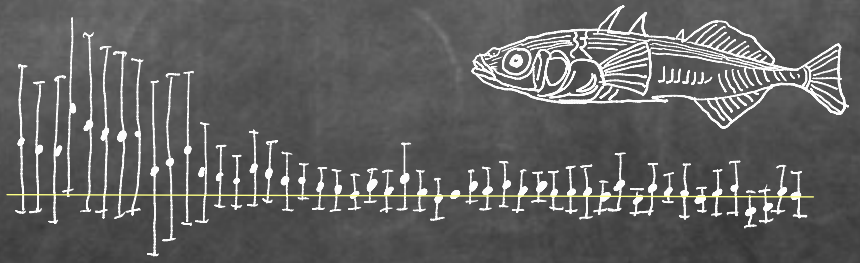
Coevolution Of Habitat Choice In A Stochastic World



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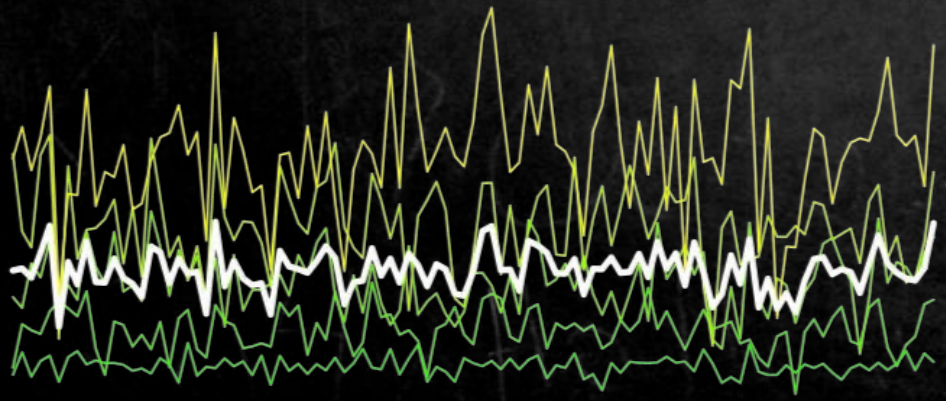
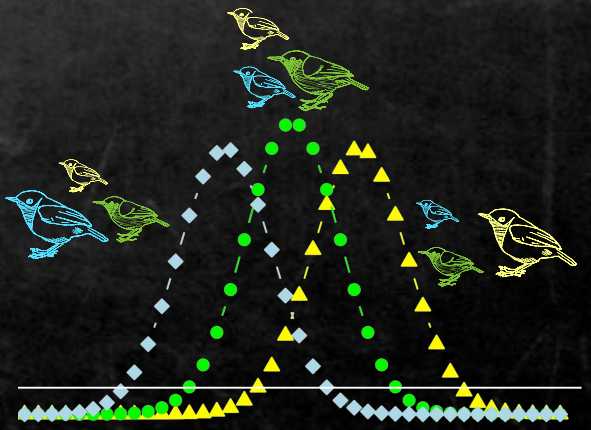
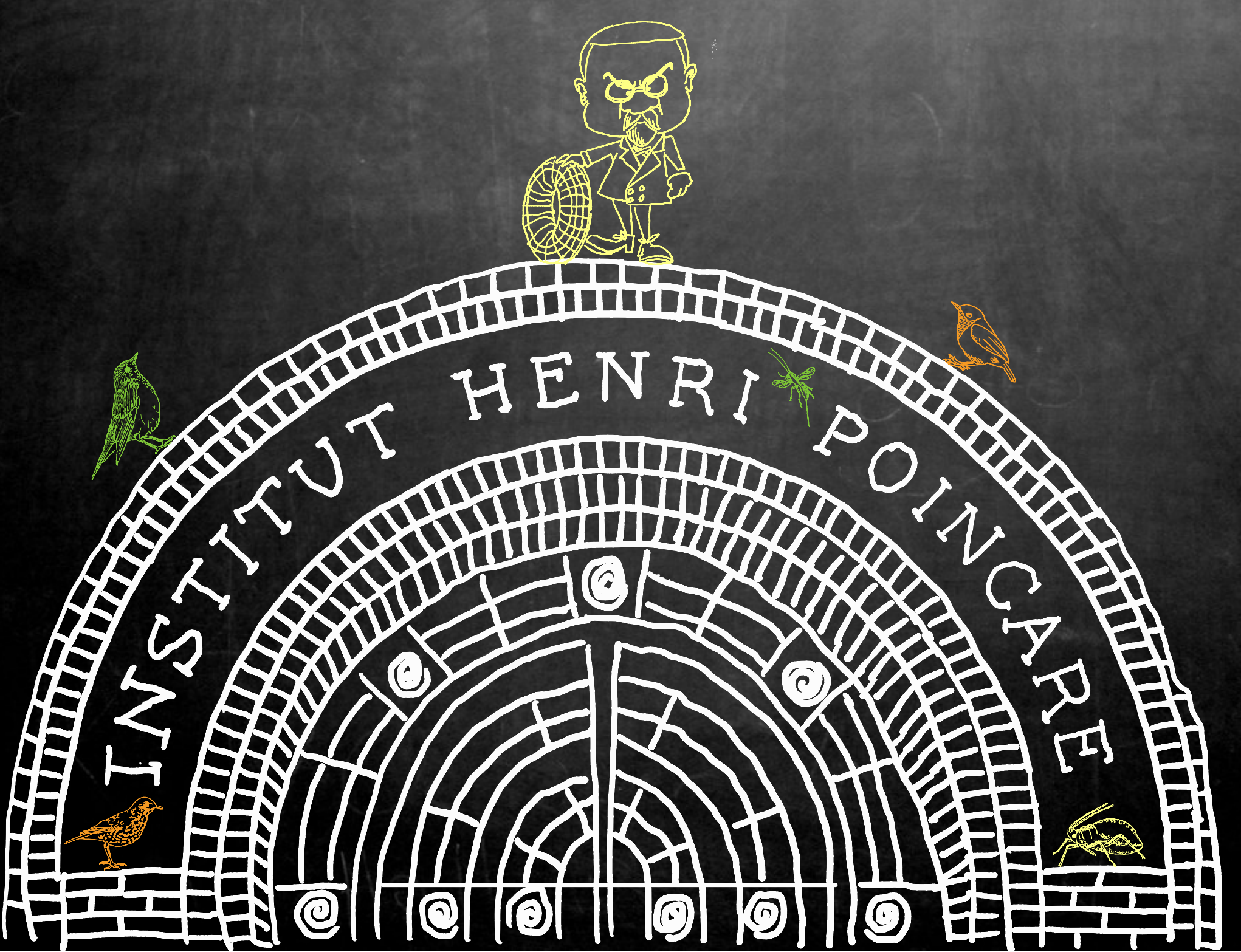
University of California, Davis

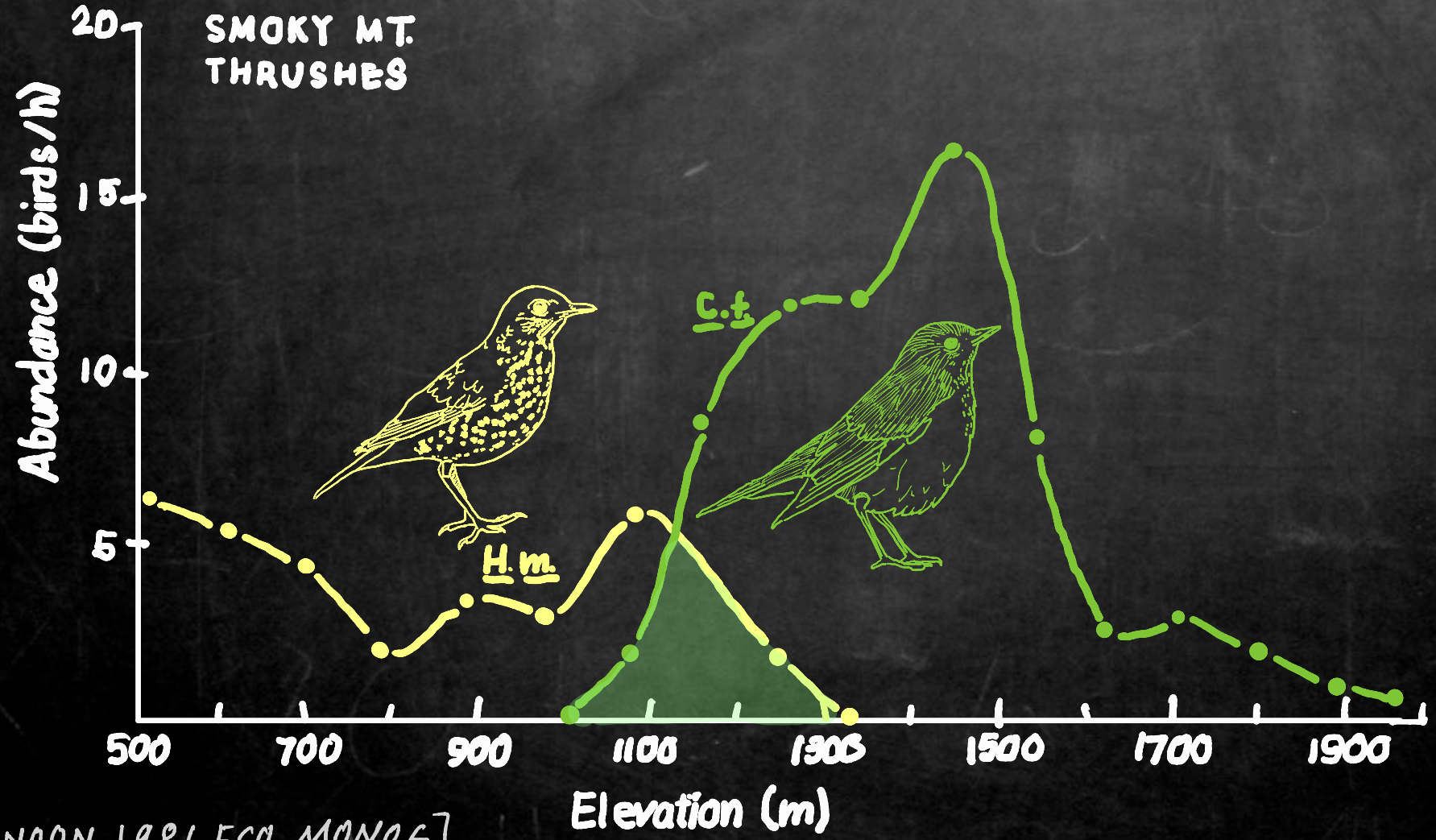
w/ Alex Hening &
Dang Nguyen






INSTITUT HENRI POINCARE

What determines the distribution and abundance of plants and animals?



[NOON 1981 ECO. MONOG.]

[NOON 1981 ECOLOGICAL MONOGRAPHS]

"I was studying earthworm brains for my doctoral dissertation... I was irritated by Lack's dogmatic position... that territorial behavior did not affect habitat selection... in desperation... I put it all into mathematical models ... [and] made several wonderous discoveries... I soon dropped the earthworm research; both the worms and I were having nervous breakdowns and getting nowhere."

This Week's Citation Classic®

CC/NUMBER 8
FEBRUARY 25, 1991

Fretwell S D & Lucas H.L. On territorial behavior and other factors influencing habitat distribution in birds. I. Theoretical development. *Acta Biotheor.* 19: 16-36. 1970.

IDEAL FREE DISTRIBUTION: per-capita growth rate equal in all occupied patches & lower elsewhere is an evolutionarily stable strategy (ESS)

[CRESSMAN & KŘIVAN 2006 AM.NAT
CANTRELL ET AL. 2007 J. BIOL.DYN.]

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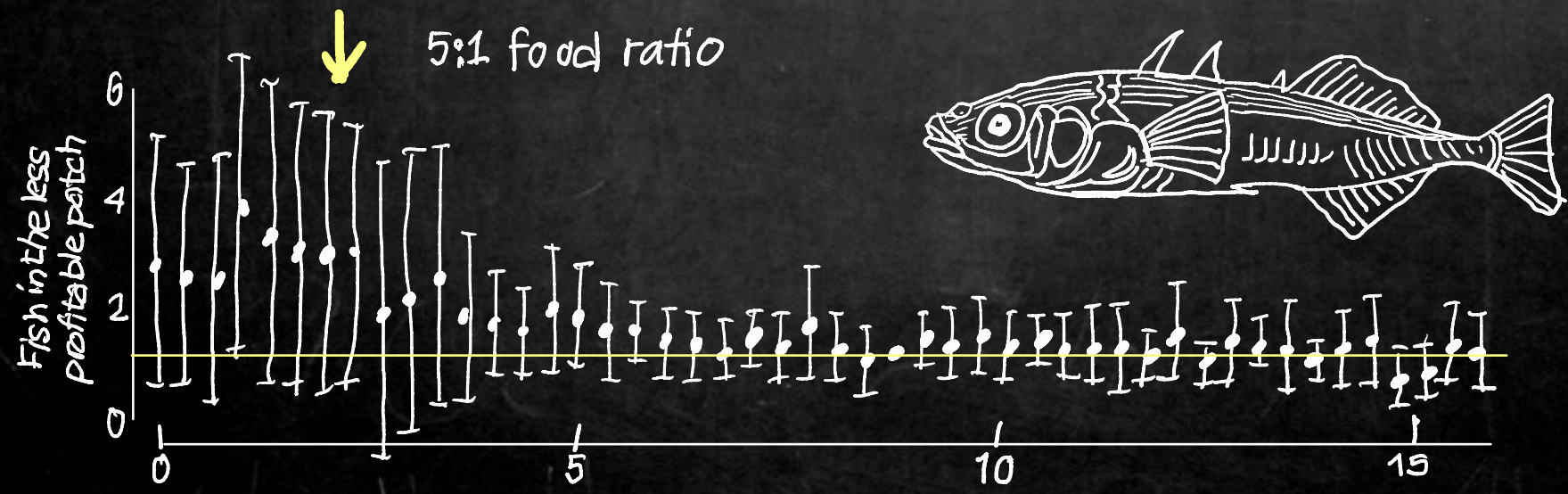
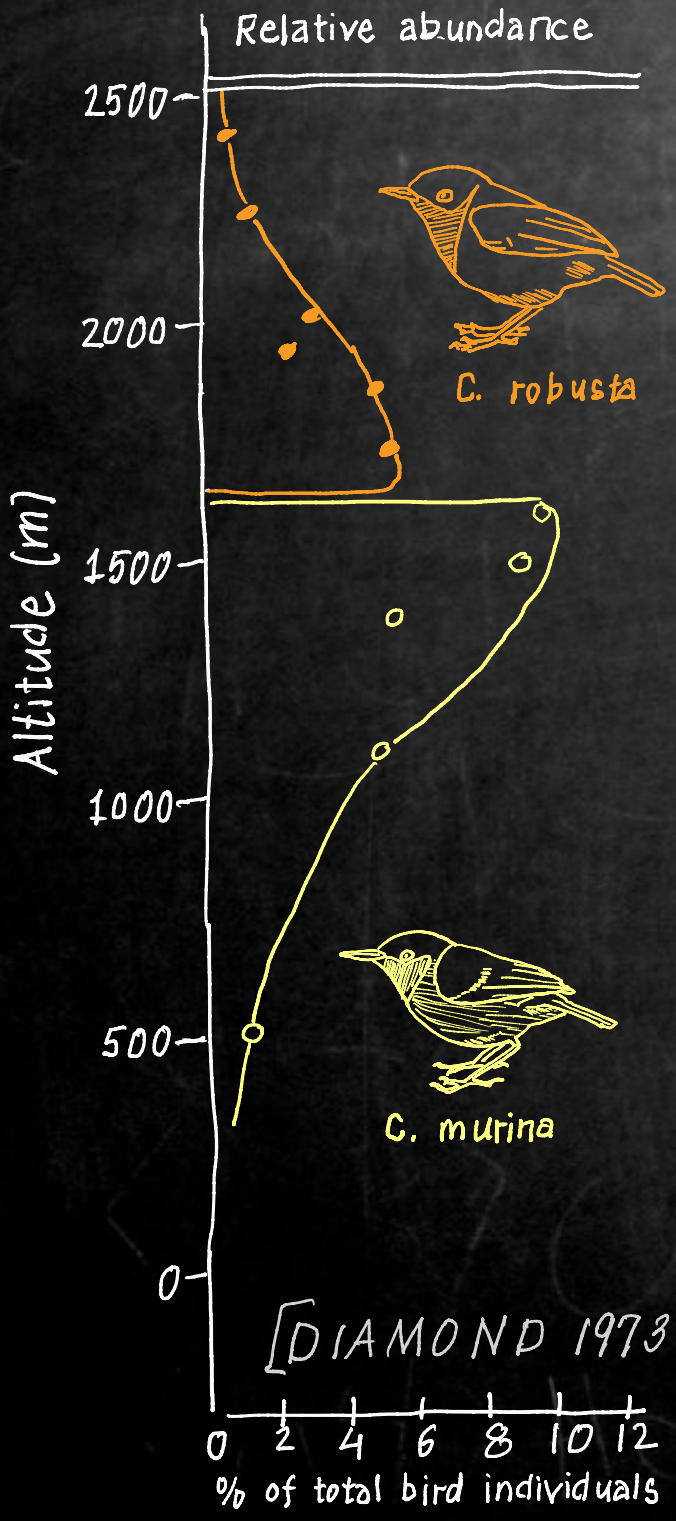
CANTRELL ET AL. 2007 J. BIOL. DYN.]

IMPLICATIONS

- no sink populations under equilibrium conditions
- input matching



[MILINSKI 1979 ZEIT. TIER PSY.]

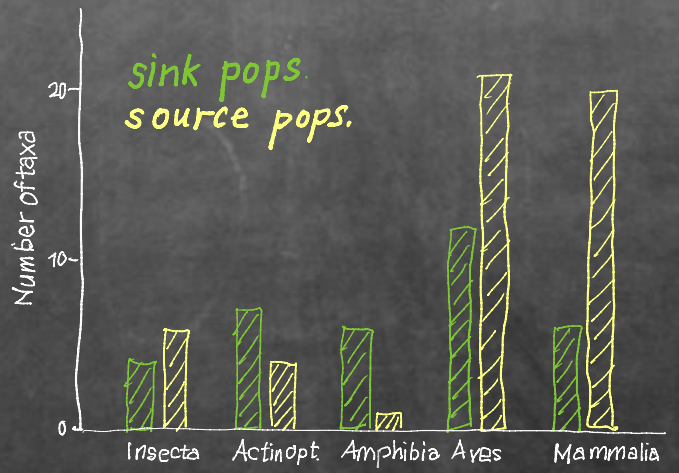


[DIAMOND 1973 SCIENCE]

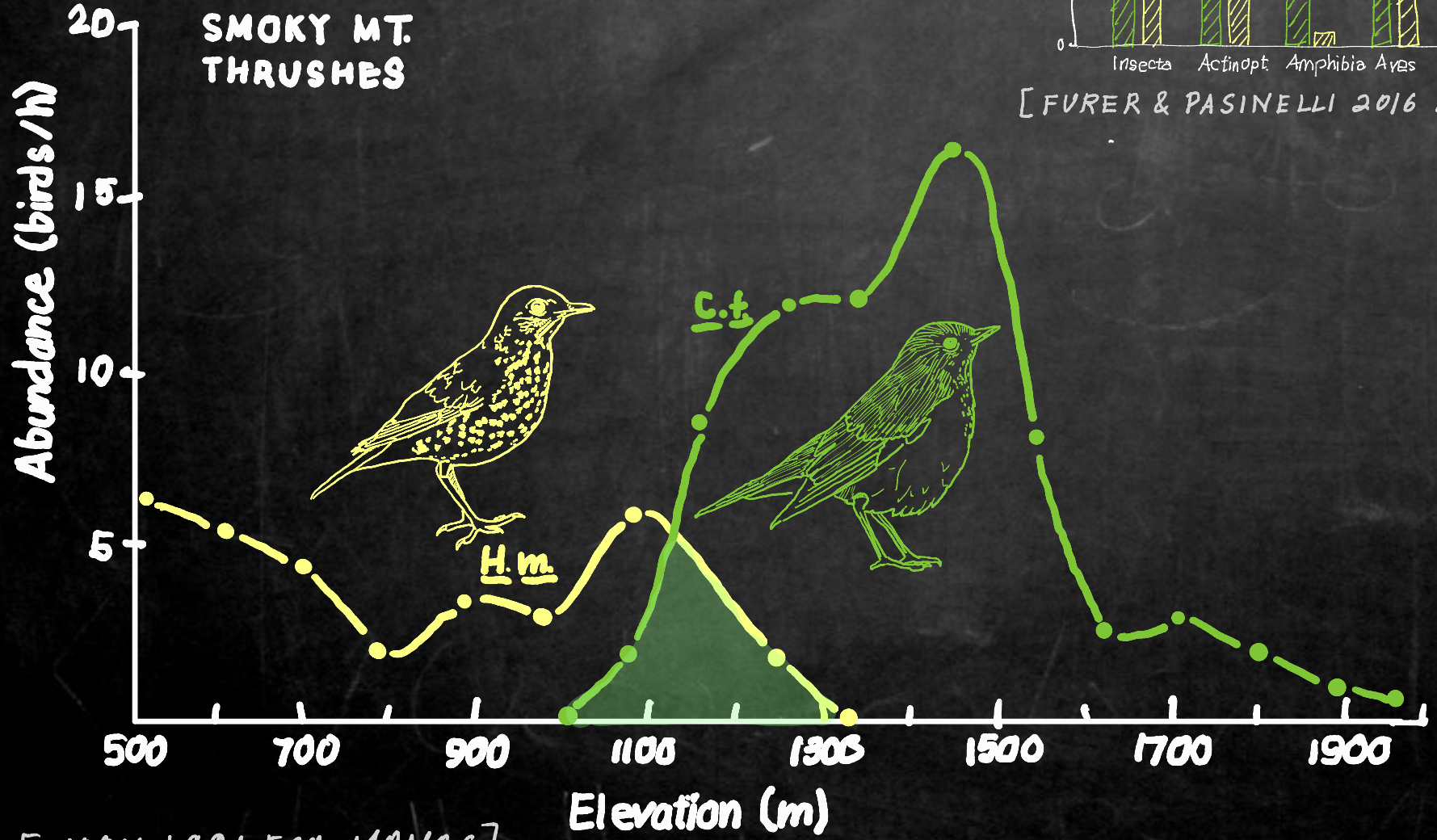
Ghost of competition past

[LAWLER & MAYNARD SMITH 1976 AM. NAT.]

BUT... sink populations, input mismatch, co-occuring competitors are common

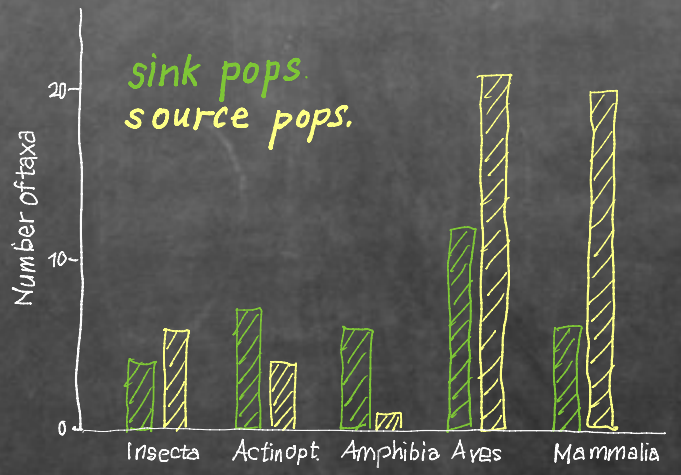


[FURER & PASINELLI 2016 BIOL. REV.]



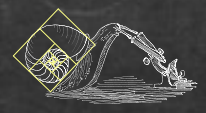
[NOON 1981 ECO. MONOG.]

BUT... sink populations, input mismatch, co-occuring competitors are common



[FURER & PASINELLI 2016 BIOL. REV.]

Theory suggests temporal environmental variation can select for sink populations and input mismatch



[HOLT 1997 EVOL. ECO.; JANSEN & YOSHIMURA 1998 PNAS; S. 2012 AM. NAT.]

What effect does spatial-temporal variation have on the coevolution of patch-selection in metacommunities?

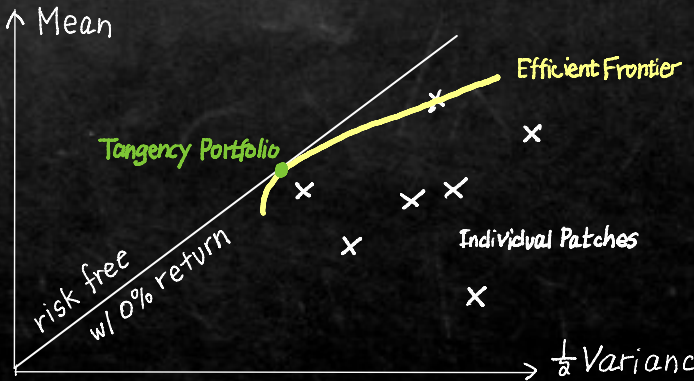
$$dx_i = x_i \sum_{l=1}^{k} p_i^l \left\{ f_i^l (p^l \circ x^l)\, dt + dE_i^l \right\}$$

I. Models & Coexistence

II. Main Results: Coevolutionary Stability

III. Applications: Competing Species Predator-Prey

IV. Modern Portfolio Theory & Finale




EEP
T
IMPLE
TUPID
KISS

- Implicit space
- Lotka Volterra dynamics
- Brownian noise