STATUS OF THE COCHITO, *PHOCOENA SINUS*, IN THE GULF OF CALIFORNIA

R.L. BROWNELL, Jr.

Abstract

The cochito (*Phocoena sinus*), the smallest member of its genus, is known from 21 confirmed records from the upper Gulf of California and is probably found only in that area. Diagnostic and general morphological characters are given, including the external measurements of two specimens; little to no data are available on other aspects of its biology. Affinities of the axial skeleton and external morphometry suggest that *P. sinus* evolved from a Pleistocene stock of Burmeister's porpoise (*P. spinipinnis*). *P. sinus* has been taken incidentally in the gillnet fishery for totoaba, *Cynoscion macdonaldi*, perhaps since the late forties, and the annual kill during the early seventies may have been in the tens to hundreds. Although the fishery for totoaba was banned in 1975, a small number of cochito will probably continue to be taken in other fisheries and this may have considerable impact on the small population. Research is needed to determine, among other things, the life history of the species and the effects on it of incidental capture in trawl and gillnet fisheries.

Résumé

Le marsouin *Phocoena sinus*, le plus petit des membres de ce genre, est connu sur la base de 21 indications confirmées en provenance de la partie supérieure du golfe de Californie; il est probable qu'on ne le trouve que dans cette zone. L'auteur donne le diagnostic et les caractères morphologiques généraux, y compris les mesures extérieures, de deux spécimens; on ne possède pratiquement aucune donnée sur les autres aspects de sa biologie. Le squelette axial et la morphométrie externe suggèrent que *P. sinus* aurait évolué à partir d'un stock du pléistocène de marsouins de Burmeister (*P. spinipinnis*). *P. sinus* a été capturé accidentellement dans la pêcherie au filet maillant de *Cynoscion macdonaldi*, peut-être depuis la fin des années 40; au cours des premières années 70, la mortalité annuelle pourrait avoir été de l'ordre de dizaines ou de centaines de marsouins. Bien que la pêche de *Cynoscion macdonaldi* ait été interdite en 1975, un petit nombre de *P. sinus* continuera peut-être à se faire prendre dans d'autres pêcheries, ce qui pourrait avoir un retentissement considérable sur cette petite population. Il est nécessaire d'effectuer des recherches pour déterminer, entre autres, le cycle biologique de l'espèce et les effets des captures accessoires dans les pêches au chalut et au filet maillant.

Extracto

El cochito (*Phocoena sinus*), que es el miembro de menor talla de su género, se conoce por 21 avistamientos confirmados en la parte alta del Golfo de California, y probablemente se encuentra sólo en esa zona. Se indican sus caracteristicas distintivas y sus características

morfológicas generales, incluidos los datos obtenidos midiendo dos ejemplares; sobre los demás aspectos de su biología existen muy pocos datos o ninguno. Las afinidades del esqueleto axial y la morfometría externa sugieren que *P. sinus* procede de una población del Pleistoceno de marsopa de burmeister (*P. spinipinnis*). El fócenido *P. sinus* se ha capturado accidentalmente en la pesquería con redes de enmalle de totoaba (*Cynoscion macdonaldi*) quizás desde finales de los años cuarenta, y el número de animales muertos anualmente a principios de los años setenta oscila probablemente entre algunas decenas y algunos centenares de animales. Aunque la pesca de totoaba se prohibió en 1975, probablemente seguirán capturándose algunos cochitos en otras pesquerías, lo que podría tener considerables repercusiones en su población, tan reducida. Son necesarias investigaciones para determinar, entre otras cosas, el ciclo vital de la especie y los efectos que tienen en ella las capturas accidentales en las pesquerías de arrastre y de enmalle.

R.L. Brownell Jr.
John Hopkins University, Box 84, Baltimore, Maryland 21205, USA

Introduction

The cochito, *Phocoena sinus*, is the smallest species of *Phocoena*. The range of this species is probably only the upper Gulf of California, Mexico, and it has probably been taken as an incidental catch in the totoaba, *Cynoscion macdonaldi*, fishery for a number of years. This paper reviews what is currently known about the biology and exploitation of *P. sinus*; recommendations are also made for the research needed to determine the status of this species.

Species account

Diagnostic characters

Norris and McFarland (1958) reported that *P. sinus* is distinct from *P. Phocoena* as follows: In *P. sinus* (1) the cranium is smaller in adults, with a relatively much broader and shorter rostrum; (2) the basi-cranial axis is deflected downward at a greater angle, in relation to the horizontal axis of the rostrum; (3) the foramen magnum is relatively larger; (4) the maxillary bone does not enter the orbit but is excluded from it by the lateral margin of frontal bone, instead of completely covering the lateral margin of frontal and entering the orbit; (5) the maxillary leaves a relatively larger exposure of the dorsal aspect of frontal bones, where the latter contact the supraoccipital; (6) the antero-ventral extension of the nasal bones is covered by the mesethmoid; (7) the posterior edge of the palate has a medial U-shaped indentation formed of the medial edges of the rounded, roughly triangular pterygoid bones and the ventral extension of the vomer, which enters the palate just posterior to the palatine bones. In *P. phocoena* the posterior edge of the palate has a W-shaped indentation formed by the pointed, usually acutely triangular pterygoid bones and a central, pointed extension of the palatines, which sometimes cover the ventral extension of the vomer completely, but more often leave it as a small point of bone at their apex; (8) by the lower maxillary and mandibular tooth counts. The teneral external morphology of *P. sinus* is similar to *P. phocoena*, but *P. sinus* differs as follows: (1) total length is less; (2) the flippers are proportionately larger with more concave posterior border; and (3) the dorsal fin is proportionately higher, with a more concave posterior border.

General characters

Additional descriptions of *P. sinus* skulls may be found in Orr (1969) and Noble and Fraser (1971). The only description of the post-cranial elements is that of Noble and Fraser (1971). The only photographs and drawings of skulls are found in Norris and McFarland (1958) and Noble and Fraser (1971).

External measurements are available from 2 specimens (SDMNH 20688 and LACM 28259). These have not been published previously and are given in Table 1. The body proportions of *P. sinus* are closer to those of *P. spinipinnis* than *P. phocoena*.

Little is known of the colour pattern of *P. sinus*, but there is a flipper stripe. It is widest at the anterior insertion of the flipper, and is thinner posteriorly. A narrow component of the flipper stripe extends from the flipper insertion dorsally to the axilla.

The vertebral count is lower than in other species of *Phocoena*: 7 cervical, 12-13 thoracic, 13-15 lumbar, and 29-30 caudal vertebrae with 19-20 chevron bones (Noble and Fraser, 1971; Brownell, unpublished data). The anterior 3 cervicals are fused. The anterior 4 ribs have capitular and tubercular attachments. Six or 7 pairs of sternal ribs are present, with the anterior 3 attached directly to the sternum. The phalangeal formula of SDMNH 20688 is: I-1, II-9, III-8, IV-4 and V-0 (left side). No organ systems have been studied.

Table 1. External of measurements of 2 specimens of *Phoca sinus* in mm [1]

	SDMNH 20688	LACM 28259
Total length (tip of upper jaw to fluke notch)	1 390	1 500
Tip of upper jaw		
to gape	80	65
to centre of eye	135	105
to blowhole	140	105
to anterior insertion of flipper	260	265
to tip of dorsal fin	805	840
to centre of anus	960	1 050
Length of right flipper		
anterior insertion to tip	270	280
axilla to tip	190	215
Maximum flipper width	85	100
Dorsal fin		
height, tip to base	115	155
length of base	160	180
Fluke		
width tip to tip	370	370
nearest point of anterior border to fluke notch	100	105
depth of fluke notch	20	20

[1] All measurements of more than 100 mm were rounded off to the nearest 5 mm.

Distribution

Norris and McFarland (1958) gave the range of *P. sinus* as "certainly occurring in the upper Gulf of California and probably extending south along the Mexican coast", but they questioned the reality of *P. sinus* occurring outside the Gulf of California. Several at-sea sightings of this species have been reported (Norris and McFarland, 1958; Norris and Prescott, 1961). However, all the sightings south of the upper gulf area must be considered as tentative and unconfirmed as they are unsubstantiated by specimens, photographs or descriptions sufficiently detailed to allow positive identification.

A total of 21 confirmed records of *P. sinus* are known (Brownell, unpublished data). Based on these records (Fig. 1), this species appears to be most abundant in the upper part of the gulf. Future studies may show that this is the only place where it is found.

Exploitation

Few details are available on the exploitation of *P. sinus*. The exploitation of totoaba started in the early twenties with hook and line

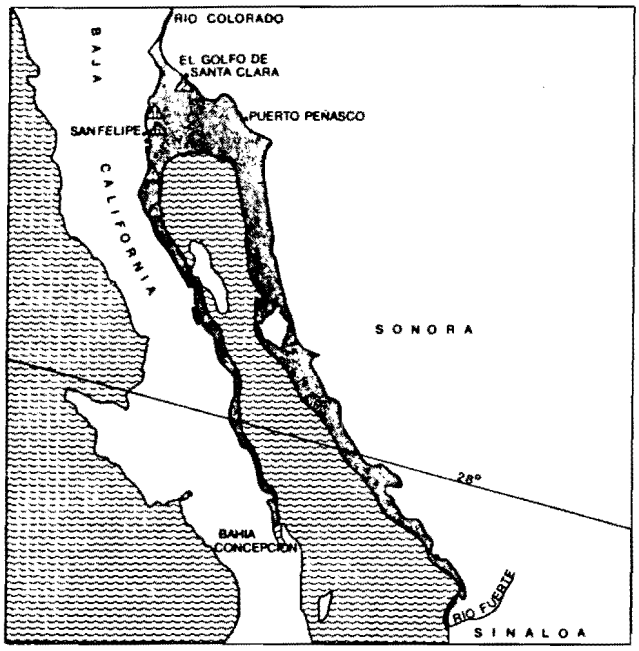

FIG. 1. – The number of confirmed specimens of *Phocoena sinus* in the Gulf of California, Mexico is recorded in the triangles. The totoaba, *Cynoscion macdonaldi*, is known in the stippled area and the main fishing areas are San Felipe, El Golfo de Santa Clara, and Puerto Penasco. The southernmost records of *C. macdonaldi* are Bahia Concepcion and Rio Fuerte. Map modified from Arvizu and Chávez (1972).

fishing and fishermen were using gillnets at least by the late forties. Small cetaceans were taken in this fishery during the late forties, but exact data are lacking on the species and numbers of animals taken (J.E. Fitch, personal communication). The main gillnet fishing areas for totoaba are San Felipe, Baja California; El Golfo de Santa Clara, Sonora; and Puerto Penasco, Sonora. Norris and Prescott (1961) have reported several accounts of *P. sinus* being taken during totoaba gillnet fishing operations around San Felipe, where W.E. Evans (personal communication) reports a catch of 10 porpoises in one day in the early seventies. Available information suggests that the annual incidental kill of *P. sinus* in the 3 main fishing areas of the upper gulf during the early seventies was in the range of tens to hundreds of porpoises.

In 1975 the Mexican Government announced a total closed season on both sport and commercial fishing for totoaba, because the species has declined drastically in recent years (Arvizu and Chávez, 1972; Flanagan and Hendrickson, 1976). If good enforcement capabilities are available, this indefinite ban will decrease the number of porpoises killed in the totoaba fishery. However, gillnet fishing for other sciaenids and sharks will probably continue and these fishing operations probably take some porpoises. Cochitos are also occasionally taken in shrimp trawls (Norris and Prescott, 1961).

REPRODUCTION

Nothing is known about reproduction in this species, but 2 female specimens 1.39 m and 1.50 m in total length were both physically mature.

FOOD HABITS

Fitch and Brownell (1968) reported one *P. sinus* with fish otoliths in its stomach. The fish were identified as grunts (*Orthopristis reddingi*) and Gulf croakers (*Bairdiella icistius*). Both of these fishes are abundant throughout the upper Gulf of California. Remains of squid were also found in the stomach of the same porpoise.

PARASITES

No endoparasites are recorded (Dailey and Brownell, 1972).

PREDATORS

Man is the only known predator of *P. sinus*.

BEHAVIOUR

Only Norris and McFarland (1958) and Norris and Prescott (1961) have reported observations on live *P. sinus*, but these observa-

tions were very meagre. Usually 2 porpoises are sighted together (Norris and Prescott, 1961).

REMARKS

Norris and McFarland (1958) have discussed the possible origin of *P. sinus* from *P. phocoena* from the eastern North Pacific or *P. spinipinnis* from the eastern South Pacific. Although *P. sinus* is intermediate in some aspects, they favoured the latter because the cranium of *P. sinus* resembles *P. spinipinnis* more than it does *P. phocoena*. Noble and Fraser (1971) have described an incomplete skeleton of *P. sinus* and compared it with specimens of *P. phocoena* and *P. spinipinnis*. They stated that the axial skeletons of *P. sinus* suggested a closer affinity to *P. spinipinnis* than with *P. phocoena*. The 2 complete axial skeletons that I have collected of *P. sinus* agree with the specimen described by Noble and Fraser (1971). Externally *P. sinus* lacks the peculiarly shaped and tuberculated dorsal fin of *P. spinipinnis*, but the size of the pectorals and other external measurements of *P. sinus* are more similar to *P. spinipinnis* than to *P. phocoena*. Thus, *P. sinus* and P. *spinipinnis* appear to be closely related. *Phocoena sinus* probably evolved as the result of a northward movement of an ancestral *P. spinipinnis* stock into the Gulf of California during one of the Pleistocene glacial ages (Norris and McFarland, 1958).

Recommendations for research

Data are needed on the present catch of *P. sinus* which, although low, may represent a considerable impact on the localized and relatively small population. Additional research needs are to: (i) examine carcasses of stranded or incidentally-taken porpoises to determine the basic life history parameters; (2) review gill-net and trawl fisheries for totoaba, other sciaenids, sharks and shrimps in the upper Gulf of California to determine how long *P. sinus* has been taken incidentally; (3) evaluate the probable impact of future incidental takes of *P. sinus* by fishing operations in the upper Gulf: (4) obtain more information on the total range of *P. sinus*; (5) evaluate the effects on the habitat of the diversion of the Colorado River water for agricultural purposes, and of insecticide contamination in the river; and (6) evaluate the probability of harassment from increasing tourist boat traffic in the upper gulf.

Acknowledgements

I wish to thank W.E. Evans, J.E. Fitch, J.R. Hendrickson, E.D. Mitchell and W.F. Perrin for their assistance during the preparation of this manuscript.

References

ARVIZU, J. and H. CHÁVEZ, 1972. Sinopsis sobre la biología de la totoaba, *Cynoscion macdonaldi* Gilbert, 1890. *FAO Fish. Synops.*, (108): pág. var.

DAILEY, M.D. and R.L. BROWNELL, Jr., 1972. A check list of marine mammal parasites. *In* Mammals of the sea, biology and medicine, edited by S.H. Ridgway. Springfield, Ill., Charles C. Thomas, pp. 528-89.

FITCH, J.E. and R.L. BROWNELL, Jr., 1968. Fish otoliths in cetaceans stomachs and their importance in interpreting feeding habits. *J. Fish. Res. Board Can.*, 25(12):2561-74.

FLANAGAN, C.A. and J.R. HENDRICKSON, 1976. Observations on the commercial fishery and reproductive biology of the totoaba, *Cynoscion macdonaldi*.

in the northern Gulf of California. *Fish. Bull., NOAA/NMFS*, 74(3):531-44.

NOBLE, B.A. and F.C. FRASER, 1971 Description of a skeleton and supplementary notes on the skull of a rare porpoise *Phocoena sinus* Norris and McFarland. *J. Nat. Hist.*, 5:447-64.

NORRIS, K.S. and W.N. MCFARLAND, 1958 A new porpoise of the genus *Phocoena* from the Gulf of California. *J. Mammal.*, 39:22-39.

NORRIS, K.S. and J.H. PRESCOTT, 1961 Observations on Pacific cetaceans of California and Mexican waters. *Univ. Calif. Publ. Zool.*, 63:291-402.

ORR, R.T., 1969 An additional record of *Phocoena sinus*. *J. Mammal.*, 50:384.