

## Trophic model of the Northern Gulf of California ecosystem

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### Summary

A trophic model for the ecosystem of the Northern Gulf of California (Figure 1) was developed focused on resource exploitation and biodiversity conservation. The main tool employed was the Ecopath software (Christensen & Pauly 1992). The ecosystem model includes 34 functional groups; sharks (1), marine mammals (4) marine birds (2), rays (2), fish (11), shrimps (5), cephalopods (1), crabs (1), benthic invertebrates (2), Polychaeta (1), zooplankton (1), primary producers (2) and detritus (1). Model explicitly includes key species in the area for conservation or as target for fishing. There are two species with a high interest for conservation: the "vaquita" (*Phocoena sinus*), an endemic porpoise, and the totoaba (*Totoaba macdonaldii*), a large sciaenid fish, whose stocks are small or depleted. Main fisheries are shrimp trawling, and artisanal focused to shrimp and to fish species. There are three main ports in the area, San Felipe, Puerto Peñasco y Santa Clara. Eight fleets were defined in accordance with their location. Among shrimp species, the most relevant are the blue (*Lytopenaeus stylirostris*) and brown (*Farfantepenaeus californiensis*) shrimps. Within the ecosystem there is a Natural Reserve designed to protect the vaquita and the totoaba.

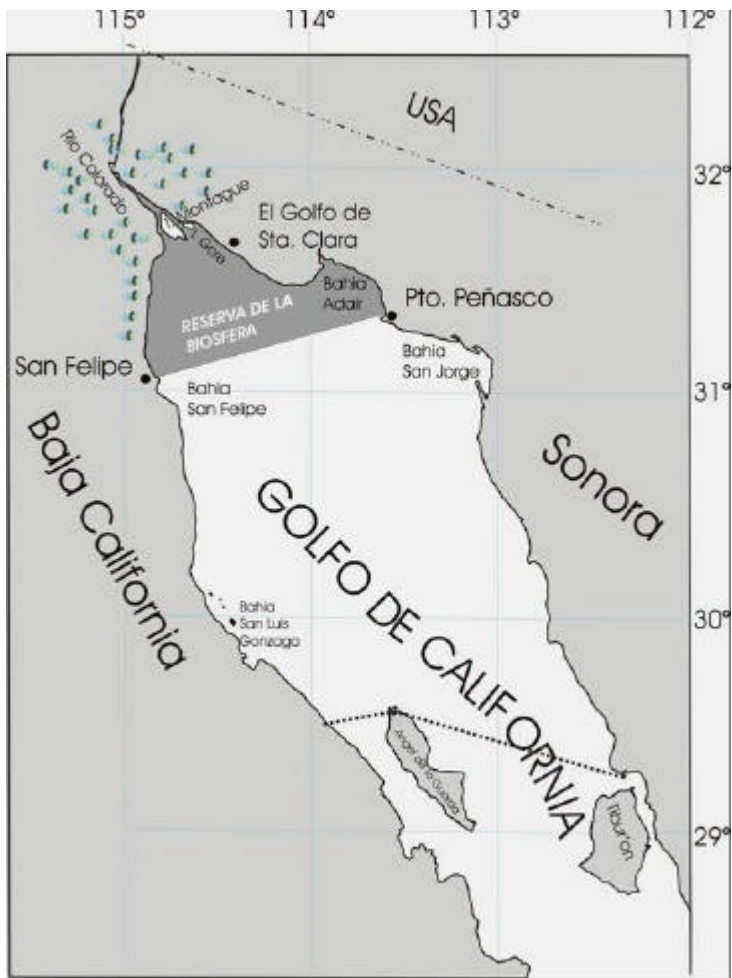


Fig. 1 Ecosystem of the Northern Gulf of California. The southern limit of the ecosystem modeled is shown by dotted line, just on the Northern border of Isla Angel de la Guarda and Isla Tiburón.

The general statistics of the Ecosystem are:

Parameter	value	units
Sum of all consumption	2578.954	t/km <sup>2</sup> /year
Sum of all exports	5707.67	t/km <sup>2</sup> /year
Sum of all respiratory flows	1169.87	t/km <sup>2</sup> /year
Sum of all flows into detritus	6104.761	t/km <sup>2</sup> /year
Total system throughput	15561	t/km <sup>2</sup> /year
Sum of all production	7772	t/km <sup>2</sup> /year
Mean trophic level of the catch	2.78	
Gross efficiency (catch/net p.p.)	0.000226	
Calculated total net primary production	6876.6	t/km <sup>2</sup> /year
Total primary production/total respiration	5.878	
Net system production	5706.73	t/km <sup>2</sup> /year
Total primary production/total biomass	41.471	
Total biomass/total throughput	0.011	
Total biomass (excluding detritus)	165.816	t/km <sup>2</sup>
Total catches	1.556	t/km <sup>2</sup> /year
Connectance Index	0.313	
System Omnivory Index	0.369	
Total market value	0.2	MXN
Total value	0.2	MXN
Total fixed cost	0.02	MXN
Total variable cost	0.03	MXN
Total cost	0.04	MXN
Profit	0.15	MXN