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THE USE OF PHOTOIDENTIFICATION TO STUDY THE AMAZON RIVER DOLPHIN, *INIA GEOFFRENSIS,* IN THE COLOMBIAN AMAZON

Observations on the Amazon river dolphin, *Inia geoffrensis,* and on a delphinid, *Sotalia fluviatilis,* are limited to the brief moments that these animals spend on the surface. This is certainly true in the turbid Amazon waters, although in some tributaries and flooded forest settings the waters are sufficiently transparent to allow one to follow the dolphins underwater. There is no obviously visible sexual dimorphism in either species that would facilitate inference about social structure and behavior. Because of these difficulties, it is important to find new ways of gathering information on these species in the wild.

One possible tool is photoidentification, which has contributed significantly to the development of knowledge about the biology and behavior of whales and dolphins. The research of Würsig (1978), Würsig and Würsig (1980), Norris *et al.* (1985), Wells *et al.* (1987), Würsig and Jefferson (1990), and others have shown that photoidentification is both a valid and a valuable tool for studying small cetaceans. For fresh-water dolphins the only work reported is that by Yuanyu *et al.* (1990), who tried to identify individuals of the species *Lipotes vexillifer* in China on the basis of notches and scars in the dorsal region.

Since 1991 we have been seeking criteria to identify individual *I. geoffrensis* and *S. fluviatilis,* concentrating mainly on notches and scars on the dorsal fin, but also noting the distinctive pigmentation patterns that occur on the backs of some *I. geoffrensis.* The work was carried out at the same time as other research on the populations and behavior of these two species in the Tarapoto and El Correo lakes of the Colombian Amazon and the Peruvian lake of Caballococha. Some 50 km of the River Amazon, which separates the lakes, were also covered (Fig. 1). This is a preliminary study, designed to test the feasibility of photoidentification in the Amazon region.

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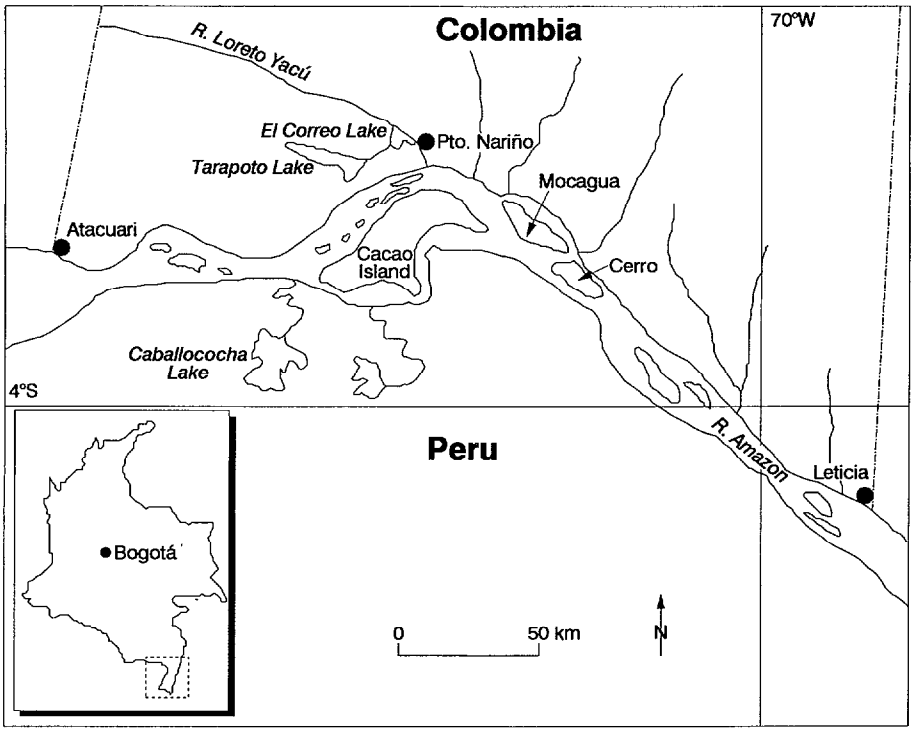

Figure 1. Location of study area in the Colombian Amazon.

The photographs were taken in 1991 and 1992, most of them from a 4.5-m boat with a 25-hp outboard engine; a few were taken from land. They were classified according to date, location, and season. The cameras used were 35-mm reflex with 200-mm and 70–210-mm lenses. Exposures were made at shutter speeds of 1/1,000–1/2,000. Fujichrome 100 ASA slide film was pushed to 200 ASA and developed by the E6 process. Black-and-white pictures were taken with Ilford HP5 at 400 ASA and developed for 12 min in D76 at 1:1 dilution. Most photographs were taken in color because of the importance of pigmentation patterns. The slides were projected to give a standard size of 20 by 25 cm, and the notches and colors were traced on paper for cataloging purposes in line with suggestions made by Würsig and Jefferson (1990). Enlargements of the black-and-white photographs were compared with the tracings.

Because of the turbid water and other visibility problems, identifying characteristics on the back, head, dorsal fin, and upper flanks were the only ones considered in our analysis. Photographs showing silhouettes against the light were used when notches were present, but never for pigmentation. All animals that surfaced sufficiently high in the water to provide a good image were photographed.

Out of the 3,600 photographs taken between January 1991 and January 1992, 400 were selected for quality, focus, light, and identifying marks. Twenty

Table 1. Identified dolphins photographed at least twice. Codes beginning with M are *Inia geoffrensis* identified by notches; codes beginning with P are *I. geoffrensis* identified by pigmentation; and codes beginning with S are *Sotalia fluviatilis* identified by notches; locations are defined by A for River Amazon, C for Caballococha Lake, T for Tarapoto and El Correo Lakes.

	Field period										
Code	01-91	06-91	07-91	10-91	12-91/ 01-92	07-92	09-92	01-93	04-93	07-93	08-93
M1					C			A			
M2					C	A	A	A	C	A	C
M3					A					A	
M4					T					A	
M5					T						
M6					C						
M7		A									
M8					C						
M9					T						
M10	A										
M11							C				
M12			A							A	A
M13								C		A	
M14						C	C	C		A	
M15								C	C	C	C
M16								C		A	
M17										A	
M18							C	C			
M19										C	
M20										A	
M21										A	A
M22										A	
M23										A	
M24								C			
M25			A								
M26										A	
M27								C			
M28								C			
M29								A			
M30								C			
M31					T						
M32								C			
M33		A									
M34			A			A					
P1	A	A	A	C	A						
P2	T	T	A								
P3			A								
P4				C	C		C	C	C	C	
P5							C				
P6						C	C	C	C	C	C
P7								C			
P8							C	C			
P9								C			
P10		A									
P11							C	C	C	C	C
SM1		T					T,C	T	T		
SM2							T	T			

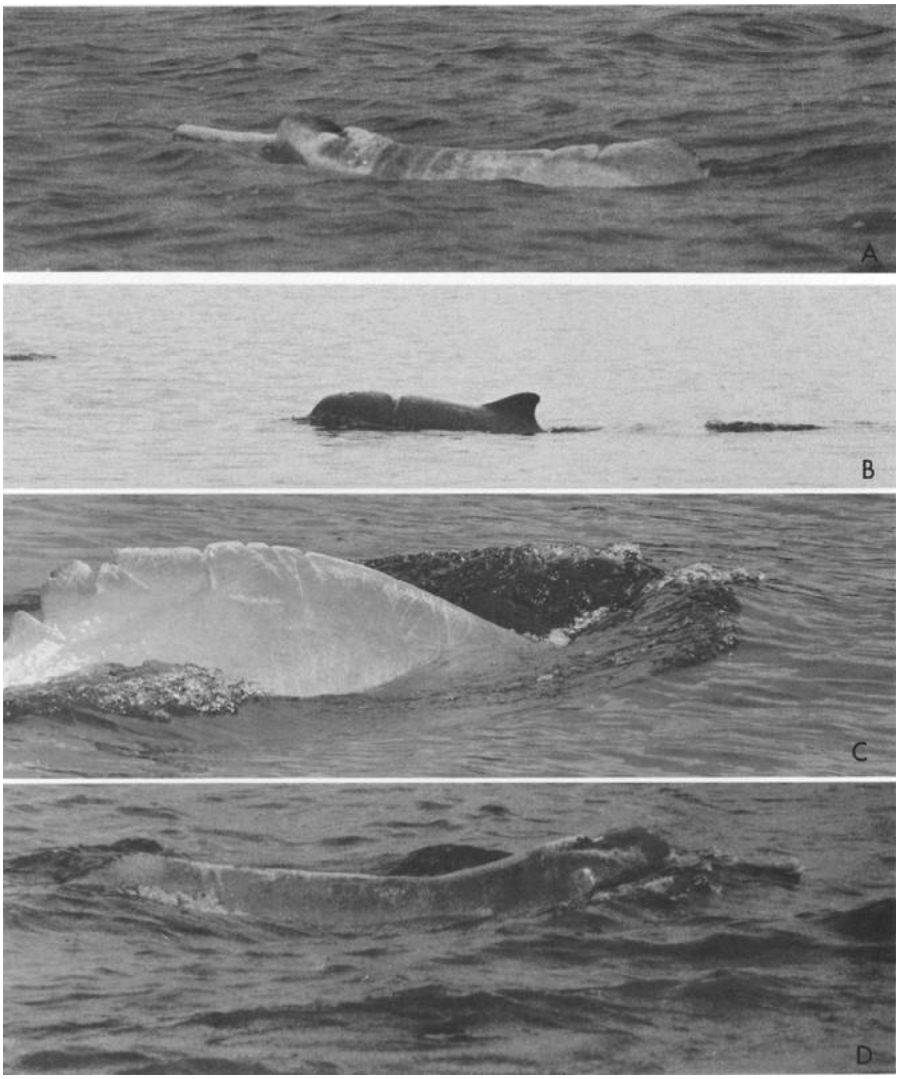

Figure 2. A. *I. geoffrensis* M12 identified by two notches; B. *S. fluviatilis* SM1 identified by a deep scar behind the head; C. *I. geoffrensis* Ml with serrated back and dorsal fin; D. *I. geoffrensis* P1 identified by pigmentation pattern.

I. geoffrensis and 2 *S. fluviatilis* were identified; of these 22 dolphins, 9 were photographed on at least 2 separate days within the same period, 8 were photographed during two different periods, and 5 were photographed during 3 or more different periods (Table 1). All the individuals identified were adults.

Table 1 shows 13 *I. geoffrensis* and 2 *S. fluviatilis* with identifying notches in the dorsal region. The notches include nicks (Fig. 2A), deep scars (Fig. 2B), multiple cuts (Fig. 2C), and small serrations. While we cannot be certain of the origin of these notches, we have seen dolphins biting one another in the

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dorsal region, producing wounds. We have also seen cuts on dolphins found dead after being entangled in monofilament nets. The deep cuts on the dorsal fin of *I. geoffrensis* M1 (Fig. 2C) may have been produced by a monofilament net or a propeller blade.

Table 1 also shows the seven *I. geoffrensis* identified by pigmentation patterns on the upper parts of the body. When analyzing photographs for pigmentation, and allowing for possible variations in lighting conditions, we found that the dominating skin tones of some animals can change. Predominantly grey dolphins can become pink, and *vice versa.* This process can be seen when a dolphin increases its activity, turning pinker, or gradually loses its rosy hue as physical activity decreases again. The color change, which appears to be related to capillary processes and thermoregulation, does not seem to occur in all animals (Klocek 1981, Best and Da Silva 1989). Despite the alteration in color, the pigmentation pattern remained clear. This color change with constant patterning was observed for three animals. We therefore decided that clear pigmentation patterns could be used to identify dolphins regardless of overall color change (Fig. 2D).

The percentage of individuals identified by notches and the percentage by pigmentation patterns does not reflect the real proportion of these animals in the overall population. Identifying animals by pigmentation requires higher quality photographs with a greater portion of the dolphin's body above the surface, and is, therefore, more difficult. *I. geoffrensis* are not timid on the whole and often surface within 30 m of a slow-moving boat. *S. fluviatilis* tend to avoid boats and surface very rapidly. Although they usually show greater body area and even leap clear of the water, it is not easy to anticipate their movements and take well-focused photographs.

Both the number and the percentage of animals identified in the preliminary study reported here were low. Estimates based on strip transects in the Tarapoto and El Correo lakes (Trujillo 1992), as well as counts in the other areas, suggest that between 25% and 33% of *I. geoffrensis* adults were identified in 1991–1992. However, a further 24 *I. geoffrensis* have now been photoidentified; this would bring the proportion up to over 50% of adults. In the case of *S. fluviatilis,* the initial proportion identified was minimal, but 40 individuals have now been photographed on more than one occasion. We estimate that this represents over a third of *S. fluviatilis* adults regularly in the area.

Although we have not seen evidence of changes in notches or pigmentation so far, we are aware that there could be variations over time and that this must be checked with care (Yuanyu *et al.* 1990).

The possibilities of using photoidentification with *I. geoffrensis* and *S. fluviatilis* are promising. In particular, the method should contribute to the systematic study of social structure and group membership, the description of behavior related to feeding and reproduction, the monitoring of daily and seasonal migration patterns, the expansion of data on mortality, the identification of key environments in the dolphin life cycle, and the design of conservation strategies.

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