

Breeding birds of Hatuta'a, Marquesas Islands: species inventory and influence of drought on their abundance

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SUMMARY.—Hatuta'a (or Hatutu) is a small, remote, uninhabited island located in the northern Marquesas Islands (French Polynesia) that supports a rich seabird assemblage of at least 15 breeding species and four landbird species, including the largest population of the rare Marquesas Ground Dove *Gallicolumba rubescens*. We present data collected from 1922 to 2010 on the breeding birds of Hatuta'a and discuss the influence of a severe drought, observed in 2010, on their distribution and abundance. Numbers of Marquesas Ground Doves and Northern Marquesas Reed Warblers *Acrocephalus percernis* appear to fluctuate according to wet and dry periods that markedly affect the vegetation.

The Marquesas Islands (French Polynesia) are located in the south-east Pacific Ocean at 07–11°S and 139–141°W, c.500 km north of the Tuamotu archipelago and 1,300 km north-east of the Society Islands (Fig. 1). Their climate is a mix of 'humid tropical' and 'arid tropical' (Laurent *et al.* 2004). Because of their exposure to south-eastern humid winds and their

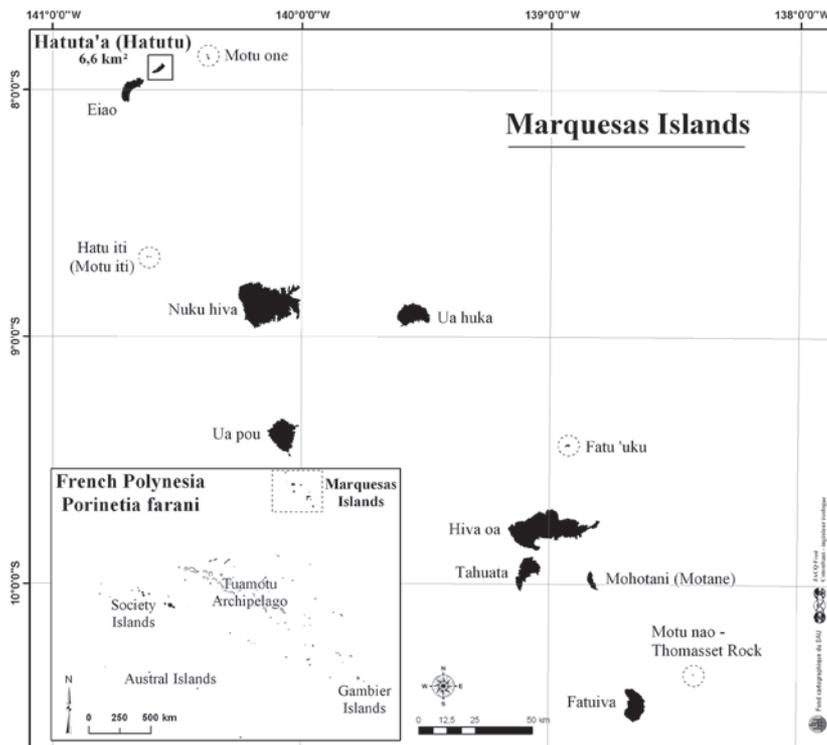


Figure 1. Map of the Marquesas Islands and location of Hatuta'a.

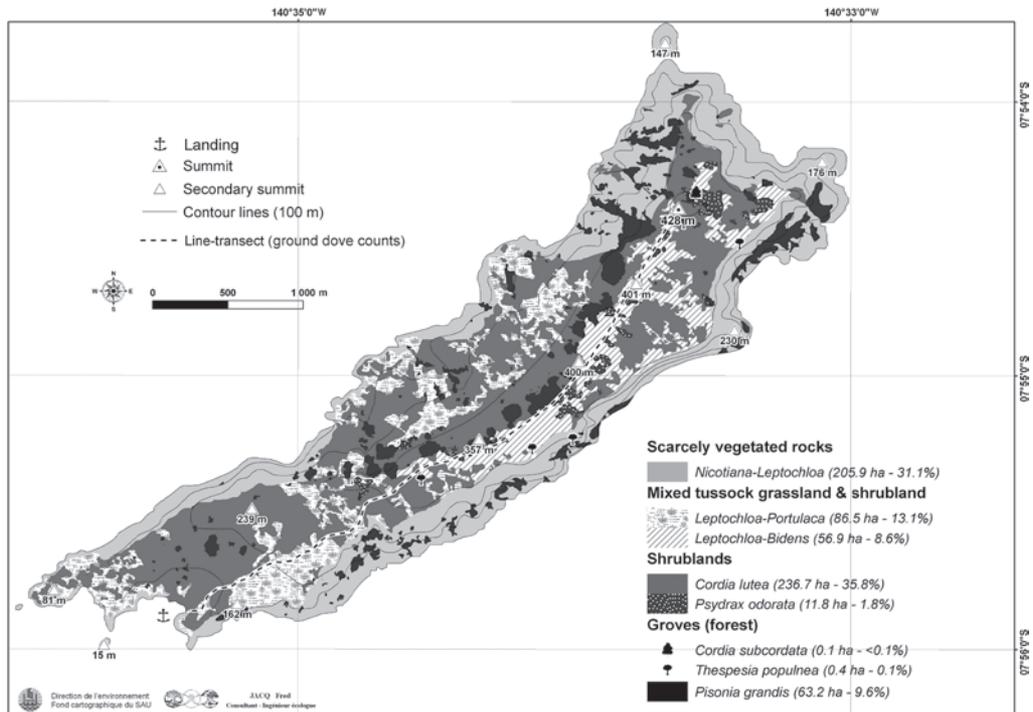


Figure 2. Topographic vegetation map of Hatuta'a and location of the transect used to census Marquesas Ground Doves *Gallinucula rubescens* in 2010 (modified from Butaud & Jacq 2007)

high elevation, most of the Marquesas exhibit a dry to wet altitudinal gradient (Florence & Lorence 1997, Gillespie *et al.* 2011). Hatuta'a, also called Hatutu (07°926'S, 140°578'W) is a small (6.6 km²) remote and uninhabited island in the north of the archipelago, comprising a plateau with a low slope oriented west to east (max. elevation 428 m) and surrounded by sea cliffs (Fig. 2). It is a typical 'dry island' (Decker 1973) regularly subjected to severe droughts. There is no permanent standing water, only temporary pools on the ground or on flat rocks, formed after rain. Low vegetation comprising largely succulent herbs (*Portulaca* spp.), tussocky grass (*Leptochloa xerophila*) and xerophitic shrubs (*Cordia lutea*, *Waltheria tomentosa*), along with scattered groves of larger trees (*Pisonia grandis*, *Thespesia populnea*) cover most of the island. The vascular flora comprises just 26 native species (Florence *et al.* 2007, Butaud & Jacq 2007, 2009, 2011; J.-Y. Meyer unpubl. data 2010).

Hatuta'a has been classified as a 'Territorial Natural Reserve' since 1971 and 'Habitats and Species Management Area' since 2000 (Meyer 2007, Meyer & Salvat 2009). Decker (1973: 66) described it as 'a pristine terrestrial ecosystem—the only sizeable one left undisturbed in the central Pacific dry zone'. The two kinds of oceanic upwelling within the region (Rougerie *et al.* 1992, Rougerie & Wauthy 1993) provide nutrient-rich waters and contribute to the diversity of seabirds, which are well represented on Hatuta'a. On the other hand, a dry climate and small island size probably has contributed to the paucity of landbirds on Hatuta'a, where only four species are known, in contrast to as many as ten on larger islands in the Marquesas. This paper presents a list of the breeding birds of Hatuta'a, an island rarely visited by naturalists, with documented changes since the early 20th century, and records the impact on landbirds of the severe drought of 2010.

TABLE 1

Sources of information on the birds of Hatuta'a. Acronyms: CEPA = Conservation des Espèces et des Populations Animales, CNRS = Centre National de la Recherche Scientifique, EPHE = Ecole Pratique des Hautes Etudes, ORSTOM = Office de la Recherche Scientifique et Technique Outre-Mer (now = Institut pour la Recherche et le Développement), PES = Pacific Entomological Survey, SOP = Société d'Ornithologie de Polynésie.

Visitors	Dates	Sources
R. H. Beck (WSSE)	26–29 September, 2–5, 8, 10–12 October 1922	Beck (ms)
A. M. Adamson (PES)	October 1929	Adamson (1936)
G. Lebronnec & Tauraa (PES)	April 1931	
J.-C. Thibault (ORSTOM-EPHE)	18–28 September 1975	Thibault (1989)
S. L. Montgomery, W. C. & B. H. Gagné (Univ. of Hawai'i, Bishop Mus.)	9 August 1977	Montgomery <i>et al.</i> (1980)
J.-C. Thibault (EPHE)	8–13 August 1987	Thibault (1989)
C. Blanvillain & J.-M. Lernoald (CEPA/SOP)	April 2002	Blanvillain & Lernoald (2003)
B. Gangloff (CNRS) & P. Raust (SOP)	11–14 March 2007	Gouni & Raust (2007)
P. Raust (SOP)	17 August 2008	Raust (2008)
J.-F. Butaud & F. Jacq	5–8 June 2010	This work
A. Cibois, J.-Y. Meyer, E. Poroi & J.-C. Thibault	15–19 November 2010	This work

Methods

Our sources of ornithological data for Hatuta'a include unpublished notes of the Whitney South Sea Expedition (WSSE) archived at the American Museum of Natural History, New York (AMNH), various published expedition and research reports (see Table 1), data from museum specimens at AMNH and the Muséum national d'Histoire naturelle, Paris (MNHN), and field work conducted by the authors in June and November 2010. Bird censuses conducted at different times were difficult to compare due to heterogeneity among observers. However, we used these data to assess status of breeding birds and report on population trends where evident. Our studies of landbirds focused largely on the Marquesas Ground Dove, a Vulnerable species (BirdLife International 2013) found only on Hatuta'a and Fatu'uku in the Marquesas. In November 2010, two teams of observers independently geo-referenced (GPS Garmin) the same c.40 m-wide line transect between the landing site and the summit (Fig. 2). Bird counts were segregated into four 100-m altitudinal zones. Transects were linked to a vegetation map indicating the estimated area of the different vegetation types. This topographic vegetation map results from analysis of aerial photographs taken in 2003 compared to field data from 2007 (Butaud & Jacq 2007).

Results and Discussion

Seabirds.—Table 2 summarises data on status and number of seabirds obtained between 1922 and 2010. With 15 to 19 breeding species, Hatuta'a supports most of the seabird diversity of the Marquesas Islands (21 species in total). However, this diversity obscures the small numbers of breeders of most species, especially terns and boobies, and contrasts with the very large colonies of Sooty Terns *Onychoprion fuscatus* found in some years on other small islands in the Marquesas (Holyoak & Thibault 1984).

TABLE 2
Data on status and number of breeding seabirds from 1922 to 2010. Empty cells correspond to lack of record (see text for references).

Species	September–October 1922	September 1975	August 1987	March 2007	June and November 2010
Herald Petrel <i>Pterodroma heraldica</i>					one displayed with Phoenix Petrels (18 November); status unknown
Phoenix Petrel <i>Pterodroma alba</i>	at least 17 collected; several dozen present	c.30 pairs	one individual	250 pairs	uncommon in June; c.100 in Nov.
Bulwer's Petrel <i>Bulweria bulwerii</i>	five collected at sea				several seen at sea near Hatuta'a (8 June)
Christmas Shearwater <i>Puffinus nativitatis</i>	at least 19 collected, including two chicks	several seen at dusk flying to the plateau			several pairs displaying in the morning at south cliffs (November)
Wedge-tailed Shearwater <i>Puffinus pacificus</i>	at least 11 collected; small colonies	several tens of pairs		possibly heard	
Tropical Shearwater <i>Puffinus bailloni</i>	one chick collected; numerous at sea	heard at dusk and early in the morning mainly on the west side (slopes covered by tussock grass)			
White-throated Storm Petrel <i>Nesofregatta fuliginosa</i>	two adults collected at sea				several dozen seen at sea near Hatuta'a (8 June)
Red-tailed Tropicbird <i>Phaethon rubricauda</i>	eight collected including two chicks	several pairs displaying			20–30 pairs around cliffs of north and south coasts
White-tailed Tropicbird <i>Phaethon lepturus</i>	one visiting a hole in a cliff			one in flight	a pair flying along southern cliffs (November)
Great Frigatebird <i>Fregata minor</i>	12 collected; numerous nests observed	c.300 occupied nests on north and west slopes	c.200 occupied nests, mainly on west slope	150–200 occupied nests on west slope	breeding in June; >1,000 occupied nests in November
Lesser Frigatebird <i>Fregata ariel</i>	at least two chicks collected; nests observed on leeward side	200–300 occupied nests at the same place	no breeding colony	no breeding colony	no breeding colony
Masked Booby <i>Sula dactylatra</i>		three pairs	11 pairs	37 pairs (c.150–200 pairs)	breeding in June; 74 nests (c.100–150 pairs) in November
Red-footed Booby <i>Sula sula</i>	five collected; numerous breeder in trees and shrubs	several hundred nests	several hundred nests	c.50–100 pairs	breeding in June; >1,000 pairs in November
Brown Booby <i>Sula leucogaster</i>	six collected	65 occupied nests	54 occupied nests	c.100–150 pairs, mainly on plateau	breeding in June; 20 occupied nests; several tens of non-breeders in November

Species	September–October 1922	September 1975	August 1987	March 2007	June and November 2010
Grey-backed Tern <i>Onychoprion lunatus</i>	one male collected in breeding condition				
Sooty Tern <i>Onychoprion fuscatus</i>	at least six collected; nests on western islet and on plateau	200–400 pairs breeding on western islet and 1,000 pairs on plateau	breeding on western islet and 300 pairs on plateau	a few dozen on western islet	several tens breeding on western islet in June; no breeding in November
Brown Noddy <i>Anous stolidus</i>	nine collected; not numerous and not breeding	several dozen pairs breeding	several dozen pairs breeding	several pairs breeding	breeding in June; several dozen pairs, but not breeding in November
Black Noddy <i>Anous minutus</i>	12 collected; numerous, but not breeding	several dozen at roost; not breeding	several hundred pairs breeding	200–500 pairs breeding	breeding in June; >1,000 pairs on fresh nests, but no eggs or chicks in November
Blue Noddy <i>Procelsterna cerulea</i>	three collected	several pairs breeding on west cliffs	several pairs breeding on west cliffs		breeding in June; several dozen pairs on west and south cliffs in November
White Tern <i>Gygis alba</i>	'common' and at least 17 specimens collected	several hundred pairs breeding	c.700 pairs breeding pairs	several hundred breeding pairs	breeding in June; >1,000 pairs, but no breeding in November

Breeding uncertain. Two species, Polynesian Storm Petrel *Nesofregatta fuliginosa* and Bulwer's Petrel *Bulweria bulwerii*, have been recorded at sea close to Hatuta'a, but never ashore. A Grey-backed Tern *Onychoprion lunatus* in breeding condition was collected in 1922, but no subsequent evidence of its presence exists. White-tailed Tropicbird *Phaethon lepturus*, recorded several times, might breed in small numbers. A single Herald Petrel *Pterodroma heraldica* (pale morph) displayed in flight with a small group of Phoenix Petrels *P. alba* on 18 November 2010.

Regularly recorded species. Twelve species were recorded by most observers: Phoenix Petrel, Wedge-tailed Shearwater *Puffinus pacificus*, Christmas Shearwater *P. nativitatis*, Tropical Shearwater *P. bailloni*, Red-tailed Tropicbird *Phaethon rubricauda*, Red-footed Booby *Sula sula*, Brown Booby *S. leucogaster*, Great Frigatebird *Fregata minor*, Blue Noddy *Procelsterna cerulea*, Brown Noddy *Anous stolidus*, Black Noddy *A. minutus* and White Tern *Gygis alba*. Numbers of Phoenix Petrel are relatively small, with some variation, possibly related to a complex breeding cycle undetected by infrequent visitors (see Schreiber & Ashmole 1970). However, Hatuta'a is one of the species' few known breeding sites (Brooke 2004, Gangloff *et al.* 2009). Numbers of Great Frigatebirds were large during every visit, and the island represents this species' most important breeding locality in the Marquesas.

Irregular breeders. Lesser Frigatebird *Fregata ariel* has not bred since 1975, while Sooty Tern populations have varied over the years, with the lowest numbers in 2007 and 2010.

Colonisers. Although known from subfossil remains (Steadman 2006), Masked Booby *Sula dactylatra* was not recorded by the WSSE in the first quarter of the 20th century (Beck ms, Quayle ms). The first record, of a few pairs, on Hatuta'a was in 1975, with 100–200 pairs in the 2000s.

TABLE 3
Numbers of breeding landbirds between 1922 and 2010. Periods of severe drought are shaded (see text) and empty cells correspond to lack of record.

Species	September–October 1922	September 1975	August 1987	March 2007	June 2010	November 2010
Pacific Reef Heron <i>Egretta sacra</i>		one pair and a juvenile; one empty nest	one only; two empty nests		at least two	one pair
Spotless Crake <i>Porzana tabuensis</i>	several specimens collected	one only	recorded individually or in pairs at 11 localities	four	not recorded	not recorded; no response to playback
Marquesas Ground Dove <i>Gallicolumba rubescens</i>	common, 73 collected	c.200–250	c.200–250	c.1,070	148 counted	<200 (see Table 4 for details)
Northern Marquesas Reed Warbler <i>Acrocephalus percernis postremus</i>	22 collected	c.35–50 pairs	c.35–50 pairs	c.50–100	uncommon	c.15

Landbirds.—Only four species breed on Hatuta'a (Table 3), one each from the Ardeidae, Rallidae, Columbidae and Acrocephalidae. Pacific Reef Heron *Egretta sacra* occurs on nearly all of the main Marquesas, but at low densities, making the occurrence of only several pairs on Hatuta'a unsurprising. The lack of records of Spotless Crake *Porzana tabuensis* in 2010, despite use of playback in November, is surprising because it was encountered during nearly all previous visits. Its apparent absence may be attributable to the severe drought (see below). Marquesas Ground Dove is endemic to the archipelago and occurred on several islands in the past (Nuku Hiva: Gray 1859; Hiva Oa, Tahuata and Ua Huka: Steadman 2006). Today, it is confined to the smallest islands of Fatu'uku (= Fatu Huku), where a few pairs were recorded in 2011 (Butaud 2011), and Hatuta'a, with the largest remaining population. Both islands are refugia from predators (e.g. feral cats, Black Rat *Rattus rattus* and pigs, which are otherwise widely distributed in the Marquesas). Counts conducted on Hatuta'a in November 2010 (Table 4) revealed a sharp decline compared to 2007 (Table 3). Over the years, Marquesas Ground Dove has been found throughout the island, from shore to summit, including cliffs. They forage on the ground in most habitats, less frequently in trees, and are most abundant in mixed tussock grassland (*Leptochloa xerophila*, *Portulaca* spp.) and subshrub (*Bidens beckiana*), which cover just 21.7% of the island (Fig. 2). Northern Marquesas Reed Warbler *Acrocephalus percernis* is known from only four islands in the northern Marquesas, with each island inhabited by an endemic subspecies (Cibois et al. 2007)—*A. p. postremus* occurs on Hatuta'a. Twenty-two specimens were collected on Hatuta'a in 1922 and as many as 100 birds were observed in each of 1975, 1987 and 2007, but many fewer in 2010 (Table 3). Overall, the numbers of individuals and population density are much lower for *A. p. postremus* compared to other populations of *A. percernis* and Southern Marquesas Reed Warbler *A. mendenae*, which is endemic to the southern Marquesas (AC & J-CT unpubl.).

Consequences for birds of the 2010 drought.—Several severe droughts affecting the vegetation of Hatuta'a have been described (Beck ms, Adamson 1936, Blanvillain & Lernoald 2002). More recently, in 2002 and 2010, droughts resulted in complete defoliation and the disappearance of many plants over much of the island. In March 2007, the vegetation



Figure 3. Vegetation of Hatuta'a during wet and dry periods: (a) West coast. Left: relatively 'green' aspect (August 1987). Right: during severe drought, *Pisonia* trees and *Walteria*–*Cordia* shrubland mostly defoliated (November 2010) (J.-C. Thibault); (b) Ridge in front of Eiao. Left: subshrub (*Bidens*) and shrub (*Walteria*) in front, and trees (*Pisonia*) behind, with their leaves (March 2007) (© Benoît Gangloff). Right: same patch of vegetation completely defoliated (November 2010) (J.-Y. Meyer); (c) Near the summit. Left: patches of succulent herbs (*Portulaca* spp.), tussock grass (*Leptochloa xerophila*) and shrubs (*Cordia*) (March 2007). Right: defoliated shrubs and bare ground (June 2010) (J.-F. Butaud)

was luxuriant, but in June 2010 it was largely defoliated. Some water was trapped in rocky depressions in gullies at the time of the June visit, indicating recent rainfall, but largely dry conditions apparently persisted for the next few months as trees and shrubs were defoliated and ground cover largely absent in November (Fig. 3). Changes in the vegetation in 2010 did not appear to affect seabird breeding. We observed nesting Great Frigatebirds in the defoliated *Cordia lutea*, Red-footed Booby in defoliated *Pisonia grandis*, Brown and Masked Boobies on bare ground, and Phoenix Petrels in dry tussock grass *Leptochloa xerophila*.

TABLE 4
Results of Marquesas Ground Dove *Gallicolumba rubescens* surveys on Hatuta'a in November 2010.

Habitat	Area investigated (ha)		Number of birds counted		Density (birds/ha)		Total area (ha)	Number estimated	
	Count 1	Count 2	Count 1	Count 2	Count 1	Count 2		Count 1	Count 2
<i>Leptochloa-Portulaca</i> (0–100 m)	2	1.2	0	0	0	0	21.0	0	0
<i>Leptochloa-Portulaca</i> (100–200 m)	10.7	1.52	1	0	0.09	0	23.1	2	0
<i>Leptochloa-Portulaca-Bidens</i> (200–300 m)	7.8	3.4	2	4	0.25	1.18	39.2	10	46
<i>Leptochloa-Portulaca-Bidens</i> (>300 m)	c.10	12.6	23	31	2.3	2.46	60.1	138	148
<i>Pisonia grandis</i>	c.15	--	5	--	0.33	--	63.0	21	--
<i>Cordia lutea</i>	c.5	c.5	0	0	0	0	236.6	0	0
Other habitats not occupied							218.4		
Totals							661.4	171	194

The 2010 drought appeared to have a marked affect on populations of at least three of the landbirds. Only Pacific Reef Heron, which forages mainly in marine habitats, seemed unaffected. We attribute the lack of records of Spotless Crake in 2010 to diminished numbers, as well as their being more secretive because of drought-induced reduction in vegetation cover, rather than the species being absent from the island. In the case of the ground dove, numbers drastically declined between March 2007 and November 2010, when birds were mostly concentrated at the (probably more humid) summit and where available habitat covers just 43.5 ha. They were less frequently seen in groves of *Pisonia grandis* and on cliffs on the south side; shrublands of *Cordia lutea* were used to hide from observers and for protection against attacks by frigatebirds. Numbers of ground dove encounters diminished further between June and November 2010, and their range was more restricted. They were encountered at elevations as low as 50 m in June, but not below 100 m in November. Numbers of reed warblers also declined (Table 3). The defoliated *Cordia lutea* was abandoned, in favour of *Pisonia* groves that are probably richer in invertebrates in the leaf litter. No song was heard and all nests were empty, suggesting no recent breeding. A similar situation was noted by the WSSE in 1922, during another severe drought, when all specimens were sexually inactive (Beck ms; AMNH specimens). Conversely, breeding was recorded during a normal wet period when the vegetation was green (Thibault 1989). During most of the dry periods, reed warblers bred on neighbouring Eiao, where the drought was less severe as the island's higher elevation captured rain clouds (Thibault 1989; AC & J-CT unpubl.; AMNH specimens). We suspect that on Hatuta'a, the droughts led to a decrease in resources for landbirds, mainly invertebrates for the reed warbler and seeds for the ground dove. We are uncertain of the rainfall in 2011, but in October 2012 photographs taken from offshore show the vegetation to be only partially defoliated. At this time, Marquesas Ground Doves were again 'abundant' (X. Curvat pers. comm. November 2012 to J-CT).

Our records of Hatuta'a's breeding birds and native biota indicate that they appear relatively well adapted to periodic droughts. In view of global change, with increasing air temperatures (IPCC 2007) and potentially more frequent and intense droughts, the island

may lose its natural resilience to these climatic fluctuations in the future, which would probably dramatically impact its endemic avifauna and flora. We recommend that this protected area of high ecological value should be carefully monitored as a 'sentinel island site' for French Polynesia's terrestrial biodiversity.

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