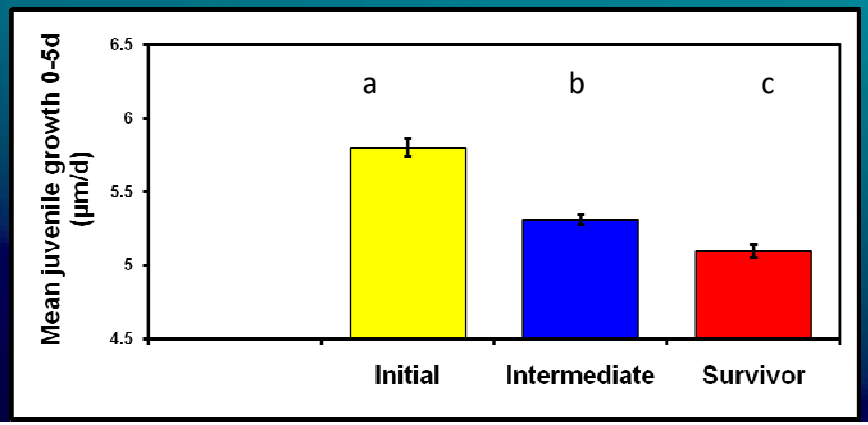




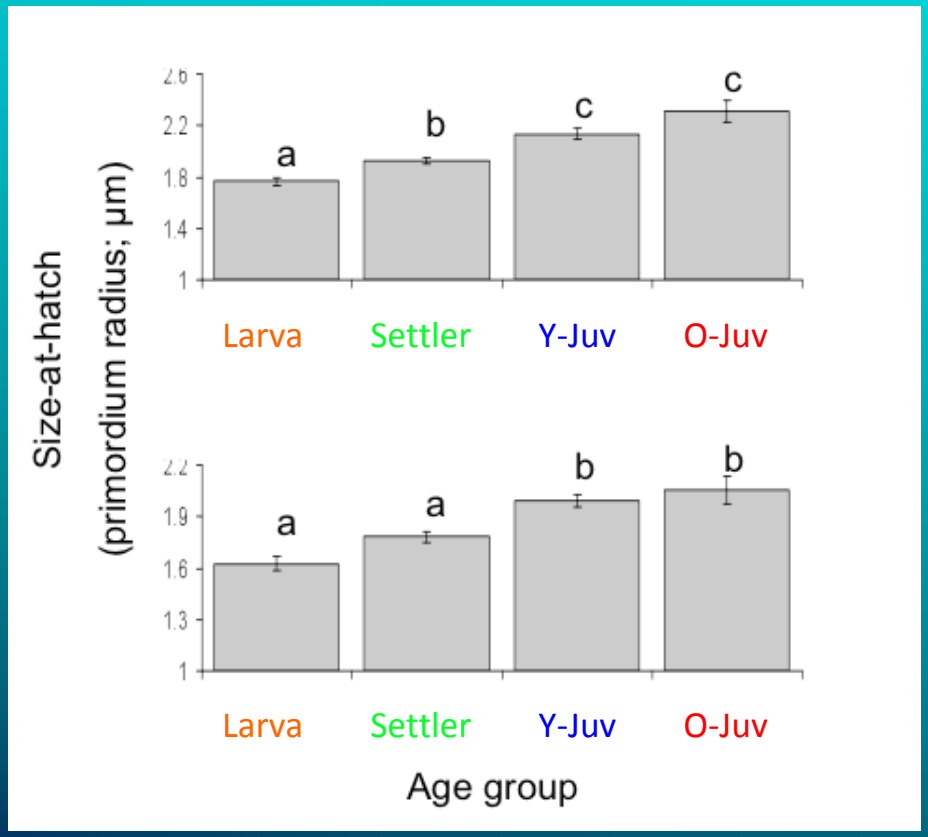








Snappers:
Ocyurus chrysurus (yellowtail) & *Lutjanus synagris* (lane)



Size-at-hatch influences survival
through the larval AND into the juvenile stage

Preliminary conclusions

★Mesoscale eddies propagate along the Keys frequently (present during each of 3 cruises); activity captured in the high resolution hydrodynamic model.

★Reef fish larvae consistently more abundant offshore in eddy & FC waters than on shelf; assemblages vary by water mass.

★For some species, larval condition higher nearshore than offshore.

★Larval supply & recruitment varies by region & site: generally higher in LK, agreeing with modeled predictions.

★Some sites may have more self-recruitment than others; LK related to eddy presence; lower & less variable in UK

★Fine-scale modeling will be refined with additional empirical data.

★Survival of recruits is non-random & varies distinctly among species.

★Larval size at hatch impt. throughout larval & into juvenile stage.

★Dispersal kernels will quantify degree to which FK populations dependent on upstream sources.

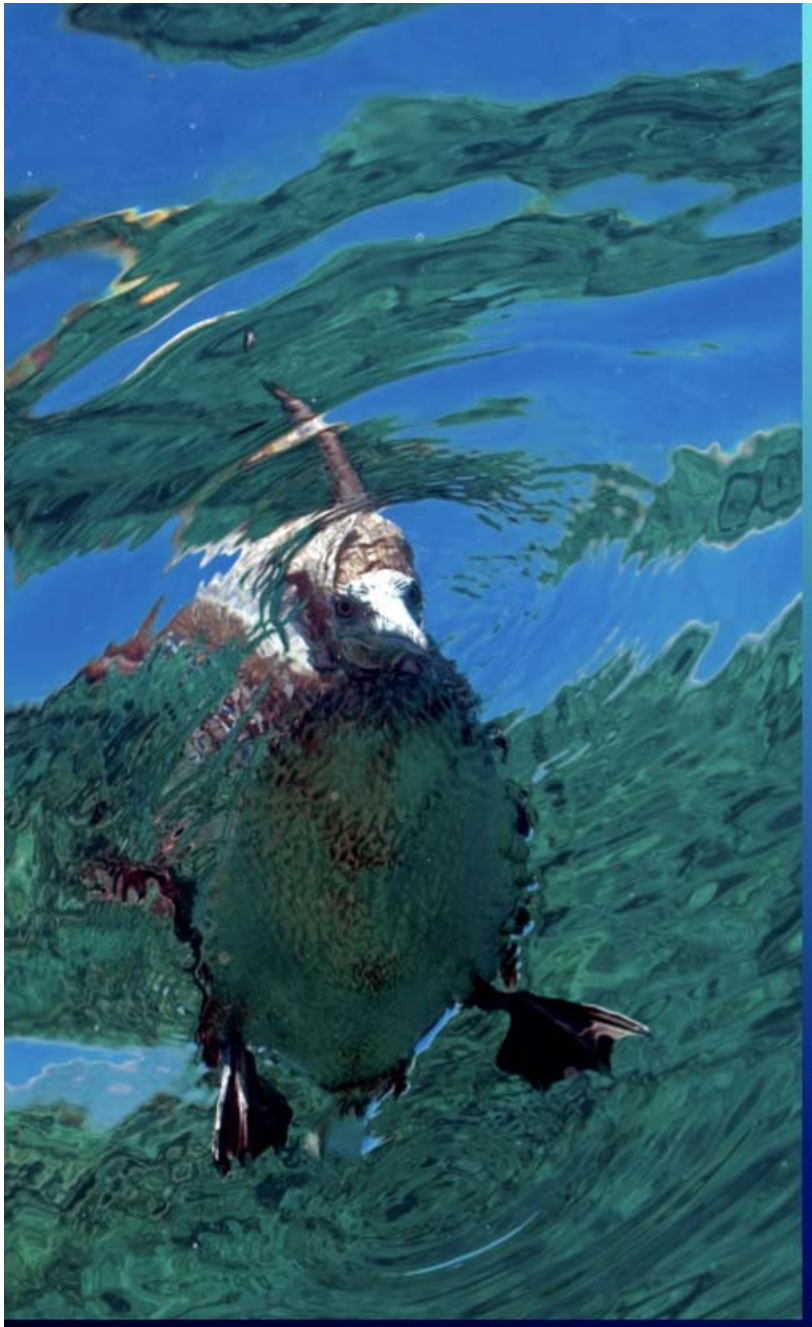


Photo E. D'Alessandro

Acknowledgements

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Research Assistants: T Murphy, L Parsons

Graduate Student Field Assistants: S Bignami, T Rankin

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RSMAS Dive Program: R Gomez

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FK-HYCOM: H Kang BOLTS: A Srinivasan