Corbicula fluminea Distribution and Biomass Response to Hydrology and Food: A Model for CASCaDE Scenarios of Change

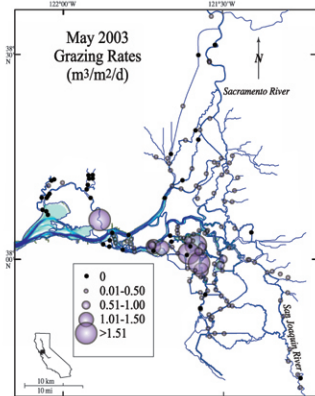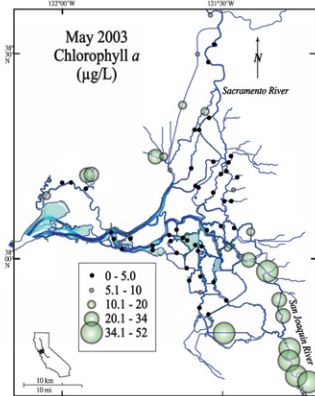## by Francis Parchaso and Janet Thompson

Why Do This?

Corbicula is an efficient phytoplankton consumer and is a vector for contaminant transfer up the food web. Therefore, the *Corbicula* model is an important link within the framework of CASCADE.
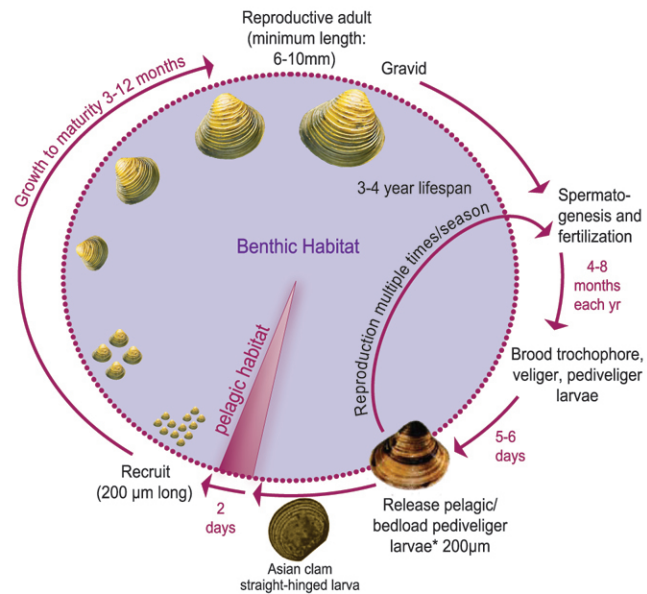

May 2003
Chlorophyll *a*
(µg/L)

- 0 - 5.0
- 5.1 - 10
- 10.1 - 20
- 20.1 - 34
- 34.1 - 52

May 2003
Grazing Rates
(m3/m2/d)

- 0.01-0.50
- 0.51-1.00
- 1.01-1.50
- >1.51

The inverse *corbicula* – phytoplankton distributions reflect top-down control of phytoplankton

May 2003
Corbicula fluminea
Biomass (g/m2)
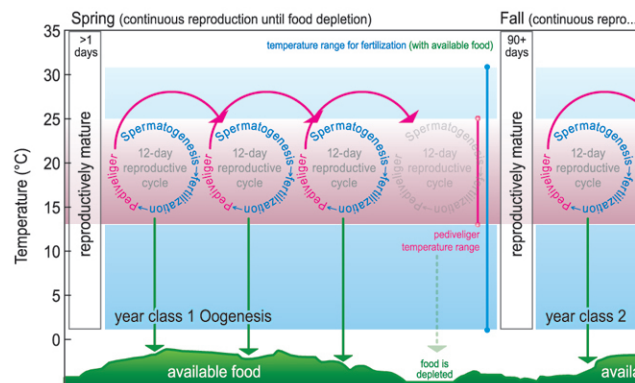
- 0
- <0.1-10
- 51-100
- >100
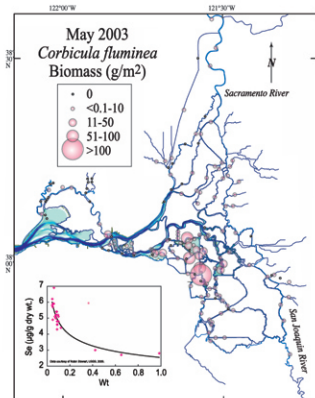
Contaminant transfer potential is a function of total clam biomass and population size structure.

Life Cycle of *Corbicula fluminea*

Reproduction is continuous as long as food is available and temperature thresholds are not exceeded.
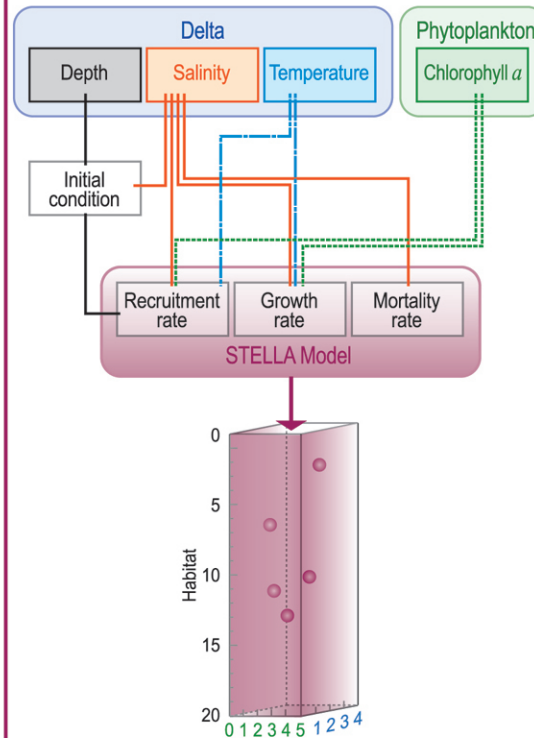

Reproductive adult (minimum length: 6-10mm)
Gravid
Growth to maturity 3-12 months
3-4 year lifespan
Reproduction multiple times/season
Benthic Habitat
pelagic habitat
Spermato-genesis and fertilization
4-8 months each yr
Brood trochophore, veliger, pediveliger larvae
5-6 days
Recruit (200 µm long)
2 days
Release pelagic/ bedload pediveliger larvae* 200µm
Asian clam straight-hinged larva

Environmental Controls on Reproduction

Spring (continuous reproduction until food depletion)
Fall (continuous repro...)
temperature range for fertilization (with available food)
Spermatogenesis / fertilization
12-day reproductive cycle
pediveliger temperature range
reproductively mature
year class 1 Oogenesis
year class 2
available food
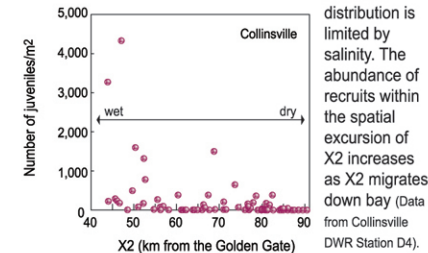food is depleted

Population Model Input and Output

- *Corbicula* biomass, growth rate and population structure are determined in STELLA.
- Environmental controls on initial conditions and population parameters are based on output from the Watershed and Delta models.
- STELLA output is stored in a 3D lookup table for use by the Phytoplankton and Contaminants models.

Delta
Depth | Salinity | Temperature
Phytoplankton
Chlorophyll *a*
Initial condition
Recruitment rate | Growth rate | Mortality rate
STELLA Model

Phytoplankton Biomass | Temp.
Biomass and population size structure
Biomass converted to grazing rate
Contaminant Model
Phytoplankton Model
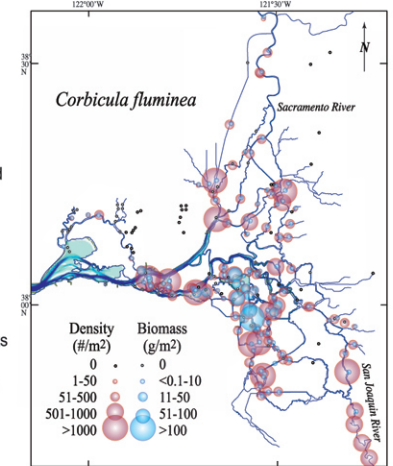
Initial Condition

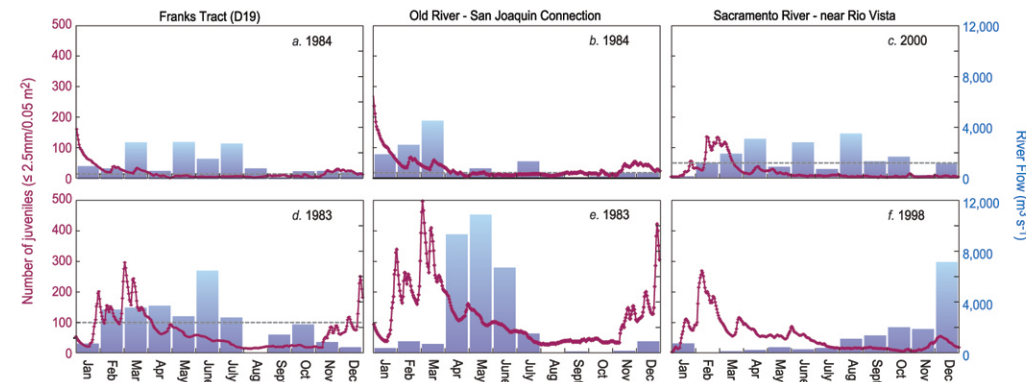### Abundance and distribution at t0

Seaward distribution is limited by salinity. The abundance of recruits within the spatial excursion of X2 increases as X2 migrates down bay (Data from Collinsville DWR Station D4).

Collinsville
wet | dry
X2 (km from the Golden Gate)

Corbicula is present throughout the Delta. Recruits (high density and low biomass locations) occur throughout the Delta except in the upper Sacramento River. Large numbers of adults (high biomass) occur only in the central Delta.
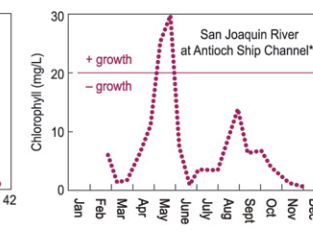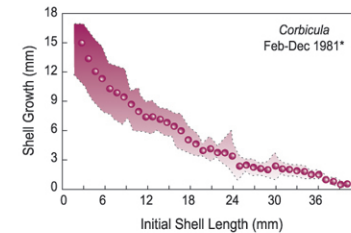
Corbicula fluminea

Density (#/m2) | Biomass (g/m2)
- 0 | 0
- 1-50 | <0.1-10
- 51-500 | 11-50
- 501-1000 | 51-100
- >1000 | >100

The Model Parameters
Recruitment Rate

Franks Tract (D19) — a. 1984
Old River - San Joaquin Connection — b. 1984
Sacramento River - near Rio Vista — c. 2000
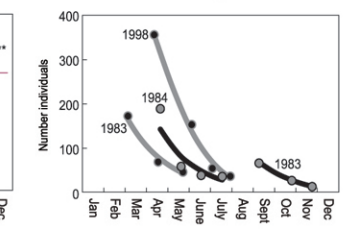d. 1983
e. 1983
f. 1998

(a, b, c) Recruitment is continuous and occurs at a relatively constant rate in dry years throughout the Delta.

(d) In wet years, recruitment in flooded islands increases and remains continuous.

(e, f) During wet years, recruitment in the Central Delta and Sacramento River increases and is seasonal.

Growth Rate

Corbicula
Feb-Dec 1981*

*Foe, C. and A. Knight 1986. A method for evaluating the sublethal impact of stress employing Corbicula fluminea. American Malacological Bulletin Special edition No. 2: 133-142.

San Joaquin River at Antioch Ship Channel**
+ growth
– growth

**Foe C. and Knight A. (1985). "The effect of phytoplankton and suspended sediment on the growth of Corbicula fluminea (Bivalvia)." Hydrobiologia 127: 105-115.

We assume the growth shown occurred over the 6 week period when chlorophyll *a* was greater than 20µg/L, and thus growth rates vary from 0.02 to 0.4 mm/day depending on size of animal.

Mortality Rate

1998
1984
1983

Mortality is consistent between wet and dry years (based on analyses of size-frequency histograms from DWR/USGS collaborative studies).

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