



The vaquita will be the second cetacean species driven to extinction by humans

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Abstract

Within the interior of the Upper Gulf of California lives a small marine cetacean called Vaquita marina (*Phocoena sinus*). Limited habitat and by-catch by gillnet has resulted in the reduction of its population to 154 individuals, making it endangered. The Mexican federal government has taken environmental and economic actions to protect and encourage its conservation. Economic action was taken in January 2008 through a program of buy-out fishing permits, as a solution to reduce by-catch deaths to zero. However, as of December of 2011, only 340 permits have been withdrawn which is coupled with the refusal of the public to surrender fishing permits because fishing is the most important economic activity in the region. The transformation of fishing activities into tourism services is still not the solution to save the vaquita from extinction. This problem requires developing a viable economic alternative and proper management of the social aspects of the communities involved. The authorities have few years to find a solution before the vaquita is the second species to disappear due to human activities.

Key words: *Phocoena sinus*, vaquita, marine fisheries, Upper Gulf of California

According to Gerrodette et al. (2011), there are 245 vaquitas (*Phocoena sinus*) (Norris and McFarland, 1958) remaining in the Upper Gulf of California. They also warn that the vaquita is the most endangered cetacean, after the recent, likely extinction of the baiji (*Lipotes vexillifer*) in China (Turvey et al. 2007), due the accidental deaths in fishing gear (bycatch) (Rojas-Bracho et al., 2006). The rare vaquita, accidentally caught in various gillnets used in the Upper Gulf of California (D'Agrosa et al. 2000), is endemic to this region and has the most restricted distribution of all marine mammals worldwide. This species is at risk of extinction because of its very small population size and the reduced range of its habitat (Jaramillo-Legorreta et al. 2007).

The Mexican federal government has taken environmental and economic action to protect the vaquita, starting with the declaration in June 1993 of the Upper Gulf of California and Colorado River Delta Biosphere Reserve

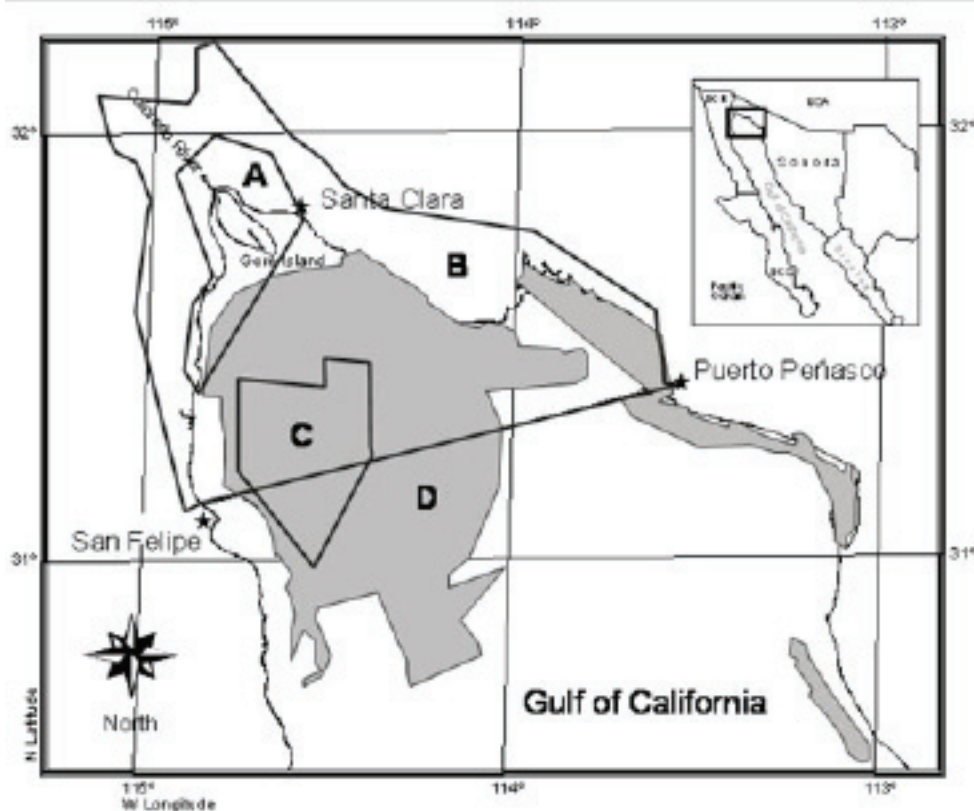


Figure 1: Location of the Biosphere Reserve of the Upper Gulf of California and Colorado Delta River and the Vaquita Protection Area. (A) Core zone, (B) Buffer zone, (C) Vaquita Protection Area. (D) Fishing activities allowed in the shaded areas.

(Figure 1) and its subsequent support with a management program designed to promote sustainable activities with conservation use of the area's biodiversity (Rojas-Bracho et al. 2006). The most recent measure to protect the vaquita and its habitat was a declaration in December 2005 of a Vaquita Protection Area (refuge) to further limit fishing activities (DOF 2005). An Economic action was taken when 65 fisheries permits of 866 (data given by federal local offices in the UGC) were withdrawn through a US\$ 13.5 million buyout program of the Mexican Ministry of Environment (Secretaría de Medio Ambiente y Recursos Naturales) with the support of some international non-profit organizations on March 7th of 2008 (Sanjurjo et al. 2008).

Gerrodette et al. (2011) also declare that there are few years remaining to find a solution to the bycatch problem and conclude that funds to establish a total fishing moratorium on all entangling nets is the only solution to reduce

fishing related mortality to zero. This conclusion does not consider the social and economic costs to the fishermen living within this Marine Protected Area. This oversight is a common issue addressed by Clausen and York (2008), which concludes that social analyses must be included in overall conservation-research strategies. Under the harsh local climate along this coast, the most important economic activity is fishing, although tourism is growing in importance. While there is potential to change the economy, transforming fishermen into tourism service worker is still in the distant future (Rodríguez-Quiroz and Bracamonte-Sierra 2008, Rodríguez-Quiroz et al. 2010).

Management of the reserve and the refuge implies a series of actions to achieve protection of critical species and the well being of the communities within the reserve. From 2004 through 2007, a series of studies were conducted by the World Wildlife Fund and

Table 1:

Response of fishermen in the Upper Gulf of California to the question: "If the most important fishery to you was closed, what would you ask of the government?"

Options	Puerto Peñasco	Golfo de Santa Clara	San Felipe
Economic compensation	7	27	7
Permit for another fishery	39	33	29
Payment of permit's cost	4	15	2
Nothing	11	7	10
Continue fishing anyway	21	8	27
Other	18	2	4
Create new employment	--	7	8
Did not answer	--	2	13

Table 2:

Authorized artisanal scale fishing vessels by group of species in the three fishing ports in the Upper Gulf of California

Source: Federal government offices in the communities of the Upper Gulf of California.

*Curvina, bigeye croacker, Spanish mackerel, rays.

Species	San Felipe	Golfo de Santa Clara	Puerto Peñasco
Clams	15	12	39
Jumbo squid			4
Shrimp	318	232	56
Snails	1	--	42
Fish*	295	412	175
Swimming crab	11	39	229
Mullet	10	76	8
Octopus	2	--	40
Sharks	10	26	69
Total	662	797	662

the Centro de Investigaciones Biológicas del Noroeste in the Upper Gulf of California to implement a scheme for compensation that would aid in reducing artisanal fishing with gillnets in the vaquita refuge (the buyout program mentioned above). In the study, we interviewed ~10% of the fishermen in the three fishing communities in this area. The most important results of these studies come from the responses of 60% of fishermen in San Felipe and 40% of fishermen in Santa Clara who stated they would not stop fishing because it

is the only activity they feel comfortable doing and one they have done for years (Rodríguez-Quiroz and Bracamonte-Sierra 2008, Rodríguez-Quiroz et al. 2010, Table 1). This is the main reason why only 65 permits were retired in the first year of the buyout program out of the >2000 small boat fishermen that make their living by fishing (Table 2).

The fishermen gross profits are also an important issue. Shrimp is the most economically important fishery, followed by the curvina. These two resources provide employment for

Income (weekly) (US dollars)	Fishing activities (%)	Other activities (%)
<50	17	39
51-100	12	48
101-200	32	4
201-300	19	9
>301	20	0

Table 3:
Weekly income of fishermen in the Upper Gulf of California

fishermen from September to April (Jaramillo-Legorreta et al. 2007, Rodríguez-Quiroz et al. 2010). Income for ~71% of the fishermen range from ~US\$150 to 300 per week during the fishing season and 87% mentioned that they receive less than ~US\$100 per week in other activities when the shrimp and curvina season ends (Table 3).

In April 2008, in a meeting regarding vaquita conservation, Ani Youatt of the Natural Resource Defense Council, an NGO from the United States, declared the intention of establishing an embargo on Mexican shrimp to force protection of the vaquita (Godoy 2008). Stopping shrimp fishing is almost impossible because the Mexican market for shrimp is very important (Rodríguez-Quiroz et al. 2009). In 2006, Mexico produced 100,000 metric tons of shrimp for local consumption and imported another 20,000 metric tons. The irony of this is simple. The Mexican shrimp exported to the United States is caught by industrial fishing trawlers. The shrimp caught by small-scale shrimp fishermen using entangling nets is almost entirely consumed in the domestic market. So the shrimp em-

bargo would affect a different area than the one where the vaquita live (Aragón-Noriega et al. 2010).

The other very important fishery is curvina (D'Agrosa et al. 2000). Since 1996, the curvina catch has been over 2000 tons per year with an income rate of 68% (Rodríguez-Quiroz et al. 2010). About 98% of interviewed fishermen participated in the curvina fishery. Discouraging curvina fishing is another sensitive issue because curvina is almost entirely consumed in local markets, such as Mexico City and Guadalajara. The open curvina season is coupled with the peak fish consuming season in Mexico during the season of Lent.

In previous studies dealing with vaquita conservation (D'Agrosa et al. 2000, Jaramillo-Legorreta et al. 2007), the steps taken to protect the vaquita



Fishing equipment. Photo credit: Eugenio A. Aragón-Noriega.

against threats have been described. However, we need to admit that this is another case of failure in conservation planning, as addressed by Redford and Taber (2000) and later by Knight (2006). There had been many meetings to find solutions to this problem among Mexican federal authorities, non-governmental organizations and fishermen so, what was the real failure in conservation of the vaquita in the Upper Gulf of California? As mentioned above, the social and economic aspects of fisheries were never considered. Even D'Agrosa et al. (2000) and Jaramillo-Legorreta et al. (2007) mention the need to develop an economically feasible alternative source of income, but what these measures are have not been explored. Recent studies have found that after years of the buyout program, no one expected the low success of the program (only 340 permits retired until 2011). Another example of the failure of the buyout program is the experience of fishermen who go into tourism activity. With the money they receive from selling their permit, they build resort cabins. However, there are few clients using these cabins (pers. observation, 22 April 2008, meeting in Santa Clara, Sonora between Mexican authorities and fishermen who sold their fishing permits) which further decreases their kind of livelihood (Rodríguez-Quiroz and Bracamonte-Sierra 2008).

In summary, there are 8 months out of the year of very intensive fishing activities using entangling nets that incidentally kill this porpoise. There are no real complementary economic alternatives to support more than 4000 traditional fishermen when there is a considerable local market for fish and shrimp. According to Jaramillo-Legorreta et al. (2007), the authorities have two years to find a solution to the demise of the remaining vaquitas, a very slim possibility given the past actions of the authorities. Because of this, many

observers believe that the vaquita will be the second cetacean species driven to extinction by humans.

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Literature Cited

- Aragón-Noriega, E.A., Rodríguez-Quiroz, G., Cisneros-Mata, M.A. and A. Ortega-Rubio. 2010. Managing a protected marine area for the conservation of critically endangered Vaquita *Phocoena sinus* (Norris, 1958) in the Upper Gulf of California. *International Journal of Sustainable Development and Word Ecology* 17: 410-416.
- Clausen, R. and R. York. 2008. Economic growth and marine biodiversity: influence of human social structure on decline marine trophic levels. *Conservation Biology* 22: 458-466.
- D'agrosa, C., Lennert-Cody, C.E. and O.Vidal. 2000. Vaquita bycatch in Mexico's artisanal gillnet fisheries: driving a small population to extinction. *Conservation Biology* 14: 1110-1119.
- DOF (Diario Oficial de la Federación). 2005. Programa de protección de la vaquita dentro de área de Refugio ubicada en la porción occidental del Alto Golfo de California. *Diario Oficial de la Federación*, Septiembre del 2005.
- Gerrodette, T.; Taylor, B.L.; Swift, R.; Rankin, S.; Jaramillo-Legorreta, A.M. & Rojas-Bracho, L. 2011. A combined visual and acoustic estimate of 2008 abundance, and change in abundance since 1997, for the vaquita, *Phocoena sinus*. *Marine Mammal Science* DOI: 10.1111/j.1748-7692.2010.00438.x
- Godoy, E. 2008. Camarones congelados. *Revista Poder y Negocios* 50-53 pp.
- Jaramillo-Legorreta, A., Rojas-Bracho, L., Brownell, R.L., Read, A.J., Reeves, R.R., Ralls, K. and B.L. Taylor. 2007. Saving the vaquita: Immediate action, not more data. *Conservation Biology* 21: 1653-1655.
- Knight, A.T. 2006. Failing but learning: writing the wrongs after Redford and Taber. *Conservation Biology* 20: 1312-1314.
- Redford, K.H. and A. Taber. 2000. Writing the wrongs: developing a safe-fail culture in conservation. *Conservation Biology* 14: 1567-1568.
- Rodríguez-Quiroz, G. and A. Bracamonte-Sierra. 2008. Pertinencia de las ANP como política de conservación y mejoramiento de la calidad de vida. *Análisis de percepción en la Reserva de*

- la Biosfera del Alto Golfo de California y Delta del Río Colorado. *Estudios Sociales* 16: 141-176.
- Rodríguez-Quiroz, G., Aragón-Noriega, E.A. and A. Ortega-Rubio. 2009. Artisanal shrimp fishing in the Biosphere Reserve of the Upper Gulf of California. *Crustaceana* 82: 1481-1493.
- Rodríguez-Quiroz, G., Aragón-Noriega, E.A., Valenzuela-Quiñónez, W. and H.M. Esparza-Leal. 2010. Artisanal fisheries in the conservation zones of the Upper Gulf of California. *Revista de Biología Marina y Oceanografía* 45: 89-98.
- Rojas-Bracho, L., Reeves, R.R. and A. Jaramillo-Legorreta. 2006. Conservation of the vaquita *Phocoena sinus*. *Mammal Review* 36: 179–216.
- Sanjurjo, E., Cox, S.B. and S. Anderson. 2008. Buy-outs and buy-in: Saving the vaquita in the Gulf of California. A Private Sector Approach – Conservation Agreements in support of Marine Protection, Americas: Mexico pp: 1-5.
- Turvey, S.T., Pitman, R.L., Taylor, B.L., Barlow, J., Akamatsu, T., Barrett, L.A., Zhao, X., Reeves, R.R., Stewart, B.S., Wang, K., Wei, Z., Zhang, X., Pusser, L.T., Richlen, M., Brandon, J.R. and D. Wang. 2007. First human-caused extinction of a cetacean species? *Biology Letters* 3: <http://dx.doi.org/10.1098/rsbl.2007.0292>.

