The highland forests of northern Central America—part of the Mesoamerican biodiversity ‘hotspot’—support rich avian communities that display high levels of regional endemism. However, compared to similar ecosystems elsewhere in Middle America—those of Costa Rica or Mexico, for example—they remain poorly studied by ornithologists. The montane forests of northern Honduras near the Caribbean coast are especially under-explored, with few published data from this region. An indication of the Wallacean shortfall (lack of species-level biogeographic data) from the area is its exclusion from regional reviews of avian richness in Mesoamerican cloud forests, and the lack of Important Bird Areas (IBAs) identified by BirdLife International. This paucity of information has facilitated some ambiguity as to which species occur in these coastal mountains and how their altitudinal distributions differ from those reported from highland forests in the interior cordilleras of Central America. Here, we review data collected in 2006–14 by the long-running Operation Wallacea ornithological monitoring programme in Cusuco National Park (CNP) and its immediate environs.
in north-west Honduras. We highlight notable distributional and altitudinal records based on information in the literature.

**Study area and Methods**

CNP is a protected area in dpts. Cortés and Santa Bárbara in north-west Honduras (Fig. 1). It is located in the Sierra de Omoa, part of the Cordillera de Merendón, encompassing an altitudinal range of 500–2,242 m

The study area comprises parts of two protected areas: most of CNP and the adjacent Merendón Water Producing Zone; additionally the nearby Caribbean lowlands include Cuyamel-Omoa National Park (Fig. 1). We also reviewed records from the coastal village of Paraíso (15°41.2’N 88°06.2’W) which lies entirely outside but close to CNP’s northern border.

Vegetation classifications in CNP include cleared agricultural land and patches of second-growth moist broadleaf forest at lower altitudes (500–1,200 m), semi-arid pine–oak forest and tropical montane cloud forest at middle / upper elevations (1,200–2,000 m), and elfin forest on mountaintops above 2,000 m

Despite its relatively small size, CNP supports a rich biodiversity with high levels of endemism among many taxonomic groups, especially herpetofauna

Its biological importance is such that it was recently listed as one of Earth’s top 100 ‘most irreplaceable’ protected areas

Eight-week formal ornithological surveys were undertaken in CNP in June–August annually since 2006 as part of an Operation Wallacea long-term biodiversity monitoring programme

and were preceded by informal preliminary survey work in 2004–05. The formal monitoring programme comprised two survey methods. Firstly, an extensive point count protocol whereby ten-minute unlimited-radius dawn counts

(05h30–09h30 each morning) were conducted at 129 sites located throughout CNP. These sites were spread across 28 transects of variable length. Transects each contained between two and eight sites, with a distance of 300 m separating each site. Each site was surveyed three times in the course of each field season. As of the end of the 2014 season, the survey has yielded c.571 person-hours of opportunist observations during the main field seasons (when ornithologists were in the field but not undertaking formal survey work). Some additional surveys were undertaken at other times of year—notably field work led by JVD to survey wintering Golden-cheeked Warblers Setophaga chrysoparia in CNP’s pine–oak habitats

This was undertaken in January or February for a period of five days annually in 2007–09, with a two-day survey in January 2010. Consequently the park’s avifauna is now relatively well known, especially its resident species. A total of 287 species had previously been reported from CNP

although we carefully scrutinised the previously published inventory and removed several uncertain records. This produced a more conservative park list of 266 species. A full account of species removed from the previous inventory will be provided in a future publication (Jones et al. in prep).

To identify notable range extensions, we compared all 266 species on our list with the distributions mapped in one of the region’s widely used field guides

the principal monograph on Honduran avifauna

various periodical publications

and high-quality online resources

We also consulted the distribution maps in the national field guide to Honduras prior to its publication. We include any range extensions reported in the latter work here, given that they had been unpublished elsewhere at the time of writing. We acknowledge that this is a limited range of material against which to compare our records—this is due to a paucity of ornithological research in the region (further highlighting the need for more information regarding regional species distributions). We defined all species detected in the park, but not currently mapped anywhere within north-west Honduras in any of our comparative sources, as ‘substantial extensions’ of range, and all species mapped as occurring in north-west Honduras by at least one previous source, but not within the CNP, as ‘minor extensions’. We also calculated the number of observations for each species regarded as a range extension by our formal surveys (and opportunistic records for which we possessed quantitative data).

We noted our highest and lowest altitudinal records for each species on the park list, and compared these against altitudinal ranges described elsewhere. Elevations were obtainable for most records in our database as all of the long-term mist-netting and point count locations possess accurate GPS coordinates. Opportunistic sightings that could not be accurately calibrated to a nearby GPS coordinate were discarded. All species for which our data exceed the currently defined overall altitudinal ranges we report as global high- or low-altitude records. All species for which our
data exceed currently described elevation ranges for northern Central America—especially those in Howell & Webb12—we report as regional high- or low-altitude records.

Following recommendations for publicly accessible, digital inventories26, we uploaded all available vocal recordings and photographs supporting our records to Xeno-canto (www.xeno-canto.org) and the Internet Bird Collection (http://ibc.lynnexds.com), respectively, and collated unique voucher numbers for each.

### Results

In the course of processing the data collected between 2006 and 2014, we reviewed a total of 25,781 individual bird records in our point count database and 2,772 captures in our mist-netting database, as well as opportunistic sightings from all of the authors’ personal records. From this analysis, we identified 18 species for which we believe our records represent a substantial extension to their currently described range (Table 1), and a further 23 species that we report as minor range extensions (Table 2). All of these range extensions are based on records made within the borders of CNP except Spot-breasted Oriole *Icterus pectoralis* and Altamira Oriole *I. gularis*. Both were recorded just outside the park in Paraíso village on the Caribbean coast, where they appear to be common. We also identified another ten species for which we believe our data represent new global high-altitude records (Table 3) and ten which we believe represent regional high-altitude records (Table 4). No global or regional low-altitude records were identified.

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### Table 1. Bird species records from Cusuco National Park representing substantial extensions to current ranges. Taxonomy follows that of AOU1. Species denoted <wv> are winter visitors. Species marked * are Mesoamerican hotspot endemics and are discussed in the species accounts. Species marked # were detected just outside the limits of Cusuco National Park on the Caribbean coast at Paraíso. Species marked † were mapped as occurring in Cusuco National Park and/or its vicinity by Gallardo et al.10. Species highlighted in bold are known to breed in the study area. Notations in the evidence column are as follows: C = captured (mist-netted), H = heard, P = photographed, S = sight record. # Observ column shows total number of individuals of each species detected during formal surveys and opportunistic records for which we possess quantitative data. Species marked > in this column possess further opportunistic records, but without quantitative data. Initials in the observer column are those of authors with records of each species. Species observed by four or more authors are annotated ‘multiple’.

<table>
<thead>
<tr>
<th>Family</th>
<th>English name</th>
<th>Scientific name</th>
<th>Evidence</th>
<th># Obs</th>
<th>Observers</th>
<th>XC voucher</th>
<th>IBC voucher</th>
</tr>
</thead>
<tbody>
<tr>
<td>Columbidae</td>
<td>White-winged Dove†</td>
<td>Zenaida asiatica</td>
<td>S,H,P</td>
<td>442</td>
<td>Multiple</td>
<td>XC192164</td>
<td>IBC319291</td>
</tr>
<tr>
<td>Apodida</td>
<td>Black Swift†</td>
<td>Cypseloides niger</td>
<td>S,H,P</td>
<td>&gt;13</td>
<td>SEIJ, TM, WS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trochilidae</td>
<td>Berylline Hummingbird</td>
<td>Amazilia beryllina</td>
<td>S,C,P</td>
<td>2</td>
<td>WS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Picidae</td>
<td>Acorn Woodpecker†</td>
<td>Melanerpes formicivorus</td>
<td>S,H,C</td>
<td>&gt;6</td>
<td>Multiple</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vireonida</td>
<td>Warbling Vireo&lt;wv&gt;</td>
<td>Vireo gilvus</td>
<td>S</td>
<td>&gt;1</td>
<td>ER</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Certhiidae</td>
<td>Brown Creeper†</td>
<td>Certhia americana</td>
<td>S</td>
<td>2</td>
<td>JVD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Troglodytida</td>
<td>Rufous-browed Wren*</td>
<td>Troglodytes ruficollis</td>
<td>S,H,P</td>
<td>&gt;1</td>
<td>ER</td>
<td>XC284621</td>
<td>IBC20167</td>
</tr>
<tr>
<td>Cinclidiae</td>
<td>American Dipper</td>
<td>Cinclus mexicanus</td>
<td>S,H,C,P</td>
<td>&gt;4</td>
<td>Multiple</td>
<td>XC319292</td>
<td></td>
</tr>
<tr>
<td>Turdidae</td>
<td>Ruddy-capped Nightingale-Thrush†</td>
<td>Catharus frantzii</td>
<td>S,H,C,P</td>
<td>110</td>
<td>Multiple</td>
<td>XC286563</td>
<td>IBC319289</td>
</tr>
<tr>
<td>Parulidae</td>
<td>Townsend’s Warbler&lt;wv&gt;</td>
<td>Setophaga townsendi</td>
<td>S</td>
<td>2</td>
<td>JVD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parulidae</td>
<td>Hermit Warbler†&lt;wv&gt;</td>
<td>Setophaga accadialis</td>
<td>S</td>
<td>4</td>
<td>FR, JVD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parulidae</td>
<td>Painted Redstart</td>
<td>Myioborus pictus</td>
<td>S</td>
<td>2</td>
<td>JVD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thraupidae</td>
<td>Cinnamon-bellied Flowerpiercer</td>
<td>Diglossa baritula</td>
<td>S,H,C,P</td>
<td>5</td>
<td>Multiple</td>
<td>XC319290</td>
<td></td>
</tr>
<tr>
<td>Icteridae</td>
<td>Spot-breasted Oriole†</td>
<td>Icterus pectoralis</td>
<td>S,P</td>
<td>4</td>
<td>Multiple</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Icteridae</td>
<td>Altamira Oriole†</td>
<td>Icterus gularis</td>
<td>S</td>
<td>5</td>
<td>Multiple</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fringillida</td>
<td>Elegant Euphonia†</td>
<td>Euphonia elegantissima</td>
<td>S</td>
<td>&gt;1</td>
<td>Multiple</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---
Fourteen sound-recording and 24 photographic vouchers were lodged in support of our distribution records (Tables 1–2). No vouchers were lodged for altitudinal records as we did not possess recordings or photographs pertaining to any of the specific individual records, nor would they represent verifiable documentation of altitude.

None of these records pertain to species considered threatened or Near Threatened by the IUCN, although seven are of endemics that occur only in the Mesoamerican biodiversity hotspot. We provide further information relating to these regional endemics in the following species accounts.

Black-crested Coquette Lophornis helenae
Fairly rare and local, typically recorded c.2–3 times per field season by a combination of mist-net captures, point count records and opportunistic observations. Global high-altitude record. Max. altitude 1,500 m, but TM, ER & WS caught one in a mist-net in pine-oak forest at 1,655 m on 25 June 2007. Additional records in CNP were made at 1,500–1,650 m in other areas of pine-oak forest, broadleaf cloud forest, and cultivated clearings within the park’s borders.

White-bellied Emerald Amazilia candida
Fairly common throughout the park and frequently recorded via mist-netting and opportunistic observations. Global high-altitude record. The literature currently defines its altitudinal range as 0–1,600 m. SEIJ & ID trapped one at an elfin forest edge at 1,930 m on 25 June 2012. Also regularly recorded at 1,600–1,900 m elsewhere in the park.

Wine-throated Hummingbird Atthis elliotti
Rare in CNP, being recorded a total of seven times by our formal surveys (usually individuals...
Records from Cusuco National Park, Honduras

Table 3. Bird records from Cusuco National Park representing global high-altitude records. Taxonomy follows that of the AOU1. Species marked <sv> are summer visitors. Species marked * are Mesoamerican hotspot endemics8 and are discussed in the species accounts. The ‘previous record’ column refers to sources of these records in the References. Species marked † are also noted as occurring at or beyond these elevations in Gallardo et al.10. Notations in the evidence column are as follows: C = captured (mist-netted), H = heard, P = photographed, S = sight record. Notations in the observer column represent the initials of the author(s) responsible for the record.

<table>
<thead>
<tr>
<th>Family</th>
<th>English name</th>
<th>Scientific name</th>
<th>CNP record</th>
<th>Previous record</th>
<th>Evidence</th>
<th>Observers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Columbidae</td>
<td>Grey-chested Dove</td>
<td>Leptotila cassini</td>
<td>1,655 m</td>
<td>1,400 m8,13</td>
<td>C</td>
<td>ER, WS</td>
</tr>
<tr>
<td>Trochilidae</td>
<td>Black-crested Coquette*</td>
<td>Lophornis helenae</td>
<td>1,655 m</td>
<td>1,500 m13</td>
<td>C</td>
<td>ER, WS</td>
</tr>
<tr>
<td></td>
<td>White-bellied Emerald†</td>
<td>Amazilia candida</td>
<td>1,930 m</td>
<td>1,600 m4</td>
<td>C</td>
<td>ID, SEIJ</td>
</tr>
<tr>
<td>Ramphastidae</td>
<td>Keel-billed Toucan†</td>
<td>Ramphastos sulphuratus</td>
<td>1,640 m</td>
<td>1,600 m18</td>
<td>S</td>
<td>ID</td>
</tr>
<tr>
<td>Furnariidae</td>
<td>Scally-throated Leaf-tosser</td>
<td>Selasorus guatemalensis</td>
<td>1,560 m</td>
<td>1,250 m18</td>
<td>S, P</td>
<td>SEIJ</td>
</tr>
<tr>
<td></td>
<td>Ruddy Woodcreeper</td>
<td>Dendrocincla homochroa</td>
<td>1,940 m</td>
<td>1,800 m18</td>
<td>C</td>
<td>TM, WS</td>
</tr>
<tr>
<td>Troglodytidae</td>
<td>Nightingale Wren</td>
<td>Microcerculus philomela</td>
<td>2,015 m</td>
<td>1,800 m9</td>
<td>H</td>
<td>FR</td>
</tr>
<tr>
<td></td>
<td>Spot-breasted Wren*</td>
<td>Phlegopterus maculatus</td>
<td>1,620 m</td>
<td>1,300 m13</td>
<td>S</td>
<td>ER</td>
</tr>
<tr>
<td>Turdidae</td>
<td>Black-headed Nightingale-Thrush</td>
<td>Catharus mexicanus</td>
<td>2,070 m</td>
<td>1,800 m8,13</td>
<td>H</td>
<td>FR</td>
</tr>
<tr>
<td>Cardinalidae</td>
<td>Red-throated Ant Tanager</td>
<td>Habia fasciacauda</td>
<td>1,350 m</td>
<td>1,300 m18</td>
<td>C</td>
<td>ER</td>
</tr>
</tbody>
</table>

Table 4. Bird records from Cusuco National Park representing regional (northern Central America) high-altitude records. Table 3 provides a summary of all information provided and of all symbols used.

<table>
<thead>
<tr>
<th>Family</th>
<th>English name</th>
<th>Scientific name</th>
<th>CNP record</th>
<th>Previous record</th>
<th>Evidence</th>
<th>Observers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eurypygidae</td>
<td>Sunbittern</td>
<td>Eurypygus helias</td>
<td>1,565 m</td>
<td>1,300 m18</td>
<td>C</td>
<td>TM, WS</td>
</tr>
<tr>
<td>Furnariidae</td>
<td>Wedge-billed Woodcreeper</td>
<td>Glyphorynchus spinurus</td>
<td>1,350 m</td>
<td>1,200 m13</td>
<td>C</td>
<td>WS</td>
</tr>
<tr>
<td>Tyrannidae</td>
<td>Ochre-bellied Flycatcher†</td>
<td>Myiarchus euleucus</td>
<td>1,655 m</td>
<td>1,600 m13</td>
<td>C</td>
<td>ER, WS</td>
</tr>
<tr>
<td></td>
<td>Yellow-olive Flycatcher†</td>
<td>Tachyphonus sulphurenses</td>
<td>1,350 m</td>
<td>1,200 m13</td>
<td>C</td>
<td>WS</td>
</tr>
<tr>
<td></td>
<td>Sulphur-bellied Flycatcher&lt;sv&gt;</td>
<td>Myiodynastes latreutris</td>
<td>1,925 m</td>
<td>1,800 m8,13</td>
<td>S</td>
<td>TM</td>
</tr>
<tr>
<td>Vireonidae</td>
<td>Lesser Greenlet</td>
<td>Hylophilus decurtatus</td>
<td>1,575 m</td>
<td>1,500 m9,12</td>
<td>S</td>
<td>ID</td>
</tr>
<tr>
<td>Troglodytidae</td>
<td>White-breasted Wood Wren†</td>
<td>Hermitia leucatactis</td>
<td>1,430 m</td>
<td>1,300 m9,12</td>
<td>H</td>
<td>SEIJ</td>
</tr>
<tr>
<td>Incertae Sedis</td>
<td>Bananaquit</td>
<td>Coereba flaveola</td>
<td>1,655 m</td>
<td>1,000 m12</td>
<td>C</td>
<td>ER, WS</td>
</tr>
<tr>
<td>Cardinalidae</td>
<td>Red-crowned Ant Tanager</td>
<td>Habia rubica</td>
<td>1,650 m</td>
<td>1,500 m13</td>
<td>S</td>
<td>ID</td>
</tr>
<tr>
<td>icteridae</td>
<td>Chestnut-headed Oropendola†</td>
<td>Psarocolius wagleri</td>
<td>1,625 m</td>
<td>1,200 m13</td>
<td>H</td>
<td>ER</td>
</tr>
</tbody>
</table>

Trapped in mist-nets). However, it was recorded on several additional occasions during recent field work not included here (SEIJ pers. obs.). Minor range extension as, while mapped as occurring in north-west Honduras13,32,2 these maps do not encompass most of CNP. Breeds in CNP as evidenced by a female with a brood patch and a male with cloacal protuberance (WS), and observations of numerous males singing on territories (SEIJ).

**Yellowish Flycatcher Empidonax flavescens**

Very common in CNP, with 871 records at 1,200–2,000 m. Minor range extension as current maps only indicate its presence within a very small part of the Merendón cordillera beyond the CNP13,32. Evidence of breeding regularly observed in CNP by SEIJ & WS, including females with brood patches, males with cloacal protuberances, and juveniles both trapped and observed in the field.
Rufous-browed Wren *Trogodytes rufociliatus*

Apparently rare in CNP, known only from one photographed by ER at c.1,300 m on 5 August 2007. Substantial range extension, current literature describing the species only from the central cordilleras of Honduras, c.70 km to the south.\(^{4,10,13}\) However, this species was recorded relatively regularly during more recent field work not included herein, with multiple singing males heard and seen on territories at several locations (SEIJ pers. obs.).

Spot-breasted Wren *Pheugopedius maculipectus*

Fairly common at lower–middle altitudes in the park, being detected relatively frequently by mist-netting and point counts. Global high-altitude record. Currently reported altitudinal range 0–1,300 m\(^{4,12,13,25}\), and, while the majority of our records are from this range, it has occasionally been detected higher, up to 1,620 m (sight record by ER on 2 August 2006). Also recorded by JVD at higher altitudes than the current limits in Santa Barbara National Park, central-west Honduras.

Mountain Thrush *Turdus plebejus*

Rare in CNP. Known from only three records (a sight record by ER on 28 July 2006, and vocal records by FR & ID on 8 July 2010 and 22 June 2012), all above 1,700 m in the centre of the park. These represent a substantial extension to the species’ known distribution, it being currently mapped as occurring only in the central cordilleras of Honduras, c.70 km to the south.\(^{4,10,12,32}\).

Discussion

This study reports a large number of new distribution and elevational records from the mountains of north-west Honduras. Many of the range extensions are of species apparently very common in CNP, e.g. Common Chlorospingus *Chlorospingus flavopectus* (2,912 records) and White-winged Dove *Zenaida asiatica* (442 records). Other species appear to be very rare, e.g. Chestnut-collared Swift *Streptoprocne rutila* and Sparkling-tailed Hummingbird *Tilmatura dupontii*, both of which are known from single records alone. It is uncertain whether these infrequently recorded species are transient visitors, naturally rare, or under-recorded by our surveys. Further work in CNP may improve our knowledge of their status.

Several range extensions we report are substantial, e.g. for Ruddy-capped Nightingale-Thrush *Catharus frantzii* and Mountain Thrush. Several altitudinal range extensions are also notable; Banaanaquit *Coereba flaveola*, for example. While this species occurs in montane ecosystems elsewhere in the Neotropics up to 2,400 m\(^{13}\), its upper elevational limit in northern Central America is reported to be 1,000 m\(^{12}\). Records from CNP greatly exceed this, with the species recorded as high as 1,655 m.

Several reasons can be hypothesised for the fairly substantial number of novel records we have reported from CNP. Many new range records probably reflect Wallacean shortfall, considering the poorly studied nature of the mountains of northern Honduras. Our review of the literature located no other recent scientific research from these mountains other than that resulting from Operation Wallacea’s biodiversity monitoring programme in CNP. That the area remains poorly explored indicates that the potential for novel records is high. Existing distribution maps also suggest a presumption by species distribution models (presumably influenced by the lack of field data) that several montane species only occur in the higher central Honduran mountains. Some of our range extensions prove this is not correct. The previously undocumented presence of other montane species is perhaps the product of assumptions that some species found in the interior cordilleras of Honduras do not reach the Caribbean slope, which many of our minor range extensions indicate is not the case.

The relatively numerous new high-altitude records we present from CNP are, at least in part, likely to stem from a lack of regional exploration, in the mountains of north-west Honduras specifically but also in Mesoamerican montane areas generally. The lack of detailed ecological data for many species in these mountains suggests that their altitudinal ranges might be inadequately known, at least regionally. This could be especially relevant with respect to seasonal upslope movements. Another factor is the coastal nature of the mountains within CNP. Milder maritime climate and the influence of Alizé trade winds on the north-facing slope of the Merendón cordillera create relatively warm conditions at middle and high altitudes in CNP, which could permit some species to persist higher than is possible in the cooler, drier mountains of interior Central America\(^7\). The influence of warmer air parcels influencing species distributions in cloud forests has been described elsewhere, albeit not for birds\(^8\). However, if local conditions do influence avian ranges on the Caribbean slope, without a more thorough understanding of the ecological determinants of avian species ranges relevant to microclimate, accurate predictions will prove challenging. These are interesting ecological questions, however, that could have a potentially important influence on our understanding of the biogeography of the northern Central American coast.

The large number of novel altitudinal records we report from CNP might also reflect the effects of climate change. Upslope elevational shifts in species distributions have been identified as one
of the major consequences of global warming in tropical montane cloud forests. Such changes could represent a serious conservation concern for the park’s avifauna, as continued warming and associated changes in habitat structure are predicted to severely limit suitable habitat ranges for many cloud forest endemics inhabiting Mesoamerican cordilleras in the mid-term future.

In summary, our study contributes to an understanding of avian distributions in montane forests of north-west Honduras. Our results also suggest conservation implications for other northern Mesoamerican coastal ranges, indicating that the biological importance of cordilleras facing the Caribbean may have been under-estimated, being more species rich and supporting broader altitudinal niches than predicted previously. Such implications extend to nearby protected areas. Pico Bonito National Park, 130 km to the east, for example, covers a large (107,107 ha) part of the Cordillera Nombre de Dios and reaches altitudes of 2,480 m. Despite being one of the primary birdwatching destinations in Honduras, little formal ornithological work has been conducted there and it remains poorly known. Our results from CNP suggest that the forests of Pico Bonito, along with other mountains on the northern Honduran coast, could support richer avian communities than predicted by published range maps, and this should be considered when determining the conservation value of these poorly studied areas. We strongly advocate continued exploration of these ecosystems, as well as of the ecological determinants and mechanisms underpinning biogeographical patterns there.

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