



VOLUME 52: NO. 3, 1998
SPRING MIGRATION
March 1–May 31, 1998

field notes

AMERICAN BIRDING ASSOCIATION IN ALLIANCE WITH THE NATIONAL AUDUBON SOCIETY



Sulids Unmasked

Which Large Booby Reaches California?

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In the past few decades we have witnessed dramatic advances on the “frontiers of field identification.” Learning that aging shorebirds (Jonsson & Grant 1984, Veit & Jonsson 1987) and gulls (Grant 1982, 1986) was the most important step in their identification, for example, is a recent development. Yet much about the distribution and identification of seabirds still remains beyond the horizon. While Harrison (1983, 1987) brought together some of what was known about seabirds on a worldwide scale, numerous problems in the eastern Pacific Ocean were not discussed, or earlier, incorrect material was reiterated. Only within the last ten years have seabird identification questions at the “frontiers” been considered for such enigmas as *Pterodroma* petrels (Bailey et al. 1989, Roberson & Bailey 1991, Spear et al. 1992), small black-and-white shearwaters (Howell et al. 1994, Roberson 1996), and frigatebirds (Howell 1994). There are still seabird plumages that remain unknown except to a handful of researchers (for example, see cover photo).

The Masked (or “Blue-faced” or “White”) Booby is generally considered the big white sulid of the tropics (Nelson 1978, A.O.U. 1998). One recent review (del Hoyo et al. 1992) listed five races: nominate *dactylatra* (Caribbean & s. Atlantic), *melanops* (w. Indian Ocean), *fullagari* (Tasman Sea), *personata* (e. Indian Ocean, w. & c. Pacific), and *granti* (e. Pacific). But Pitman and Jehl (1998) presented compelling evidence that two species of large white boobies co-exist in the eastern tropical Pacific: the pantropical, yellow-billed Masked Booby *Sula dactylatra*, and the orange-billed *S. granti* of the Galapagos and nearby islands, for which they coined the English name Nazca Booby. Consistent differences in bare-part color and plumage, breeding habitat preferences, and assortative mating in colonies where the two

taxa occur together provide persuasive arguments that two biological species are involved. It seems likely the proposed split will in due course be adopted by the A.O.U. and other authorities. In this paper I consider them separate species. [Hereafter, specific English names without quotes refer to the species as defined by Pitman & Jehl (1998). The term “Masked” Booby (in quotes) refers to combined taxa (sensu A.O.U.).]

This species split has interesting implications for field observers in North America, especially in California where vagrant “Masked” Boobies have appeared. Of related interest is a little-known field identification problem between juvenal-plumaged Nazca Booby and adult Brown Booby (see the comparison of Figures 3 and 4; page 278). This paper discusses field identification problems, presents a gallery of photos showing differing age-class plumages, reviews California records, and highlights unresolved questions.

METHODS

I have field experience with both Masked and Nazca boobies from a four-month research cruise in the eastern tropical Pacific (Sept.–Dec. 1989). Prior to the cruise, R. L. Pitman had informed me that two taxa might exist, but little was then known beyond differences in adult bill color. I took about a hundred photos of “Masked” Boobies during this cruise and observed thousands of boobies. I reviewed over 200 unpublished photos of both species loaned by Pitman, another 60 photos of central Pacific Masked Boobies borrowed from R. B. Clapp, videos from the breeding islands, additional published photos, and the literature. In 1993, I studied all relevant specimens at the American Museum of Natural History, New York (AMNH), and the National Museum of Natural History, Washington, D.C. (USNM), and (in 1998) at the California Academy of Sciences, San Francisco (CAS). I also corresponded with seabird observers around the world.

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Figure 1 (left). A Masked Booby circles a research ship at dawn in the eastern tropical Pacific some 1200 miles southeast of Hawaii. It just now dawning on West Coast observers that the proposed split of "Masked Booby" into two species could have implications on California records. Photograph/ Don Roberson

In reviewing photographs, I tried to avoid circularity of reasoning, yet certain assumptions seem reasonable. Juvenal-plumaged birds adjacent to major breeding colonies were generally assumed to be the species breeding on that island. For example, juvenal-plumaged boobies just off Wenman and Culpepper Is., in the northern Galapagos, were assumed to be Nazca Boobies because (a) Masked Boobies are not known to nest on those islands (although occasional adult Masked Boobies have been recorded as visitors; Pitman & Jehl 1998), and (b) there appeared to be too many similar young birds to be accounted for in any other way. I exercised caution in reviewing photos of boobies around Clipperton Island. A huge colony of perhaps 30,000 pairs of Masked Booby nest there, along with six pairs of Nazca Booby (and there is one record of a possible mixed pair; Pitman & Jehl 1998). The odds are about 1 in 5000 that any juvenal-plumaged booby near the island is a Nazca, but assumptions based on these odds were consciously avoided. When a dozen or more similarly-plumaged birds appear in Clipperton photos, however, it becomes reasonable to assume that most are Masked Boobies. Photographs of youngsters in juvenal plumage, especially flightless birds still at the nest scrape, were particularly helpful.

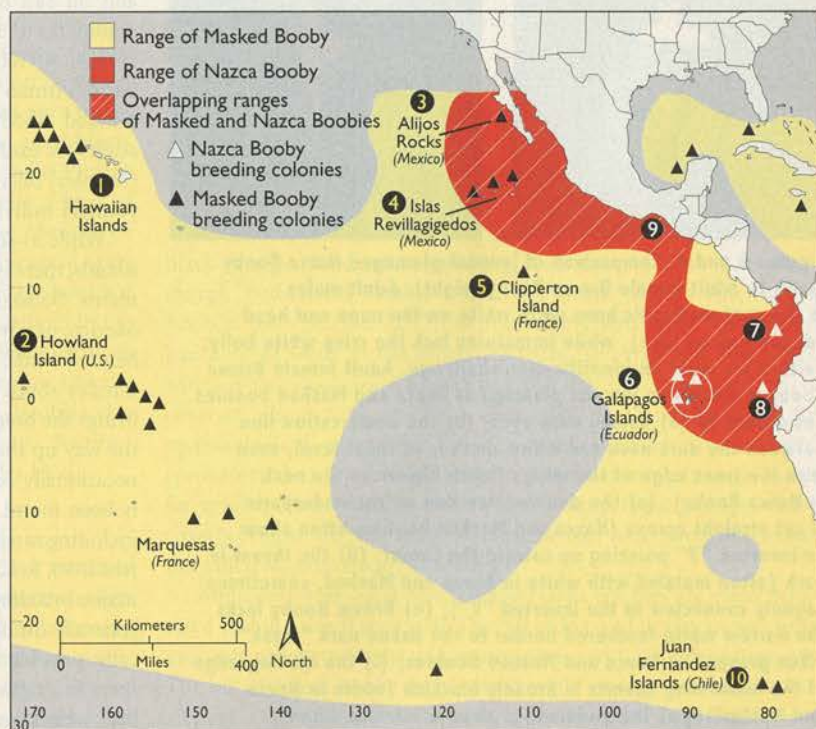
MASKED BOOBY STATUS AND DISTRIBUTION

The Masked Booby breeds on tropical islands around the world (Nelson 1978). Until Pitman & Jehl (1998) showed that two species bred in the eastern Pacific, populations in the Galapagos, on Clipperton I., and in the Revillagigedos off w. Mexico were lumped together under *S. d. granti*.¹ Now, however, *S. granti* becomes the Nazca Booby, leaving yellow-billed populations on Clipperton I. and in the Revillagigedo Is. to be labeled *S. d. californica*. Pitman & Jehl (1998) found no constant differences between adults from these islands and other yellow-billed populations (race *personata*) in the central Pacific or off Chile (a small unnamed population in the Juan Fernandez Is.), so they doubted whether "*californica*" was a viable name. In this paper I show that populations on Clipperton I. differ from all other Masked Boobies by having a small percentage of uncollared juvenal-plumaged birds among the more commonly collared youngsters. I continue, therefore, to label this population as the race *californica*.

¹The failure of previous workers (including the recent biological review by Anderson 1993) to note the distinctiveness of *granti* in the Galapagos region has an interesting history. Murphy (1936), for example, noted variability in bill and foot colors on the "Masked Boobies" on La Plata I., off Colombia (males had orange bills and khaki feet, females had pink-red bills and plumbeous feet), and considered that variability as evidence of the hopelessness of assigning subspecific rank based on soft part colors. We now know that these were Nazca Boobies, and that *S. granti* is unusual in this group in having strong sexual dimorphism in bill and leg color (see more details in Pitman and Jehl 1998).

Adult Masked Boobies around the world are white with black flight feathers and tails and have yellow bills. Atlantic populations have yellow feet (bright orange in some males, dull olive in some females; Dorward 1962), but populations in the Indian and Pacific oceans have basically gray or dingy feet, varying by population from overtones of blue or purplish (Australasia) to dull khaki yellow or pale green (e. Pacific; Pitman & Jehl 1998, Nelson 1978; Figure 5, page 278). The Tasman Sea race (*fullagari*) differs from all other taxa by having dark eyes (O'Brien 1990); all other Masked Boobies have bright yellow eyes as adults (Figure 6, page 279).

Masked Booby ranges throughout tropical oceans worldwide. There are substantial breeding populations in the northwest Hawaiian islands of *S. d. personata* (over 2700 pairs; Harrison et al. 1984) and of *S. d. californica* in the Revillagigedo Is. (over 3000 pairs) and on Clipperton I., which lies between the Revillagigedos and the Galapagos at 10°19'N, 109°13'W (over 61,000 birds; Pitman & Jehl 1998). Banding recoveries of Hawaiian birds show substantial inter-island movement of well over 1000 nautical miles (Clapp & Wirtz 1975). At-sea observations of *californica* were generally confined within a 1000 n.mile radius of their breeding islands, with concentrations in tropical seas primarily to the west and east of the breeding grounds, venturing northward only to the Alijos Rocks at about 25°N and some 185 n. miles off Baja California (where 50 pairs nest; Pitman 1985). A few vagrants have occurred farther north along the western coast of Baja and on Guadalupe I. (Gullén-Herrera 1995). At-sea researchers along the equator have observed Masked Boobies over 2200 n.miles from the nearest breeding colony (Pitman 1986, pers. obs.). Map 1 shows breeding colonies and at-sea distribution of Masked Booby. Given the distance the species is known to range, it is theoretically possible for either Hawaiian-bred birds or w. Mexico individuals to occur in California.



Map 1. Approximate distribution of Masked and Nazca boobies in eastern tropical Pacific and Caribbean (after Pitman & Jehl 1998, Pitman 1986, Nelson 1978, Raffaele et al. 1998, pers. obs.). Numbered sites show major breeding colonies and at-sea concentrations; specifics are labelled except for Malpelo I., Colombia (7), La Plata I., Ecuador (8), and concentrations in the Gulf of Tehuantepec (9). A few pairs of Nazca Boobies also nest on the Revillagigedos (4) and Clipperton I. (5); see text.



Figure 2. Nazca Booby in flight at 19°N, 115°W, about 350 n. mile southwest of the tip of Baja California, August 2, 1989. This typical juvenal plumage lacks the white cervical collar of Masked Booby, producing a pattern reminiscent of adult Brown Booby, but note the pale eye. While the tip of the bill is yellowish, the basal portion is already changing from dull ivory to a pale rose color. Photograph/ Don Roberson



Figures 3 and 4. Comparison of juvenal-plumaged Nazca Booby (left) to adult female Brown Booby (right). Adult males in the eastern Pacific have much white on the nape and head (depending on race), while immatures lack the crisp white belly; neither presents an identification challenge. Adult female Brown Booby is similar to juvenal plumage of Nazca and Masked boobies but differs by (a) having dark eyes; (b) the demarcation line between the dark neck and white chest is at chest level, even with the front edge of the wings (much higher up the neck in Nazca Booby); (c) the demarcation line on the underparts is cut straight across (Nazca and Masked boobies often show an inverted "V" pointing up toward the throat); (d) the throat is dark (often mottled with white in Nazca and Masked, sometimes vaguely connected to the inverted "V"); (e) Brown Booby lacks the narrow white feathered border to the naked dark "mask" often present on Nazca and Masked Boobies; (f) the leading edge of the underwing coverts is broadly blackish (white in Nazca and Masked); (g) the underwings show much less white; and (h) the feet are bright greenish or yellowish (dull gray or khaki in Nazca/Masked). Bill shapes are different, and the bill color of adult Brown Booby is bright white bill color of the youngest boobies is dull. Nazca and Masked are also much larger, heavier birds than Brown Booby, and have broader wings. Photographs by Don Roberson (left; same bird as figure 2) and Ron LeValley (right; Isla San Pedro Martir, Mexico, April 1988)



Figure 5. Adult Masked (left) and Nazca boobies on Clipperton I., May 1987. This spectacular photo is of two adults which happened to be sitting together; they were not a mated pair (mixed pairs are very rare). Note the bright yellow bill, yellow eyes, and all-dark tail of Masked Booby. The coral-red bill of this Nazca Booby suggests it is a female; note that the bill tip becomes yellow. Nazca Booby often has orange eyes and white central rectrices. Photograph/ Robert L. Pitman

NAZCA BOOBY STATUS AND DISTRIBUTION

The Nazca Booby nests primarily in the Galapagos and on Malpelo I., Colombia. A few pairs breed on Clipperton I. (six known pairs among 150 orange-billed birds present, but most are not nesting) and on San Benedicto I. in the Revillagigedos (eight mated pairs among up to 50 orange-billed birds and one record of a mixed pair; Howell & Webb 1990). The world population likely exceeds 60,000 pairs (Pitman & Jehl 1998). Nazca Booby is somewhat smaller than Masked Booby (12–14% lighter in weight; Anderson 1993) and adults are easily identified by their bright orange (males) to coral-red (females) bills (Figures 5 & 7). Breeding adults have orange eyes but younger individuals are yellow-eyed.

While at-sea observations are concentrated around the breeding islands, there is a strong north and south component to pelagic movements. Substantial concentrations occur from Colima to Chiapas, Mexico, nearly 1000 n.miles north of the Galapagos (including some banded birds; Anderson 1993) and south to Ecuador, nearly 800 n.miles south and east. Even more dramatic northward dispersal brings the breeding Nazca Boobies to San Benedicto I. and a third of the way up the coast of Baja to the Alijos Rocks (where nesting may occasionally occur; Pitman & Jehl 1998). Nazca Boobies have recently been found in small numbers throughout the Gulf of California, including rarely to the northern gulf (Tershy & Breese 1997, Pitman & Jehl 1998, R. L. Pitman pers. comm.), nearly 2300 n.miles north of the major breeding islands. Given this substantial northward dispersal, generally inshore of the mostly offshore Masked Booby, it is theoretically possible for Nazca Boobies to reach California. Interestingly, there is a sight record of an adult "Masked Booby" with a "coral-red bill" which was banded on Howland Island near the equator (R. B. Clapp, pers. comm.), about 3800 n.miles west of the nearest breeding Nazca Booby.

AT-SEA DISTRIBUTION AND HABITAT

Both species spend substantial time in pelagic waters since individuals do not breed until their fourth year (Anderson 1993). The



Figure 6. Adult Masked Booby in flight at 13°24'N, 117°35'W, about 1000 nmi west of Clipperton I., August 5, 1989. Yellow eyes contrast with the blackish bare "mask" of Masked Booby. All the secondaries are dark, right into the body, easily distinguishing adult Masked and Nazca boobies from the smaller white morph of Red-footed Booby, which has white tertials.
Photograph/ Don Roberson



Figure 7. Adult Nazca Booby at sea near the central Galapagos Is., October 29, 1989. The bill is orange at the base, suggesting it is a male, but also becomes yellowish at the tip. This adult has an all-dark tail, as does Masked Booby.
Photograph/ Don Roberson

majority on or near breeding islands are breeding-aged adults and recently-fledged young. Once they become independent, juvenal-plumaged birds disperse widely and do not return to breeding colonies for several years. Intermediate and subadult plumages are thus poorly known, and generally encountered only at sea.

A habitat difference may have bearing on at-sea distribution. Masked Booby is a component of the avifauna over deep warm oceans far from land. In the eastern Pacific it feeds primarily on flyingfish (Anderson 1993). Masked and Red-footed *S. sula* boobies are a major component of seabird flocks feeding over tuna/porpoise assemblages in the eastern tropical Pacific, north of the equator (Au and Pitman 1986, pers. obs.). In contrast, Nazca Booby is primarily a bird of upwelling zones in colder waters near the coast (e.g., w. Mexico) or islands (Galapagos). While individuals may traverse substantial open ocean, known concentrations are all within 200 n.miles of shore but off the coastal shelf. Nazca Boobies feed primarily on sardines in the Galapagos but switch to flyingfish during El Niño years when sardines are unavailable, and Blue-footed Boobies *S. nebulosus*, sardine specialists, starve (Anderson 1989). During these conditions, boobies also forage farther south in the Peru Current, following broader distribution of flyingfish during warm water incursions (Murphy 1936).

IDENTIFICATION

Phenology and Molt. Much of the published information on these topics is from the Atlantic (Dorward 1962) and the northwestern Hawaiian chain (Kepler 1969, Woodward 1972), but presumably something similar occurs in the eastern Pacific. The general chronology is (1) eggs are incubated about six weeks and hatch as downy young; (2) nestlings acquire juvenal plumage at three months and fledge at about four months; (3) flying youngsters remain around breeding islands, dependent on their parents, for another one–two months; and (4) at about 5–6 months of age, they disperse at sea. They will not return to their breeding grounds until three to four years of age. [Individual birds may be up to a month earlier or later than this typical schedule; Nelson 1978.]

The first sign of post-juvenal molt begins with the replacement of inner secondaries at about 6–7 months of age; the first replacement of body feathers begins at about 7 months. This means birds are dispersed at sea in true juvenal plumage for only one–two months, so the fact that birds in this plumage have reached California (see below) is remarkable. Remiges are steadily molted at about the rate of one flight feather a month, and it takes 18 months to complete a wing molt. Before this first wing molt is completed, however, the inner primaries begin molting again at month 10 or 11, so that many birds have three generations of flight feathers. Thereafter wing molt and body molt is continuously occurring except when suspended during breeding. Tail molt is erratic and asymmetric (Nelson 1978, Anderson 1993).

Adults. Adult Masked and Nazca boobies are white with entirely black remiges, easily distinguishing them from the smaller white-morph Red-footed Booby, which has white tertials. All Masked Boobies have black tails. Of 90 photos reviewed, only one Masked had a bit of white in the central rectrices, and this bird was paired with a Nazca Booby on Clipperton I. and may have been a hybrid. In contrast, about 60% of Nazca adults (20 of 33 adults in photos reviewed) had extensively white central rectrices. "Near-adults" (probably 2.5–3.5 years old) have an all-white body plumage except for small spots or blotches of dark in the rump, flanks, or upperwing coverts (Figure 18, page 282). All have the bare blackish facial "mask" for which Masked Booby is named.

Adult and near-adult Masked and Nazca boobies are easily separated on bill color if seen well. The bill of Masked Booby ranges from greenish-yellow to bright yellow, sometimes with a small orange tip. The bill of Nazca Booby ranges from bright orange to coral-red, but all have a yellow tip (usually just the distal third; one photo showed a bill with the outer half yellow). It is the color of the basal half of the bill that is important. In addition, Masked Boobies tend to have heavier bills than Nazca. Masked Booby has a very thick-based bill which tapers down to a long dagger tip, usually without much curvature. Nazca Booby typically shows a "dip" along the culmen about two-thirds of the way to the tip.



Figures 8, 9, 10. Subadult Masked Boobies in various stages of molt in the eastern tropical Pacific. The bird on the left (at 8°N, 145°W on September 5, 1989) is just into post-juvenile molt (3 innermost primaries growing) and still shows the obvious cervical collar.

The bird on the right (at ~ 25°N, 113°W on July 31, 1990) is about a month older (4 inner primaries growing) and already has much white to back and upperwing coverts.



The bird on the right (at 4°55'N, 138°41'W on September 7, 1989) appears to have nearly completed one wing molt and begun another but still has a dark rump, lower back, and mottled face. Although farther along in wing and body molt than Figure 9, it has less white on the upperwing coverts, illustrating the range of individual variation in body molt. All three show greenish-yellow bills typical of Masked Booby at this age. Photographs/ top and lower by Don Roberson, center by Robert L. Pitman



Figure 11. Subadult Nazca Booby near central Galapagos Is., September 24, 1989. The plumage and wing molt state is very like the Masked Booby in Figure 10, but the head is whiter. In life, its head showed a "buffy" cast that seems typical at this age in Nazca Booby. Note that white central rectrices have appeared, aiding identification of many subadults. Photograph/ Don Roberson

Subadults. This is a term I use from the time post-juvenile wing molt begins to the time "near adult" plumage is acquired. The progression of plumage change varies, but the neck/nape/upper back are first affected by increasing white feathers. The dark thigh patch of juvenile plumage is soon lost. On most birds the throat becomes white, breaking through the dark juvenile neck to connect to the breast. Dark areas on the lower back and rump remain until late in the plumage sequence (Figures 8–11). White central rectrices appear on those subadult Nazca Boobies that will have them as adults (about 60% of all Nazca Boobies; see Figure 11).

Bill color remains the best field character in this plumage. Masked Boobies have quite greenish-yellow bills by the time they appear "half-and-half" dark and white, while the orange or pinkish-red of Nazca Booby should be apparent on the basal half of the bill.

Juvenile Plumage. This is the plumage worn at the time a booby fledges. Pitman & Jehl (1998) suggested that there were consistent differences between the two species in the plumage tone of the upperparts, the presence or absence of a cervical collar, the pattern of blotching or flecking on the head and neck, and the presence or absence of white at the base of the tail. I considered all these suggestions, scoring 22 examples each of *S. d. californica* and *S. granti* for every suggested character. I found no consistent differences in the pattern of head/neck flecking. Most young birds have evenly dark chocolate heads with a

narrow fringe of white around the bare "mask." Some do have heads and necks speckled with variable white streaks, flecks, or blotches (a pattern shown by some field guides; e.g., Simpson & Day 1984, Pratt 1987), but this is comparatively rare if the photos and specimens I reviewed are a random sample. The other points, however, do have value as field characters, although none is diagnostic.

Pitman & Jehl (1998) stated that Nazca juvenile plumage was grayish brown above, while Masked was darker chocolate brown. My notes from the Galapagos discuss paler and grayer-backed birds there, but there is much overlap. Uniformly chocolate-brown upperparts are very common in Masked Boobies (90% of birds in juvenile plumage; see Figures 12 & 13) but a similar plumage is worn by 45% of juvenile-plumaged Nazca Boobies (Figures 2 & 14). A paler-backed pattern that looks "gray-backed" at a distance in the field is common in Nazca Booby (Figures 15 & 16). My survey found this pattern on 55% of young Nazca Boobies, but the sample was skewed because more photos were from the northernmost Galapagos Islands. I suspect this paler-backed pattern is more prevalent there than in the central Galapagos.

Likewise, the extent of white at the base of the tail feathers appeared to be greater in those juvenile-plumaged boobies that also had paler back and upperwing covert feathers. In my survey of photos, 43% of Nazca Boobies had fairly substantial white "frosting" at the base of the tail while only 12% of Masked Boobies showed anything similar. This is thus a suggestive character only.

Most intriguing is the collar vs. no-collar possibility, which could have considerable implications for field identification. The presence of a white cervical collar (sometimes expressed as "white upper back") is an oft-cited field character for juvenile-plumaged Masked Booby (e.g., Peterson 1980, Dunn & Blom 1983, Naveen 1983, Harrison 1983, 1987). Based on studies in the Atlantic and Indian oceans (Dorward 1962, Nelson 1978, del Hoyo 1992) and information from western (O'Brien 1990, D. Eades, D. James, T. Palliser, pers. com.) and



Figure 12. Juvenile-plumaged Masked Booby (*race personata*) perched on Pearl & Hermes reef, n.w. Hawaiian Is., November 19, 1980. It has a broad white cervical collar, as do almost all young Masked Boobies around the world. Many juvenile boobies have dull gray or bluish bills, but this one already shows substantial yellow at the base, easily identifying it as a Masked. Photograph/ Roger B. Clapp



Figure 13. Masked Booby in fresh juvenile plumage in flight near Clipperton I., March 28, 1983, showing the broad cervical collar which is characteristic of this species. Note that pale tips to back feathers have not yet worn off, but the head and back are still the same chocolate brown color. The eye is obviously pale, but the adult bill color cannot yet be determined. The bill tip is yellow (a character shared with Nazca Booby) but the bill base is still a dull ivory-blue. Photograph/ Robert L. Pitman



Figure 14. Juvenile-plumaged Nazca Booby in flight off Culpepper I., n. Galapagos Is., September 2, 1990. Most Nazca Boobies in this plumage lack a white cervical collar (they show only a slight indentation of white upward ahead of the wing). This particular individual is as chocolate-brown as most Masked Boobies of similar age and this bird, like the Masked in figure 13, still has a blue-gray base to the bill. Photograph/ Robert L. Pitman

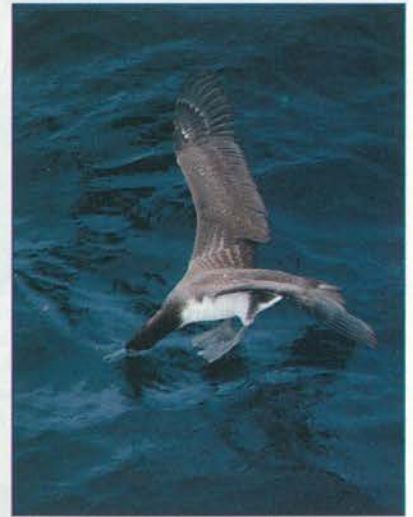


Figure 15. Juvenile-plumaged Nazca Booby diving off Culpepper I., n. Galapagos Is., September 22, 1990. It lacks a cervical collar (like figure 14), but this individual shows a much paler back and upperwing coverts than its dark head, caused by pale tipping to the feathers and a difference in the brown feather tone. Many Nazca Boobies in juvenile plumage look paler-backed in the field, a feature that is very rare in Masked Booby. Note also the extensively dark thigh patch common to young birds of both species; it will be lost soon after post-juvenile molt begins. Photograph/ Robert L. Pitman

Figure 16. Juvenal-plumaged Nazca Booby in flight off Wenman I., n. Galapagos Is., July 1986.

This bird has a white cervical collar although it is not as broad as typical of Masked Booby. It also has, however, the paler-backed look shown by many Nazca Boobies, and its bill is already suffused with a pinkish tone.

Only a small minority of Nazca Boobies show cervical collars, and these birds may be restricted to the northernmost Galapagos Is. Photograph/ Robert L. Pitman



Figure 19. Juvenal-plumaged booby 3 mi off Whites Pt., Los Angeles Co., California, April 30, 1994. The lack of a cervical collar is typical of Nazca Booby, the uniform back and head color can be shown by either species, and this bird's bill base is still bluish-gray. While this individual cannot be identified on plumage or bill color, the timing of its occurrence suggests it is a Nazca Booby. Photograph/ Stuart L. Warter



Figure 17. An uncollared juvenal-plumaged Masked Booby on Clipperton I., November 1990. This is an injured bird in an odd state of head molt but is an example of the rare Masked Booby that lacks a cervical collar. The base of the bill has become greenish-blue, a bill color shown only by Masked Booby. Photograph/ Robert L. Pitman



Figure 18. Near-adult Masked Booby, Pt. Mugu, Ventura Co., California, January 18, 1997. The plumage is adult-like except for dark spots in upperwing coverts and rump; the bird is probably 2.5 to 3 years old. The bill is greenish-yellow at the base and not as bright yellow as adult Masked Booby. Photograph/ Don Desjardin

central Pacific populations (R. Clapp, pers. com.), it can be asserted that all juvenal-plumaged Masked Boobies outside the eastern Pacific have white collars. If there are exceptions, they must be rare.

In contrast, a high percentage of juvenal-plumaged Nazca Boobies lack white cervical collars (77% lacked any collar in my survey, see also photos of fledglings in Nelson 1978 and Figures 2, 14, & 15). Unfortunately, a minority of Nazca Boobies do show a white collar, although it is usually "narrow or incomplete" (Pitman & Jehl 1998). The "collared" Nazca Boobies appear to exist only in the northern Galapagos; I found no examples in the central Galapagos or on Malpelo or La Plata islands (but the sample size for the latter sites is small). All examples of "collared" Nazca Boobies were also paler-backed birds (like Figure 16). I found no collared Nazca Booby that was otherwise plain chocolate-brown, a plumage combination that is very common in Masked Booby.

This leads us to wonder about the eastern Pacific populations of Masked Booby (*californica*). The vast majority of *californica* nest on Clipperton Island. Most juvenal-plumaged birds flying near Clipperton have white collars (e.g., photo by Pitman in Harrison 1985 and Figure 13). Yet there are enough photos from on or near Clipperton of uncollared juvenal birds (Figure 17) to call into question any definite conclusion. I was able to locate only one photo showing the Clipperton breeding colony in May when most juvenal-plumaged youngsters are past the downy stage but have not yet left the nest. Taking care not to mistakenly include Brown Boobies among the sample, I counted 18 collared and 6 uncollared juvenal-plumaged Masked Boobies in this overview photo. This, together with my other photo review, suggests that 10–25% of the population of Masked Boobies on Clipperton lack white cervical collars in juvenal plumage.

Finally, there is bill color. Nestlings begin with blackish bills but these lighten to dull gray by the time juvenal plumage is acquired. After birds begin flying, some retain grayish bills for a considerable period, but others more rapidly acquire a dull example of adult bill color. Both species brighten from the tip, and both species show predominately yellow coloration on the distal third of the bill. In Masked Booby the gray base to the bill becomes steely bluish-gray and then dull greenish-yellow before it brightens into a purer yellow color. In Nazca Booby the gray base to the bill becomes ivory, which is then suffused with a warm purple-rose or pinkish color before becoming a brighter coral-red or orange color in its second or third year. It is not known how apparent these differences will be in the field, but they appear consistent in photos.



Figure 20. Ten recently-fledged Masked Boobies perched on a log off Lisianski I., n.w. Hawaiian Is., September 1967. All have broad cervical collars. Note "inverted V" to neck/breast demarcation on birds facing forward. Photograph/ Roger B. Clapp

CALIFORNIA RECORDS AND THEIR IDENTIFICATION

There are 16 reports of "Masked" Booby from California and northern Baja California (table, page 285). To date, nine records have been accepted by the California Bird Records Committee (CBRC) and two rejected.² The others from California are under review; details of the Mexican bird were published by Everett & Teresa (1988). The records fall into three groups: nine adults or near-adults, three sub-adults in a transitional plumage, and four juvenal-plumaged boobies.

Adults. Of nine adults or near-adults in California, six had bill color described or photographed. These six had yellow bills varying in brightness and were Masked Boobies (Figures 18 & 22). Details for the other three lacked specific bill color information, but to the extent bill color was mentioned at all, it was thought to be dull. Given this, it seems likely that all adults in California have been Masked Boobies. [It is also possible that some recent records involved the same individual.]

Subadults. Two of these three boobies were described like juvenal-plumaged birds but with variable white patches on upperwing coverts, rump, and upper back (a plumage state perhaps somewhere between Figures 8 & 9). Both had white cervical collars. The northernmost of the two birds (seen by Michael Force at 38°54'N, 123°57'W, where it was the northernmost Masked Booby known in the eastern Pacific) had a "pale yellowish" bill. The bill color of the Newport Beach bird was not determined. The third subadult, on San Miguel I., was well along in transitional plumage; it was molting the inner secondaries on both wings and had a few tail feathers missing. The bill was described as "bright yellow." It again seems likely that all California subadults have been Masked Boobies.

Juvenal-Plumaged Birds. The most striking attribute of the four juvenal-plumaged birds (two photographed; Figures 19, 23, & 24) is that they all lacked a white collar. Indeed, because of this feature, the first to appear (around a fishing boat off Pt. Lobos, Monterey Co.) was first identified as a Brown Booby. This bird appears in photos to have a uniformly silvery-gray bill with perhaps the barest hint of yellow near the tip. The lack of a white cervical collar also caused debate among observers of the second bird (it was sitting on the water off Whites Pt., Los Angeles Co.). The bill of this booby was described as "dull brownish gray with the front third of the upper mandible

²The two rejected records (Nov 1987, Jan 1993) are of adult boobies with ambiguous details (see Heindel & Garrett 1995). Re-review of the details of both birds suggests "Masked" Booby was most likely correct, and I include these records here for completeness but they do not otherwise change the analysis.



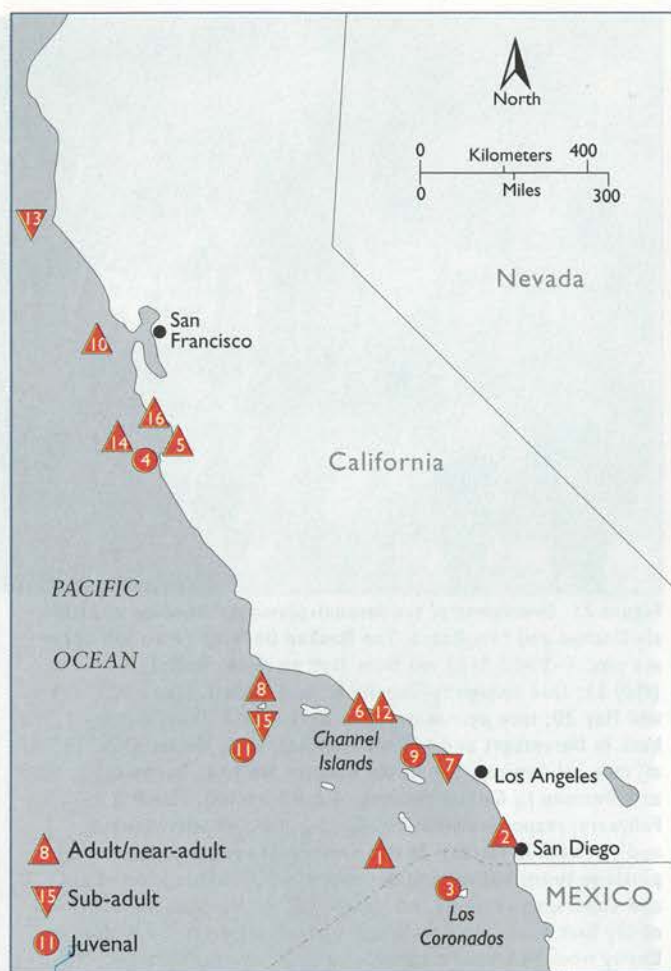
Figure 21. Specimens of ten juvenal-plumaged boobies at AMNH, six Masked and four Nazca. The Masked Boobies (from left these are nos. 1-3 and 6-8) are from (left to right) Norfolk I. (May 31; race *fullagari*), Loyalty Is. and Ducie I. (June 12 and May 20; race *personata*), San Benedicto I. (nos. 6 & 8; both in December) and 100 mi s. of Acapulco, Mexico (Jan. 14; all race *californica*). The Nazca Boobies are from Daphne I. and Wenman I., Galapagos (nos. 4 & 5 from left; March & February, respectively) and Malpelo I., off Colombia (nos. 9 and 10, both in March). In this sample all appear to have similar plumage tones but varying degrees of white tipping to the back and upperwing feathers. All Masked are collared; three of the four Nazca are uncollared. The exception is the Nazca Booby from Wenman I., north Galapagos, where there are "collared" Nazca Boobies (see Figure 16). Photograph/ Don Roberson



Figure 22. Adult Masked Booby in flight over Salinas R. mouth, Monterey Co., California, June 22, 1992. This adult was yellow-billed. It roosted on a sandy flat among Brown Pelicans for 3 days in June 1992. Photograph/ Don Roberson



Figure 23. Juvenal-plumaged booby 2 mi off Pt. Lobos, Monterey Co., California, April 5, 1990. It lacked a cervical collar and was uniformly chocolate-brown above, leading to its initial identification as "Brown Booby," but note "inverted V" at neck/breast demarcation. Bill color was blue-gray at its base, a character shared by very young birds of both Masked and Nazca boobies. The early April timing of its occurrence, however, suggests Nazca Booby. Photograph/ Larry Schumacher



Map 2. Records of "Masked" Booby for California and northwest Baja. Numbers correspond to the records listed in the table on p. 285.

having a slight yellowish wash." The bill on the northern Mexico bird was grayish. Although the observers saw no collar on this individual, they rationalized that they must have overlooked the collar because the neck was tucked in and they were unaware that uncollared birds existed (Everett & Teresa 1988). The final juvenal-plumaged bird flew by Bob Pitman and Susan Smith while they were on a research vessel; backlighting and brevity of view precluded details on bill color.

The lack of a cervical collar is suggestive of Nazca Booby. The vast majority of juvenal-plumaged Nazca Boobies lack a cervical collar, while only a minority of one population (*californica*) of Masked Booby are uncollared. Statistically speaking, it seems improbable that all four juvenal-plumaged boobies of these types in California and northern Mexico should be wearing a plumage characteristic of only a small minority of Masked Boobies. The Mexican bird had a dark brown head that "contrasted sharply at the nape with the color of the back" which was lighter brown (Everett & Teresa 1988). The Los Angeles Co. bird had a fair amount of white at the base of the tail (Figure 24). Both characters are much more typical of Nazca Booby than of Masked Booby.

GEOGRAPHIC ORIGIN

A consideration of potential geographic origin might be helpful. If all California birds came from the central or south Pacific, the uncollared juvenal birds in California must be Nazca Boobies since such a



Figure 24. Juvenal-plumaged booby 3 mi off Whites Pt., Los Angeles Co., California, April 30, 1994. This flight view from the rear shows not only the lack of a cervical collar, but fairly extensive white at the base of the tail, a feature more common in Nazca Booby. Photograph/ Stuart L. Warter

plumage is unknown in central Pacific populations of Masked Booby. There are several theoretical reasons to think that California birds originated in the central or south Pacific. Except for one at-sea record very near Mexican waters in 1977, all other occurrences have been within the last eleven years (table). This acceleration of records could reflect recent warming trends in the North Pacific Gyre. After the great El Niño of 1891, and excepting the strong El Niños of 1925 and 1957, much of this century before 1982 was characterized by a cold-water trend in California offshore sea-surface temperatures (e.g., Rasmussen 1985). Indeed, for a dozen years prior to 1976, when pelagic trips for birders first gained popularity, California offshore waters were "anomalously cool" (Norton et al. 1985). A warming trend in the late 1970s probably brought California's first Masked Booby (Lewis & Tyler 1978), but all others were after the great El Niño of 1982–1983, the most massive of this century (Arntz 1986). This does not mean that California boobies occurred because of El Niño, but rather that this event, along with other unrelated phenomena (maybe even greenhouse warming?), contributed to a recent decade-long warming trend in sea surface temperatures (see Latif et al. 1997, Zhang et al. 1998). During this period, several central Pacific seabirds began colonizing or visiting waters off western North America with much higher frequency. Laysan Albatross rapidly expanded its breeding range in the eastern Pacific (Howell and Webb 1992, Gallo-Reynoso and Figueroa-Carranza 1996). Red-tailed Tropicbirds began occurring with regularity far offshore California (over 20 records since 1979), and the occasional Sooty Tern has frequented tern colonies in coastal southern California (McCaskie 1997). Sooty Tern is the quintessential seabird over warm water tuna/porpoise assemblages in the eastern tropical Pacific (Au & Pitman 1986); prior to the current warming trend the only California record was a hurricane-driven subadult (Webster et al. 1990).

Seven of the eight adult or near-adult boobies in the last dozen years have been documented by onshore observers near nesting colonies of other seabirds. It is a fair generalization that Masked Boobies do not come nearshore except to visit breeding grounds, and it seems likely that the adult nearshore boobies in California were seeking new

nesting sites, as have Laysan Albatrosses and Sooty Terns. There is thus reason to believe Masked Boobies have been influenced by trends affecting other central Pacific seabirds, and I suspect that many of our recent adult Masked Boobies originated in the central Pacific.

However, there is no reason to exclude range expansion in west Mexican *californica* during the decade-long warming trend. A recent scattering of records along the Pacific coast of Baja California suggests this is occurring (Gullén-Herrera 1995). Further, the recent surge in records might be linked to population gains in Masked Boobies on Clipperton Island. When Beck (1907) visited Clipperton in 1901, he saw "thousands" of Masked Boobies. Yet when ornithologists visited in 1958, only a handful were present: the breeding population had been devastated by released feral pigs (Stager 1964). Stager's party eliminated all pigs in August 1958. By July 1968 a total of 4239 were counted on Clipperton (Ehrhardt 1971), and recently the population was estimated at over 61,000 birds (Pitman & Jehl 1998). This recovering population could be the source of recent California records, and 10–25% of the juvenal-plumaged birds from Clipperton I. appear to be uncollared, perhaps accounting for uncollared young boobies in California.

TIMING OF RECORDS

Another analytical approach is to consider the timing of records. Three of the four juvenal-plumaged birds were in April; the two that were photographed showed no wing molt. As previously discussed, birds in this plumage are at sea, far from breeding colonies, for only 1–2 months before beginning post-juvenal molt. These birds are 6–8 months old. They must have been hatched between August–October. So they must have originated from a colony in which adults are laying eggs in July–September. This fits numerous central Pacific colonies (e.g., Schreiber & Ashmole 1970) but none of those colonies produce uncollared young birds. So our focus is solely on the eastern Pacific.

Nazca Booby colonies on the Galapagos are asynchronous. Boobies on Española (Hood) and Wenman Is., for example, lay eggs from November–February (peak in December–January; Nelson 1978). This accounts for juvenal-plumaged birds around those islands in July–September (Figures 14, 15, 16), but should eliminate those colonies as the source of April youngsters in California. Yet many colonies, including Genovesa (Tower) and Daphne in the central Galapagos, produce eggs primarily from August–October (Nelson 1978; details in his Appendix 10). These colonies support thousands of nesting boobies (Nelson 1978, Cepeda & Cruz 1994) and could easily be the source of uncollared juvenal-plumaged birds in April in California.

In contrast, the breeding phenology of *californica* Masked Booby colonies makes it unlikely that they are the source of April juvenal-plumaged birds in California. Eggs are laid in colonies on the eastern Revillagigedos primarily in January–February, with downy young in February–April (Howell & Webb 1990, S. F. Bailey pers. com., R.L. Pitman photos). The small Alijos Rocks colony is consistent with this timing (Pitman 1985), while to the southwest on Clarion I. the timing is later, with eggs not laid until April or May (Brattstrom & Howell 1956, Everett 1988). Photos reviewed of Clipperton I. in November showed many paired boobies on nest scrapes with eggs or just-hatched naked young. Most young fledge there around May–June (Ehrhardt 1971, Pitman pers. com.), but birds hatched in November could fledge by mid-March. I have reviewed two photos (by R. L. Pitman) of fresh juvenal-plumaged Masked Boobies around Clipperton on March 28, 1983. Since these young are dependent on

	Date	Locale and County	Plumage	Bill Color
1	Jan 10, 1977	19 nmi s.w. of San Clemente I., LA	ad	greenish-yellow
2	Nov 14, 1987*	San Elito Lagoon, SD	ad	not determined
3	Apr 23, 1988	Los Coronados Is., Baja, Mexico	juv	grayish
4	Apr 5, 1990	2 mi w. Pt. Lobos, MTY	juv	grayish
5	Jun 18–22, 1992	Salinas R. mouth, MTY	ad	straw yellow
6	Jun 20, 1992	Pt. Mugu, VEN	ad	pale yellow
7	Jun 30, 1992	Newport Beach, ORA	subad	not determined
8	Jan 11, 1993*	San Miguel I., SBA	ad	not determined
9	Apr 30, 1994	3 mi s. of Whites Pt., LA	juv	grayish
10	Aug 9, 1994	SE Farallon I., SF	ad	yellow
11	Jul 16, 1996	23 nmi s.w. San Miguel I., SBA	juv	not determined
12	Jan 18–Feb 3, 1997	Pt Mugu, VEN	near-ad	yellow
13	Jun 15, 1997	10 nmi w. of Pt. Arena, MEN	subad	pale yellowish
14	Aug 29, 1997	2 nmi w. of Pt. Pinos, MTY	ad	not determined
15	Feb 16, 1998	San Miguel I., SBA	subad	bright yellow
16	Jun 19–Aug, 1998	Año Nuevo I., SM	near-ad	greenish-yellow

* = not accepted by CBRC; see footnote 2
 "nmi." = nautical mile
 County abbreviations: LA = Los Angeles, MTY = Monterey, ORA = Orange, SD = San Diego, SF = San Francisco, SM = San Mateo, SBA = Santa Barbara, VEN = Ventura

their parents for 1–2 months, it is very unlikely such birds could reach California by April. They could, however, account for the July juvenal-plumaged bird in California.³

CONCLUSION

Adult and subadult boobies in California waters all appear to have been Masked Boobies. It seems likely some originated from the central Pacific (race *personata*) and some from the eastern Pacific (race *californica*). A mid-July bird, apparently in juvenal plumage, cannot be identified.

Three juvenal-plumaged boobies in April, however, seem likely to have been Nazca Boobies. While bill color was ambiguous, the plumage characters best fit *S. granti*. All lacked a cervical collar, one showed a fair bit of white at the base of the rectrices, and another had a decidedly paler back. These marks are all typical of Nazca Boobies, but quite rare in *californica* Masked Boobies (and absent from Masked Boobies elsewhere in the world). It strains statistical probabilities to argue that all three were the rare morph of *S. d. californica* since the common, collared morph has not occurred here in juvenal plumage. For reasons of parsimony, one or more of the April birds should be *S. granti*.

Possibly more compelling is the analysis of breeding phenology. It seems unlikely that juvenal-plumaged youngsters from the eastern Pacific breeding colonies of Masked Boobies could reach California waters as early as April. In contrast, independent juvenal-plumaged birds in April are common in Galapagos populations, and such birds could easily reach California given the strong north–south component to their pelagic movements. We cannot say that any single record involves Nazca Booby, but as a group the three April records

³Timing of nesting will vary with oceanographic conditions (Nelson 1978). The dates discussed in the main text refer primarily to recent visits to the nesting islands and are thus most applicable to an analysis of recent records of juvenal-plumaged boobies in California. Astute readers may note that specimens of juvenal-plumaged birds from San Benedicto I., Revillagigedos, pictured in Figure 22 are from December. These were collected in 1901; they have such short wings that they could not yet fly. Yet the eggs from which they hatched must have been laid in August or September, a considerably different timing than noted during recent visits to that island.

likely include one or more (or all) Nazca Boobies. Hopefully the next such individual will be showing diagnostic color to the base of its bill.

We are left with some answers but many questions. More study is needed. There are frontiers here that have not yet been explored.

ACKNOWLEDGMENTS

Major credit must go to Robert L. Pitman and Joseph R. Jehl, Jr., who detailed this situation in their landmark 1998 paper in the *Wilson Bulletin*. I am most grateful to Robert L. Pitman who discussed these interesting problems with me before my 1989 field work, who loaned me his entire slide collection of the boobies from his decades at sea, and who reviewed a draft of this paper. Roger B. Clapp loaned me his extensive photo collection and provided details of central Pacific populations. Stephen F. Bailey, Alan Baldridge, Rita Carratello, Kenn Kaufman, and Paul Lehman read earlier drafts of this paper and provided many useful comments; Bailey also assisted in photo review. I profited from discussions with Lisa Ballance, David W. Eades, Gary Fredricksen, Steve N. G. Howell, David James, Tony Palliser, and Peter Pyle. Michael M. Rogers, current CBRC secretary, was helpful in locating and reviewing recent reports, as were Guy McCaskie, Mike San Miguel, Steve Rottenborn, and Daniel Singer. Archived CBRC records were obtained through the courtesy of the Western Foundation of Vertebrate Zoology, with special help from Walter Wehrtje, Jon Fischer, and Peg Stevens. Don DesJardin, Greg Lasley, Ron LeValley, Larry Schumacher, and Stuart L. Warter all contributed photographs for review, and I viewed a video of the Año Nuevo booby by Pat Morris. Bill Irwin copied several hours of his videotaped seabirds for me that included nesting boobies from Clipperton and the Galapagos. Mary LeCroy (AMNH), Phil Angle and Carla Dove (USNM), and Luis Baptista and Karen Cebra (CAS) graciously provided access to specimens in their care. My surveys in the eastern tropical Pacific were supported by Southwest Fisheries Center, NOAA, and I am grateful to S. B. Reilly, R. L. Pitman, and L. Ballance for permission to use the data collected.

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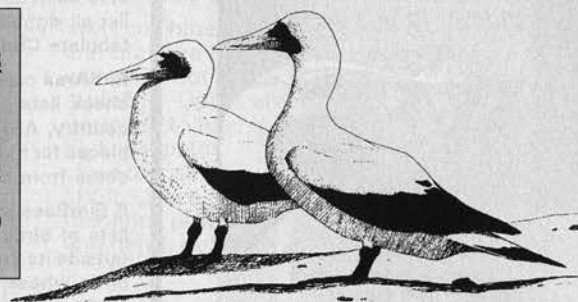
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