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Pseudorca crassidens.  
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Pseudorca Reinhardt, 1862

*Neorca* Gray, 1871. Type, *Orca meridionalis* Flower.

**CONTEXT AND CONTENT.** Order Cetacea, Suborder Odontoceti, Superfamily Delphinoidae, Family Delphinidae. The genus *Pseudorca* has been placed in the subfamily Orcininae by several workers. However, membership of this taxon is far from agreed upon. Some workers consider it to include *Orcinus*, *Globicephala*, *Orcaella*, and *Perena* in addition to *Pseudorca* (Fraser and Purves, 1960; Mead, 1975; Sliper, 1936); others argue it only contains *Orcinus* and *Pseudorca* (Heyning and Dahlheim, 1988; Kasuya, 1973).

*Pseudorca crassidens* (Owen, 1846)

False Killer Whale

*Orca meridionalis* Flower, 1864:420. Type locality “Tasmania.”  
*Orca destructor* Cope, 1866:293. Type locality “Paia, Peru.”  
*Globicephala grayi* Burmeister, 1869:367. Type locality “Argentina.”  

**CONTEXT AND CONTENT.** Context as above. There are no subspecies recognized. The one subspecies proposed, *P. c. meridionalis* (Deraniyagala, 1945) was presented without adequate justification; so it is generally ignored. *Orcinus* is based on examination of adult skeletons, proposed and later abandoned a distinction between southern and northern forms of this animal (Flower, 1884 cited in Hector, 1885).

**DIAGNOSIS.** Externally, *P. crassidens* can be distinguished from the other large delphinids by some details of its sickle-shaped flippers: a broad hump on the front margin near the middle and a slight concavity to the distal extremity.  
The dental formula is 7 to 11/7 to 12 (Purves and Pillier, 1978; Ross, 1984). The skull (Fig. 1) of a large false killer whale can be distinguished from that of a killer whale, as the width across the premaxillaries of the former is >50% of the rostral width just anterior to the anterior notch, and the lateral border of the premaxillaries is slightly less sigmoid in dorsal view and narrower distally (Heyning and Dahlheim, 1988). The tympanic bullae (Fig. 2) range from 47.7 mm to 50.5 mm in length, have an atrophied ventral keel, and lack bilateral compression (Kasuya, 1973).

**GENERAL CHARACTERS.** False killer whales (Figs. 3, 4) are almost entirely black on the dorsal surface, sides of the body, dorsal fin, pectoral flippers, and tail flukes. There may be an area of pale gray present on the sides of the head. There is also a blaze, varying from indistinct gray to nearly white, on the ventral surface; this occurs as an approximately anchor-shaped patch beginning on the throat and extending posteriorly between the flippers and occasionally to the genital slit (Norris and Prescoott, 1961). The black coloration is occasionally marked by sparsely-scattered white star-shaped scars (Fraser, 1949), which may be attributable to bites from the cookie-cutter shark, *Isistius brasiliensis* (Porter, 1977).  
Maximum recorded length is 5.96 m in a male from Denmark (Tomlin, 1957) and 5.00 m in a female from an unspecified location (Perrin and Reilly, 1984). Exact masses of full-grown animals are difficult to obtain, so estimates vary. Maximum body mass has been reported to be at least 1,360 kg (Leatherwood et al., 1988).

The falcate dorsal fin, which may be >40 cm tall, is pointed to rounded at the tip. The height is about 8% of the body length (Tomlin, 1957). The position of the dorsal fin relative to the midpoint of the back has been variously reported as: from slightly in front of, at, or slightly behind the midpoint (Fraser, 1949; Tomlin, 1957). The dorsal fin is located more anteriorly in males than in females, and in general in older animals of both genders (Tomlin, 1957). The pectoral fin is distally narrow and pointed, slightly convex on the leading edge, and about 10% of the body length (Barnard, 1954). The tailstock is strongly keeled and the flukes are indistinguishable from those of most other delphinids. Nonfunctional accessory grooves are found distal to the mammary grooves in many animals of both genders (Comrie and Adam, 1938).  
There is no demarcation between the head and beak. Slight

![Fig. 1. Ventrail, dorsal, and lateral views of the cranium, and lateral view of the left mandible of a male false killer whale (Los Angeles County Museum 84047). Greatest length of skull is 605 mm. Photos by John Heyning.](image-url)
sexual dimorphism in the external appearance of the head has been reported, with the overhang of the melon over the upper jaw in the male being greater than that in the female (Mead, 1975). There is a moderate degree of sexual dimorphism in the forehead, in that pre-melon connective tissue extends farther forward in males than in females. Skull and dentary measurements vary between genders, with those of males generally larger (Kitchener et al., 1990). The greatest skull length of 13 sexually mature female false killer whales in a stranded group in South Africa is 59 cm; for 16 males in the group the maximum skull length is 65 cm (Kitchener et al., 1990).

DISTRIBUTION. The false killer whale has been reported from all tropical, subtropical, and warm temperate seas (Fig. 5). The distribution of this species has been largely determined from stranding records; it has one of the least continuous ranges among the cetaceans (Davies, 1963).

False killer whales are known from Prince William Sound, Alaska (Leatherwood et al., 1988), south to Chile (Brown et al., 1966; Miller, 1920; Mitchell, 1965; Oliver-Schneider, 1946; Sullivan and Houck, 1979; Van Gelder, 1960). The species has been reported from Hawaii and the Galapagos Islands (Donovan, 1984; Tomich, 1986). In the western Pacific, they are found around Japan and throughout the Indo-Australian Archipelago to New Zealand (Bryan, 1978; Cawthorn, 1984; Gaskin, 1968; Ohsumi, 1972; Zhou et al., 1982). False killer whales occur throughout the coastal rim of the Indian Ocean, from southwestern Australia to southern South Africa (Leatherwood et al., 1991).

In the eastern Atlantic, false killer whales have been recorded from the British Isles (Fraser, 1936), south to South Africa (Reinhardt, 1866), including the Mediterranean, where their presence is considered unusual (Duguy et al., 1983). They are common in the

western Atlantic and are known to range from Cape Hatteras, North Carolina (Brimley, 1937) to Tierra del Fuego at the southern tip of South America (Goodall, 1989; Langguth, 1977). A record based on a skull at the American Museum of Natural History, collected on the "northeast coast...probably...Davis Strait", off Baffin Island, listed by True (1889:144), and subsequently reported by some authors as the northernmost record, is unsubstantiated (Miller, 1920). There is no evidence that false killer whales inhabit Antarctic waters as stated in Bellisson (1966).

FOSSIL RECORD. Two fossil whale teeth from the Calabrian, lower Pliocene, Japan, are attributed to P. yokoyamai, a closely related species (Matsumoto, 1926). A subfossil skeleton from England in 1846 formed the basis of the false killer whale's description by Owen (1846).

FORM. The skin does not differ in any major respect from that of other cetaceans (Purves and Pillari, 1978). In the epidermis, pigment is intense in the area of the caudal peduncle and fairly weak on the head (Sokolov, 1973). Coloration may also contain all elements at a very early stage of development, as evidenced by the advanced pigmentation of a 64.7-cm embryo (Tomlin, 1957).

There are 7 C, 9-11 T, 9-13 L, and 16-26 Ca, total 47-52 (Pausch, 1963; Purves and Pillari, 1978). From 103 skeletons examined by Purves and Pillari (1978), 82.5% had total vertebral counts of 48-50. Various degrees of fusion of the cervical vertebrae occur (Gray, 1864; Yamada, 1956). Of 82 skeletons, 67% had the first six cervical vertebrae fused, 23.8% had the first five fused, and the remaining 12.2% had all seven fused (Yamada, 1956). There is some evidence that the number of vertebrae fused increases with age (Yamada, 1956). There are 9-12 pairs of ribs (10 is the usual number), 6 of which are bicapital. The 11th and 12th pairs, when present, are floating (Purves and Pillari, 1978). Unequal numbers of ribs on each side have been reported (Yamada, 1956). Four pairs of ribs attach directly to the sternum (Arry and Pillari, 1977). The sternum has four segments which fuse to varying degrees with age (Yamada, 1956). The skeleton of the pectoral flipper shows a great deal of variability, with a wide range in phalangeal formula. The first digit has from 0 to 1 phalanges, the second 4 to 8, the third 4 to 6, the fourth 1 to 3, and the fifth 0 to 2 (Ghir et al., 1982). The most common phalangeal formula from a sample of 93 flippers was: first digit, 0; second, 6; third, 4; fourth, 2; and the fifth, 1 (Ghir et al., 1982).

The skull is massive, with a short, broad rostrum (Fig. 1). The rostrum length is at least 1.5 times its width and increases in width with age (Elliott, 1901; Tomlin, 1957). The total length of the adult skull exceeds 500 mm (Glass, 1973). The rostral portion of the internasillaries is truncated at the distal end (Elliott, 1901). The internasillaries are rugose in front (Gray, 1846) and have developed laterally, occupying 60% of the rostrum's width (Tomlin, 1957). The pterygoid bones are nearly in contact and the internasillaries are of equal breadth throughout (Dammeyer, 1924). The presence of two ossa postinterparietalia has been noted in the fetus, but not in adults (Pillari, 1987). A meckelian ossicle is present on the anterior margin of the nasal aperture (Cave, 1987). The anatomy of the facial structure follows typical delphinid form and is most similar to

Fig. 2. Lateral (upper) and medial (lower) view of left tympanic bulla/periotic complex (Stranded Whale and Dolphin Program of British Columbia 89-21). The length of the tympanic bulla ranges from 47.7 to 50.5 mm.
that of the bottlenose dolphin, *Tursiops truncatus* (Mead, 1975). Skull asymmetry and skew are similar to that in other dolphins (Ness, 1967).

The roots of the teeth may be up to 1.8 cm in diameter at the gum line (Fraser, 1949). Extensive wear on the teeth can occur; this wear includes lingual undercutting, which implies that false killer whales are capable of making small lateral and palinal jaw movements, related to the action of breaking up large prey (Ross, 1984).

In a captive animal, the body temperature ranged from 36.0 to 37.2°C, increasing with activity levels (Whitlow et al., 1974). The mean body temperature was 36.6°C (n = 83). The normal heart rate of false killer whales ranges from 60 to 100 beats/min; the respiratory rate is 8 to 18 breaths/5 min (Walsh et al., 1990).

**FUNCTION.** Hematological values measured for 30 stranded false killer whales were similar to those of other small cetaceans (Odell et al., 1979). Red blood cell counts ranged from 3.58 to 4.81 $10^6$ mm$^{-3}$ and white blood cell counts from 4.146 to 9.953 $10^3$ mm$^{-3}$ (Odell et al., 1979). Hemoglobin ranged from 14.3 to 17.2 g/100 ml (Odell et al., 1979). Mean albumin and globulin values were 3.5 and 3.9 g/100 ml, respectively (Odell et al., 1979). There is 2.6 mg/ml angiotensin equivalent in the plasma, presumably produced in the kidney, which is similar to values obtained from other cetaceans (Arvy, 1971; Malvin and Vander, 1967). The absorption maxima for visual pigments in *P. crassidens* is 486.5 nm, similar to that of other dolphins (McFarland, 1971). The ductus arteriosus closes more slowly in this species than in other dolphins (Slipper, 1961). Heart and kidney masses of an animal from California were 1.745 and 1,051 g, respectively (Sullivan and Houck, 1979).

**REPRODUCTION.** The smallest size at which females were estimated to be reproductively mature was 334 cm in South Africa (Kitchener et al., 1990) and 336 cm in Scotland (Purves and Pillier, 1978). Based on information from Japan, females mature at body lengths of 340–380 cm, corresponding to ages of 8–11 years, based on presumed annual deposition of growth layers in dentine and cementum (Kasuya, 1986). The proportion of females that were considered mature in this study was 75.5% (Kasuya, 1986).

Males from South Africa were estimated to be sexually mature at a shorter length (370–430 cm) than those from Scotland (396–457 cm—Kitchener et al., 1990). Fully mature males in Japan were >429 cm; the youngest mature males were 18.5 years old (Kasuya, 1986). Age at sexual maturity in both genders has also been estimated at 8–14 years (Purves and Pillier, 1978), but Kasuya (1986) states that males attain sexual maturity 8–10 years later than females. If, as stated by Purves and Pillier (1978), testes increase dramatically with attainment of reproductive maturity, males with a combined testes mass of 1,000 g are likely sexually mature (Kitchener et al., 1990). Other studies indicate that minimum mass of mature testes is about 1,700 g (Perrin and Reilly, 1984). Combined maximum testis mass has been reported at 8,200 g (Odell et al., 1980).

Ovulation rate is about once/year (Purves and Pillier, 1978), and may be spontaneous (Harrison et al., 1972). One ovum is shed at a time (Connor and Adam, 1938). Ovaries of the smallest adult females in one stranding were 7–10 cm in length (Connor and Adam, 1938). The only estimate of gross annual reproductive rate is from a population off Japan; about 6.7%, with a net reproductive rate of about 1.4% (Kasuya, 1986). The proportion of females estimated to be pregnant annually is 14.5% (Kasuya, 1986). Data from Japan suggest that the interval between pregnancy and lactation increases with age and that females over 45 years of age may be post-reproductive (Kasuya, 1986). The average interval between births is 6.9 years (Kasuya, 1986). The calving, and thus presumably the breeding season extends over several months (Fraser, 1949; Scott and Green, 1973) and may be year-round (Ross, 1984). Some seasonality has been found in Japan, with a parturition peak around March and a mating peak from December to January (Kasuya, 1986). Length of gestation ranges from 15.1 to 15.7 months (Kasuya, 1986; Perrin and Reilly, 1984; Purves and Pillier, 1978). A single young is born.

Mean neonatal length in one study was estimated as 175 cm (Kasuya, 1986). Fetal growth rate is about 0.418 cm/day (Kasuya, 1986). The length of the umbilical cord in one case was 60 cm (Peacock et al., 1936). Lactation lasts from 18 to 24 months (Perrin and Reilly, 1984; Purves and Pillier, 1978).

The sex ratio in both stranded and shore-driven herds is approximately equal (Fraser, 1949; Kasuya, 1986). Other studies have reported more females than males (Peacock et al., 1936; Yamada, 1956).

**ECOLOGY.** Longevity is estimated at 57.5 years for males and 62.5 years for females, based on presumed annual deposition of growth layers in teeth (Kasuya, 1986). There are insufficient data to estimate age-dependent mortality rates, but overall annual mortality was estimated to be 5–6% (Kasuya, 1986). False killer whales prey mainly on a variety of fishes and squids. Prey items include various species of squids (*Oregonianeteuthis* sp., *Todarodes* sp., *Phasmatopopsis* sp.—Ross, 1984; *Gonatopsis bau- rea*, or *Brytherapycthes magister*—Baird et al., 1989) and fish; cod (*Gadus callarias*—Peacock et al., 1936), bonito (*Sarda lineolata*), mahimahi (*Coryphaena hippurus*—Brown et al., 1966), yellowtail tuna (*Pseudosciaena sp.*), perch (*Latesolbax japonicus*—Kasuya, 1985), salmon (*Oncoyynchus sp.*—Baird et al., 1989), and catfish (*Tuplyxynrus* sp.). Food sharing has been observed in the wild (Connor and Norris, 1982). False killer whales feed during both day and night (Evans and Awbrey, 1988). In one study, food volume in the stomach was reported to have been highest in winter (Tatsuzumi et al., 1961). A mean daily feeding rate of 4.7% (wt weight) of total body mass has been calculated for a captive animal (Sergeant, 1969).

Degenerative arthropathy of the cervical vertebrae may occur with fusion of the first cervical vertebrae to the skull (Baird et al., 1989; Yamada, 1956). Acute pneumonia has been reported in captive animals (Odell et al., 1980). While the effects of pollutants increase dramatically with attainment of reproductive maturity, males with a combined testes mass of 1,000 g are likely sexually mature (Kitchener et al., 1990). Other studies indicate that minimum mass of mature testes is about 1,700 g (Perrin and Reilly, 1984). Combined maximum testis mass has been reported at 8,200 g (Odell et al., 1980).
are unknown, two stranded animals in British Columbia had levels of mercury among the highest reported in cetaceans (728 and >1,500 ppm in the liver), high levels of DDE (1,400 ppm in the blubber) and some measurable quantities of every contaminant analyzed (Baier et al., 1989; Stacey and Baird, 1991). Parasites recorded from the false killer whale include Nematoda [Anisakis simplex, Anisakis typica, Stenuris audax (Zam et al., 1971), Stenuris globiceps (Odell et al., 1986)], Acanthocephala [Bolbosoma capitatum - Fraser, 1936], Trematoda (Orthoplanchna elongata - Zam et al., 1971; Nasitrema attenuata, Nasitrema globiceps - Neiland et al., 1970; Nasitrema gondo - Morin-Imitsu et al., 1987), Amphipoda (Syncyamus pseudocara, Isocyamus delphinus - Bowman, 1955), and Crustacea (Xenobalanus globiceps - Caldwell et al., 1971).

False killer whales are not taken by standard whaling operations (Gaskin, 1967, 1968), but they are the object of some drive- and harpoon-fisheries (Miyazaki, 1983). There is some small scale incidental catch worldwide in a range of fisheries including gillnet and longline (D’Natale and Mangaro, 1981; Harwood et al., 1984; Leatherwood et al., 1991). Blubber from a 4-m long animal of unknown gender yielded 45 l of oil (Reinhardt, 1866).

False killer whales occur in waters ranging in temperature from 9 to 30.8°C (Stacey and Baird, 1991; Miyazaki and Wada, 1974), but they are in warmer waters toward the higher end of this range (Kasuya, 1975). Inshore movements are occasionally associated with those of fish resources or to shoreward flooding of warm ocean currents (Tomlin, 1957). Although the yellowtail tuna fishery off Iki Island, Japan, is year-round, kills of false killer whales associated with that fishery have been primarily from February through April (Kasuya, 1985); this suggests a seasonal movement into the area. Kasuya (1971) notes that in winter, false killer whales reportedly migrate into the coastal waters near the north and west coasts of Kyushu, Japan.

False killer whales are sometimes seen in association with other cetaceans; at least 10 different species have been reported, most often bottlenose dolphins (Leatherwood et al., 1984; Miyazaki and Wada, 1978; Minze and Yoshida, 1961; Tsutsumi et al., 1961; Zhu et al., 1982). Mixed herds with bottlenose dolphins occur off Japan only during winter months, as mixed feeding aggregations, but not in summer in the so-called breeding migrations (Tsutsumi et al., 1961).

Mean group size off Japan was 55 (n = 6, range = 2-200; Kasuya, 1971). It has been suggested, based on age composition and age at maturity, that males in the late maturing stage have been absent from schools studied in Japan (Kasuya, 1986). Mass and single strandings have been reported (Baird et al., 1989; Fraser, 1956; Mitchell, 1965; Odell et al., 1980; Ross, 1984). Group size of 14 mass strandings averaged 180 individuals ranging from 50 to 835 (Ross, 1984).

BEHAVIOR. False killer whales leap clear of the water (Fig. 4; Leatherwood et al., 1988). They have been recorded swimming at an estimated speed of at least 5 m/s (Geist et al., 1966), well above the relatively greater length than width of the lumbar vertebræe may facilitate rapid swimming (Wang, 1984). No scientific studies have been conducted on the diving behavior or actual depth of dives of false killer whales.

False killer whales make sounds with a dominant frequency around 28 kHz that last 60-75 ms and have a waveform similar to sounds of bottlenose dolphins, long sustained click trains, a whistle of 8 kHz, and occasional 2 component clicks around 100 kHz (Kamminga and van Velden, 1987). An underwater audiogram indicated false killer whales could hear sounds from 2 to 115 kHz, with a peak in sensitivity from 32 to 70 kHz, corresponding with peak frequencies of echolocation pulses (Thomas et al., 1988). In experimental trials, a captive animal could detect the presence or absence of a 7.5-cm diameter water-filled steel sphere behind a visually opaque and acoustically-transparent screen (Fryer, 1985). Vocalizations may be used for inter-individual communication and as groupings signals (Busnel and Dziezdic, 1968).

False killer whales have been captured for scientific study and have been successfully maintained in captivity. They are rated high for both observational learning and imitative behaviors (Defran and Fryer, 1980).

GENETICS. The false killer whale has the typical cetacean diploid chromosome number 2n = 44 (Kuhl, 1972). Hybrids with bottlenose dolphins have been born in captivity in Japan and Hawaii (Sylvestre and Tasaka, 1985). These hybrids exhibited characters of both parents. False killer whales are more karyotypically conservative than killer whales (Duffield, 1986).

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