

**Title**

Effects of dams on downstream molluscan predator-prey interactions in the Colorado River estuary

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**Electronic supplementary material S2. Estimation of *Neverita reclusiana* population size in the Colorado River estuary**

The pre- and post-dam population size of *N. reclusiana* was estimated based on the biomass of clams available as a prey resource. Just as estimating population sizes of living organisms requires several assumptions to be made (e.g., all species in a community are equally likely to be sampled; samples are representative of the entire habitat area; sampling reflects population distributions in size, age, etc.; sampling does not impact community dynamics [1,2]), there are additional assumptions underlying the estimation of population size from death assemblages (e.g., time-averaging of multiple generations; preservational bias). Pre-dam estimates were made solely with respect to the *Mulinia modesta* population—assuming that, as this species composed up to 95% of the community, estimates based on this species reasonably approximate the entire community—and an estimated density of 50 ind./m<sup>2</sup> over a tidal flat area of 1.2 x 10<sup>8</sup> m<sup>2</sup> [3]. To arrive at this density, Kowalewski et al. [3] estimated the areal extent of the cheniers and the average depth of the chenier accumulations. Subsequently, they determined an average density of complete *M. modesta* larger than 12.5 mm in the cheniers. Based on

estimates of time-averaging in the cheniers [4], they determined that the *M. modesta* shells originated over a 1,000-year period and, using published estimates for average *M. modesta* lifespan (three years; [5]), approximated the number of generations represented in the cheniers to be 333. Using these estimates, Kowalewski et al. [3] estimated that the density of *M. modesta* was 50 ind./m<sup>2</sup> in the pre-dam era. They also noted that their estimate was likely a conservative one, as approximately 60% of *M. modesta* individuals were broken and therefore not included in their analysis.

Post-dam estimates were derived from transect surveys of the living community. In the transects, clam—predominantly *C. fluctifraga* and *M. modesta* [3,7]—densities were three ind./m<sup>2</sup>. Accordingly, biomass was calculated for scenarios with all *M. modesta* and all *Chionista fluctifraga* to provide the minimum and maximum size of the *N. reclusiana* population that could be supported (S2 table 1). We use a clam size of 25 mm in shell length to estimate biomass and the conversion factors listed in S2 table 1. These calculations yielded an estimate of 3.09 kilojoules/ind. for *M. modesta* and 3.31 kilojoules/ind. for *C. fluctifraga* and are based on size-energy relationships derived from the phylogenetically closely related species, *Mulinia lateralis* [8] and *Mercenaria mercenaria* [9], respectively. Given that *C. fluctifraga* has a greater energetic content, fewer *C. fluctifraga* are required to sustain an individual naticid and a prey population of *C. fluctifraga* could be expected to support a larger *N. reclusiana* population than if the prey population was composed entirely of *M. modesta* (S2 table 2). On a diet composed entirely of *M. modesta*, a small (~25 mm in maximum diameter) and large (~39 mm in maximum diameter) naticid must consume 71 – 125 ind./yr<sup>2</sup>, respectively, compared to 66 – 116 ind./yr<sup>2</sup> for a diet entirely composed of *C. fluctifraga*.

**S2 Table 1.** Parameters and estimates for calculating *Neverita reclusiana* population size in the Colorado River estuary.

<b>parameters &amp; conversions</b>	<b>estimate</b>	<b>source</b>
tidal flat area	1.2 x 10 <sup>8</sup> m <sup>2</sup>	Kowalewski et al. [3]
pre-dam clam density	50 ind. m <sup>-2</sup>	Kowalewski et al. [3]
post-dam clam density	3 ind. m <sup>-2</sup>	Kowalewski et al. [3]
clam shell length to dry weight ( <i>Mulinia lateralis</i> )	DW (g) = 0.01095*(shell length cm) <sup>2.968</sup>	Walker and Tenore [8]
clam shell length to dry weight ( <i>Mercenaria mercenaria</i> )	DW (g) = 0.0000812*(shell length mm) <sup>2.39</sup>	Nakaoka [9]
dry weight to AFDM	1 g DW = 0.81 g AFDM	Rumohr et al. [10]
AFDM to kilocalorie	1 g AFDM = 5.492 kcal	Cummins and Wuycheck [11]
kilocalorie to kilojoule	1 kcal = 4.184 kj	Edwards and Huebner [12]
large naticid energy need	385 kj	Edwards and Huebner [12]
small naticid energy need	218 kj	Edwards and Huebner [12]

**S2 Table 2.** Estimates of *Neverita reclusiana* population size in the pre- and post-dam Colorado River estuary.

<b>bivalve density</b>	<b>small naticid</b>		<b>large naticid</b>	
	<b>population</b>	<b>density</b>	<b>population</b>	<b>density</b>
50 <i>M. modesta</i> /m <sup>2</sup>	8.5 x 10 <sup>7</sup> ind.	0.7 ind/m <sup>2</sup>	4.8 x 10 <sup>7</sup> ind.	0.4 ind/m <sup>2</sup>
3 <i>M. modesta</i> / m <sup>2</sup>	5.1 x 10 <sup>6</sup> ind.	0.04 ind/m <sup>2</sup>	2.9 x 10 <sup>6</sup> ind.	0.02 ind/m <sup>2</sup>
3 <i>C. fluctifraga</i> / m <sup>2</sup>	5.5 x 10 <sup>6</sup> ind.	0.05 ind/m <sup>2</sup>	3.1 x 10 <sup>6</sup> ind.	0.03 ind/m <sup>2</sup>

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