

Study of morphometric characters and feeding preferences, of Sindh Sparrow (*Passer pyrrhonotus*) captured from Punjab areas of Pakistan

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Abstract- The objective of this study was to evaluate the morphological traits and feeding habits of Sindh sparrow. A total of 20 Sindh sparrows were collected from marshes in District Bahawalnagar, Punjab, Pakistan. Recorded measurements included body weight, total length, tail length, wingspan, single wing length, primary wing length, tarsal length, metatarsal length, head size, bill length, and body circumference. Significant differences were observed in the morphometric characteristics between male and female sparrows. For male sparrows, specific measurements were body weight (6.11 ± 0.11 g), body length (13.60 ± 0.60 cm), tail length (5.40 ± 0.40 cm), wingspan (20.0 ± 1.50 cm), single-wing length (8.50 ± 1.00 cm), primary wing length (7.00 ± 1.00 cm), tarsal length (1.90 ± 0.60 cm), metatarsal length (1.30 ± 0.50 cm), head size (1.60 ± 0.40 cm), bill length (1.40 ± 0.50 cm), and body circumference (7.75 ± 0.75 cm). These were compared to corresponding measurements for female sparrows: body weight (16.20 ± 0.12 g), body length (14.00 ± 0.50 cm), tail length (6.2 ± 0.30 cm), wingspan (20.75 ± 1.75 cm), single-wing length (9.4 ± 0.40 cm), primary wing length (7.35 ± 1.15 cm), tarsal length (1.9 ± 0.60 cm), metatarsal length (1.45 ± 0.35 cm), head size (1.65 ± 0.45 cm), bill length (1.4 ± 0.50 cm), and body circumference (8.5 ± 1.00 cm). The study concludes that there are morphometric differences between male and female sparrows, their feeding preferences are similar, with diet consisting of herbal substances and various species from different families.

Index Terms-- Sindh sparrow, *Passer Pyrrhonotus*, Morphometry, feeding preferences, Pakistan

I. INTRODUCTION

The Sindh Sparrow, also known as the Rufous-backed Sparrow or Sindh Jungle Sparrow, is scientifically named *Passer pyrrhonotus* (Chandio, Dharejo, Naz, & Khan, 2015). This passerine bird belongs to the order Passeriformes, the family Passeridae, and the genus *Passer*. It is native to the South Asian region, particularly the Indus Valley (Chandio, 1844). The Sindh Sparrow's distribution is primarily confined to this area, ranging from Jhelum near Nurpur Noon to the Indus Delta, and extending north to the Kabul River near Nowshera. It breeds locally in various parts of Pakistan, especially in the western province of Balochistan, and in southeastern Iran. During the breeding season, the Sindh Sparrow is predominantly found in these specific regions. There are no significant threats to its existence, and it is classified as of least concern on the IUCN Red List (Ghalib et al., 2019; Siddique, Bokhari, Yasmeen, Aslam, & Safi, 2023). The Sindh Sparrow exhibits noteworthy migratory patterns, engaging in striking-distance activities during the winter season. Some individuals migrate to parts of western Pakistan and adjoining areas of Iran, while others are occasionally

spotted in north-western Gujarat, India. Notably, there have been reports suggesting more extended movements, such as a potential sighting in the United Arab Emirates in November 2000 (Rizwan, 2019). The breeding habits of the Sindh Sparrow involve nesting in tall grass, shrubs like acacia, and flowering plants like tamarisk scrub, usually in proximity to rivers and various wetlands (Siddique et al., 2023). In the Sindh region, the habitat of the Sindh Sparrow has expanded due to the construction and expansion of irrigated canals, contributing to its range extension into the Yamuna floodplain and parts of Rajasthan, India.

The Sindh Sparrow is characterized by a body size of 13 cm (5.1 in), slightly smaller than other species of the same family, such as the *Passer domesticus* Indicus, which has a body size of 15 cm (5.9 in). The wingspan ranges from 6.2 to 7.0 cm (2.4 to 2.8 in), tail length varies from 4.7 to 5.7 cm (1.9 to 2.2 in), and tarsal measurements fall within the range of 1.6–1.9 centimetres (0.63–0.75 in) (Bilqees, 2010). In terms of physical characteristics, the male Sindh Sparrow exhibits a small and slender black beak, a distinctive eye streak that does not reach the mantle, a grey crown and nape, and a rufous

lower back and buttocks (L.M.Shaw, 2008). Conversely, the female has a darker and greyer crown and breast compared to the female house sparrow, and the shoulder features a darker narrative. While resembling the male Sind Sparrow, the female Dead Sea Sparrow of the genus *Passer pyrrhontous* can be differentiated by yellow traces on the underparts and occasionally on fragments of the skull (Summers-Smith, 2007). The bill is black in breeding males and pale brown in non-breeding males and females, measuring 1.1–1.3 centimetres (0.43–0.51 in), making the Sindh Sparrow slightly smaller-billed than the house sparrow (Chandio, 1909). Their feeding habits involve consuming the spores of grasses and flowers like Polygonal plebeian, as well as feeding on spine-chilling centipedes such as caterpillars, primarily to sustain fledglings. The breeding range of the Sindh Sparrow is in the Indus Valley, encompassing western India and Pakistan (Chandio, 1909). While feeding, Sindh Sparrows tend to form groups, often establishing minor clusters of four to six sparrows. They exhibit a preference for mobile associations, and non-breeding Sindh Sparrows may roost in acacias or tamarisks, flowering plants near water (Marta.K.Lobocho, 2011). During the non-social standing period in winter, they form larger assemblies, with groups numbering as many as 30 Sind Sparrows, and may also interact with other seed-eating Sindh Sparrows (Hussain, 2018). Although the sparrows feed on different matters, this study was designed to investigate the morphometric characters and feeding preferences of Sindh Sparrows in different Punjab areas of Pakistan including Districts Okara and Bahawalpur. The hypothesis is sparrows eat different kind of matters in selected areas or not.

II. MATERIALS AND METHODS

STUDY AREA AND DURATION

Sindh Sparrow samples were systematically gathered from diverse water bodies in Districts Okara and Bahawalpur, including lower Baari Doab, LBD Chuchak Road, Tehsil Renala, Head Sulimanki, and Bahawalnagar. These locations play a crucial role as watering areas for migratory birds, serving as vital habitats for avian populations. A consistent effort was made to collect samples with daily visits during both morning and evening periods, covering the time frame from December 2020 to March 2021. This meticulous collection process aimed to provide a comprehensive understanding of the Sindh Sparrow population in these significant habitats throughout the specified duration

ETHICAL CONCERN AND CONSENT TO PUBLISH

The research strictly followed the ethical principles outlined in the Declaration of Helsinki. Ethical clearance was obtained from the university administration, ensuring compliance with ethical standards throughout the study. Additionally, formal consent was acquired from the relevant department, specifically for the publication of the research findings. These measures underscore the commitment to ethical practices and transparency in the research process.

MORPHOMETRIC PARAMETERS

Approximately 20 samples, comprising 10 females and 10 males, were captured with the assistance of licensed hunters possessing valid shooting licenses. These specimens underwent various morphological measurements, including body weight measured using both top and electronic balances. Additional measurements included body length (from the tip of the beak to the end of the tail), wingspan (from the tip of one outstretched wing to the other), primary wing length (from the bend of the wings to the tip of the longest feathers), tarsal length (from the shank to the base of the toes), metatarsal length (from the ankle to the tip of the toes), body circumference (measured at the largest portion of the breast), beak length (from the tip of the beak to the set point where feathering begins), and head length (from the back of the skull to the tip of the bill). All measurements were recorded using a measuring tape with a precision of 1mm. Following the morphological measurements and blood sample collection, all the birds were released back into their natural habitat (Sripad, 2014).

FOOD PREFERENCES

Birds captured in the field were promptly slaughtered to facilitate the removal of gastrointestinal tracts. Each gastric territory was carefully packed separately in polythene bags, labeled with relevant information such as field number, date, and sex, and then placed in an icebox for transportation to the Ornithological Research Laboratory. Upon arrival, the samples were stored in a refrigerator at 4°C for further processing. The stomach was then dissected to eliminate food material, which was sifted through standard process testing sieves. Utilizing a dissecting microscope (60X, SESYG306), different types of items within the stomach contents were meticulously separated and identified. This detailed process allows for a thorough examination of the avian diet and contributes valuable insights to ornithological research (W.M.Aslam, 2021).

STATISTICAL ANALYSIS

The data obtained was subjected to standard statistical analysis methods, including the calculation of mean, standard error of the mean, and range. This analysis was conducted using IBM SPSS (version 21), a widely-used statistical software. To assess the significance of differences, an unpaired t-test was employed at a 0.05 significance level. Furthermore, Pearson correlation coefficients were calculated to explore the relationships between different variables within the dataset (Fernandez, Osiewalski, & Steel, 1997).

RESULTS

This study focused on investigating the morphological characteristics and food preferences of the Sindh Sparrow, utilizing samples collected from the wetlands of District Bahawalnagar, Punjab, Pakistan. The exploration aimed to gain insights into the physical attributes and dietary habits of this avian species within the specified geographical context.

MORPHOLOGICAL STUDY

A total of 20 Sindh Sparrows, comprising 10 females and 10 males, were subjected to morphological parameter analysis.

Various morphological parameters, including body weight, body length, tail length, wingspan, single wing length, primary wing length, tarsal, metatarsal, head size, bill size, and body circumference, were examined. The range of different morphometric parameters in male and female Sindh Sparrows is detailed in Table 1.

The adult female body weight ranged from 16.08 to 16.20 g (16.20 ± 0.12), while adult males exhibited a body weight range of 16.22 to 16.11 g (16.11 ± 0.11). Body length in females ranged from 13.5 to 14.5 cm (14.0 ± 0.50), whereas in males, it varied from 13.0 to 14.2 cm (13.60 ± 0.60). Male sparrows had a tail length ranging from 5.0 to 5.8 cm (5.40 ± 0.40), while females had a tail length of 5.9 to 6.5 cm (6.2 ± 0.30). Wingspan in adult females ranged from 19.00 to 22.5 cm (20.75 ± 1.75), and in males, it ranged from 18.5 to 21.5 cm (20.0 ± 1.50). Single wing length in adult males was 7.5 to 9.5 cm (8.50 ± 1.00). Females exhibited a single wing length of 19.0 to 22.5 cm (20.75 ± 1.75). The female primary wing ranged from 6.2 to 8.5 cm (7.35 ± 1.15), while males had a primary wing length of 6.0 to 8.0 cm (7.0 ± 1.0).

Male Sindh Sparrow tarsal length ranged from 1.3 to 2.5 cm (1.90 ± 0.60), similar to females at 1.3 to 2.5 cm (1.9 ± 0.60). Female metatarsal length ranged from 1.1 to 1.8 cm (1.45 ± 0.35), whereas males had a metatarsal length of 0.8 to 1.8 cm (1.30 ± 0.50). Head length in females was 1.2 to 2.1 cm (1.65 ± 0.45), and in males, it ranged from 1.2 to 2.0 cm (1.60 ± 0.40). Bill length in males was 0.9 to 1.9 cm (1.40 ± 0.50), similar to females at 0.9 to 1.9 cm (1.40 ± 0.50). Body circumference in females ranged from 7.5 to 9.5 cm (8.5 ± 1.0), and in males, it ranged from 7.0 to 8.5 cm (7.75 ± 0.75) as depicted in Table 1.

Correlation analysis revealed significant correlations between body weight, body length, tail length, wingspan, single wing length, primary wing length, metatarsal, head length, and bill length in both male and female Sindh Sparrows. Tarsal and body circumference were positively correlated (Table 1).

TABLE 1: COMPARISON OF MENSURAL PARAMETERS AND CHARACTERISTICS OF MALE AND FEMALE SINDH SPARROW

Character	Gender	Number (N)	Mean± SD	Range (Minimum-Maximum)	SE	t-value	Coefficient (r)
Body Weight	Male	10	16.11± 0.11	16 - 16.22	0.035	-7.0763	-0.516
	Female	10	16.2±0.12	16.08 - 16.32	0.038		
Body Length	Male	10	13.6± 0.6	13 - 14.2	0.19	-3.4674	0.238
	Female	10	14± 0.5	13.5 - 14.5	0.158		
Tail Length	Male	10	5.4± 0.4	5 - 5.8	0.126	-9.6355	0.398
	Female	10	6.2± 0.3	5.9 - 6.5	0.095		
Wingspan	Male	10	20± 1.5	18.5 - 21.5	0.474	-0.9222	0.71
	Female	10	20.75± 1.75	19 - 22.5	0.553		
Single wing length	Male	10	8.5± 1	7.5 - 9.5	0.316	-3.5177	0.604
	Female	10	9.4± 0.4	9 - 9.8	0.126		
Primary wing Length	Male	10	7± 1	6 - 8.0	0.316	-6.6679	0.941
	Female	10	7.35± 1.15	6.2 - 8.5	0.364		
Tarsal	Male	10	1.9± 0.6	1.3 - 2.5	0.19	-2.2361	0.547
	Female	10	1.9± 0.6	1.3 - 2.5	0.19		
Metatarsal	Male	10	1.3± 0.5	0.8 - 1.8	0.158	-1.5	0.683
	Female	10	1.45±0.35	1.1 - 1.8	0.111		
Head Length	Male	10	1.6± 0.4	1.2 - 2	0.126	-0.5744	0.517
	Female	10	1.65± 0.45	1.2 - 2.1	0.142		
Bill Length	Male	10	1.4± 0.5	0.9 - 1.9	0.158	1.63299	0.796
	Female	10	1.4± 0.5	0.9 - 1.9	0.158		
Circumference	Male	10	7.75± 0.5	7 - 8.5	0.158	-8.3698	0.753

	Female	10	8.5± 1	7.5 - 9.5	0.316		
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Non-significant (P>0.05); * Significant (P<0.05); ** - highly significant (P<0.01) SD= Standard deviation; SE =Standard error

Further examination of male and female snipes revealed that male snipes had a mean gut weight of 0.4131g, while female snipes had a slightly higher mean weight of 0.4349 g. The mean weight of an empty gut was 0.09 g for both females and males. Females had a mean weight of gut contents of 0.337 g, whereas males had a mean weight of 0.3369 g. Importantly, there was no significant difference observed in the unfilled gut and the mean weight of gut contents between male and female Sindh Sparrows, as indicated in Table 2. These findings provide valuable insights into the dietary preferences and gut characteristics of the Sindh Sparrow population under study.

FEEDING PREFERENCES OF BIRD

The gut contents of Sindh Sparrows were found to include larvae from the families Chironomidae and Ceratopogonidae, as well as insects belonging to the orders Coleoptera, Hemiptera, and Odonata. Additionally, insects from the family Haliplidae, along with some plant material and snails, were identified in their diet. Although there was some unidentified matter in the gut contents, the primary component of the diet appeared to be insect larvae, with no evidence of fish or seeds in the gut analysis.

TABLE 2: COMPARISON OF MENSURAL ANALYSIS OF GUT VARIABLES IN SINDH SPARROW

Characters	Gender	Number (N)	Mean ± SD	SE	t-value	P-value
Total weight of gut(g)	Male	10	0.4131 ± 0.01658	0.00524	0.54034	0.578
	Female	10	0.434 ± 0.00644	0.00204		
Weight of food material (g)	Male	10	0.08 ± 0.00816	0.00258	0.01591	0.001
	Female	10	0.337± 0.00816	0.00258		
Weight of empty gut (g)	Male	10	0.3269± 0.00807	0.00255	0.01198	0.001
	Female	10	0.09± 0.00722	0.00228		

SE = Standard error, SE = Standard error, Significant (P<0.05), ** = highly significant (P<0.01), NS = Non-significant (P>0.05), SD - Standard deviation

65% of the samples. Stones were present in the gut contents of 90% of the sampled Sindh Sparrows. Odonata larvae were identified in 10% of the samples, and plant material constituted 30% of the gut content composition. Snails were found in 5% of the samples, while both Hemiptera and Haliplidae were present with an abundance of 5% each, as detailed in Table 3. These findings provide a comprehensive overview of the diverse dietary preferences of the Sindh Sparrows in the studied population.

FEEDING ANALYSIS IN THE OBSERVED SAMPLES

The gut content analysis of Sindh Sparrows revealed the presence of various components. Chironomidae larvae were found in 15 out of a total of 20 samples, indicating an abundance of 75%. Ceratopogonidae larvae constituted 20% of the gut contents, while Coleoptera larvae were observed in

TABLE 3: FOOD PREFERENCE AND ABUNDANCE OF SINDH SPARROW

Type of Food	Samples	Positives Samples	Abundance (%)
Chironomide	20	15	75
Coleoptera	20	13	65
Ceratopogonidae	20	4	20
Stones	20	18	90
Odonata	20	2	10
Plant Material	20	6	30
Snails	20	1	5
Hemiptera	20	1	5

Haliplidae	20	1	5
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COMPARISON OF FEEDING ANALYSIS IN THE OBSERVED SAMPLES

Figure 1 illustrates the distinct food contents consumed by male and female Sindh Sparrows. The common elements in their diet include Chironomidae larvae, Ceratopogonidae larvae, Coleoptera larvae, Stones, Odonata larvae, plant

material, and Hemiptera larvae. However, there are notable differences in the diet of male and female Sindh Sparrows. Male sparrows include insects of the order Hemiptera and snails in their diet, whereas females incorporate Haliplidae insects and do not consume snails. This gender-based variation in dietary preferences adds an interesting dimension to the feeding habits of Sindh Sparrows, emphasizing the diversity and adaptability within the species.

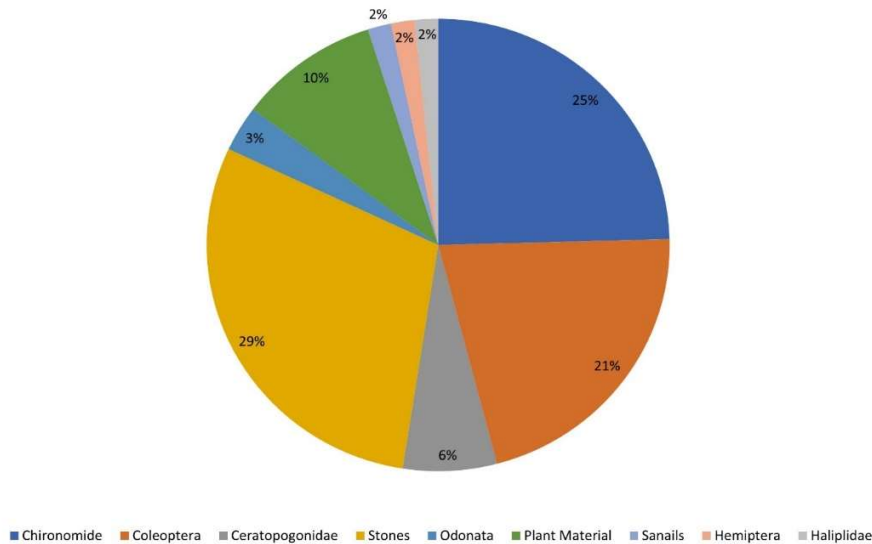


FIGURE 1: SHOWS THE DIET OF MALE AND FEMALE SINDH SPARROW

III. DISCUSSION

The current study was designed to investigate the morphometric characteristics and feeding preferences of Sindh Sparrows sampled from District Bahawalnagar, Punjab, Pakistan. The morphometric analysis was conducted on 20 randomly selected samples, comprising 10 males and 10 females. The results indicated significant differences in the body weight of male and female Sindh Sparrows, contradicting the findings of a previous study (Winegardner, 1976), which reported a significant difference in body weight between male ($16.11 \pm 0.11g$) and female ($16.20 \pm 0.12 g$) Sindh Sparrows. Several factors may contribute to the discrepancy in results. First, the difference in sample size between the two studies could be a contributing factor, as (Winegardner, 1976) conducted measurements on 80 snipes, whereas the current research focused on 20 sparrows. Additionally, environmental conditions may play a role, as suggested by the observation that passerine species, including house sparrows and Sindh Sparrows, exhibit variations in traits due to environmental influences. For instance, the study by Win Gardner (1976) on Sindh Sparrows in northern Utah, which found resident breeding behavior, differs from the migratory behavior observed in the current research. These

variations in sample size and environmental conditions highlight the complexity and variability inherent in studying avian populations, necessitating a nuanced interpretation of results.

In our research, the body length of male Sindh Sparrows was measured to be 6.11 cm, while females had a body length of 6.20 cm. These values align closely with those reported by (Grimmett, Roberts, Inskipp, & Byers, 2008). However, limited literature on the body length of Sindh Sparrows was found beyond this reference. Notably, there was a non-significant difference in wingspans between male (22.5 cm) and female (22.0 cm) Sindh Sparrows, as measured by (Grimmett et al., 2008) which supports our study. Wing lengths in both sexes were recorded as 8.9 cm in males and 8.5 cm in females. These measurements were somewhat lower compared to (A. Włodarczyk, Grzybowski, Patkowski, & Dobek, 2005) who reported wing lengths of 13.87 cm and 13.58 cm in males and females, respectively. Additionally, our findings were lower than the wing length range of 12.8 - 13.8 cm reported by (Ali, Ripley, BNHS, Press, & BNHS, 1983; Madkour & Mohamed, 2019) which could be attributed to variations in age, habitat, and the overall health of the Sindh

Sparrow. Our study also revealed that male sparrows had a bill length ranging from 6.3 to 7.2 cm, while females exhibited a bill length of 6.1 to 7.0 cm. These outcomes were consistent with their study (A. Włodarczyk et al., 2005).

In our study, the tarsal length of Sindh Sparrows was found to be in the range of 3.2 to 3.76 cm in females and 2.7 to 3.8 cm in males. These findings are consistent with the results reported by (T. Włodarczyk et al., 2019) who found a tarsal length of 3.398 ± 0.06 cm. Similarly, (A. Włodarczyk et al., 2005) documented tarsal length in male snipes as 3.35 cm and in females as 3.406 cm, supporting our study. However, our research contradicted the findings of (A. Włodarczyk et al., 2005) regarding head length, as our study revealed no significant difference in head length between male and female Sindh Sparrows, whereas (A. Włodarczyk et al., 2005) reported a head length of 2 cm in males compared to 1.6 cm in females. This discrepancy might be attributed to the migratory nature of the Sindh Sparrows in our study, while the birds studied by (A. Włodarczyk et al., 2005) were resident breeders in that area. Migratory Sindh Sparrows, having lower fat reserves, could account for these differences. Additionally, tail length, primary wing length, metatarsal, and body circumference were not previously documented in the collected works and were introduced for the first time in our study, contributing novel insights into the morphometric characteristics of Sindh Sparrows.

The study provides valuable insights into the dietary habits of Sindh Sparrows. The predominance of Diptera larvae, particularly Chironomidae larvae (75%), and Coleoptera (65%) in their diet highlights the significance of these food sources for the species. Additionally, the high abundance of stones/sand (90%) and the presence of Odonata (10%) contribute to the diverse dietary composition of Sindh Sparrows. The absence of tapeworms in the gut contents, as opposed to previous studies, suggests potential variations in the species' parasitic interactions.

Moreover, the limited presence of plant material in all samples, despite a 30% abundance, and the low abundance of snails (5%), Hemiptera (5%), and Haliplidae (5%) further enriches the understanding of their feeding preferences. It's noteworthy that the results of your study align with the findings of (Winegardner, 1976) in many aspects.

However, the absence of certain items such as herbal material in some samples and the non-detection of various families like Sialidae, Stratiomyidae, Dolichopodidae, Syrphidae, Ephydriidae, Muscidae, Brachycera, Corixinae, Tipulidae, Symphyta, Staphylinidae, Opiliones, Stylommatophora, Basommatophora, Unionoida raises intriguing questions about the factors influencing dietary variations and the ecological dynamics of Sindh Sparrows in your study area. These findings contribute to our understanding of the species' ecological niche and the intricate web of interactions within their ecosystem.

IV. CONCLUSION

In conclusion, this study revealed significant differences in morphometric characters between male and female Sindh Sparrows. The dietary analysis indicated that the feeding habits of Sindh Sparrows include a variety of food sources, including herbal substances and species from families such as Sialidae, Stratiomyidae, Dolichopodidae, Syrphidae, Ephydriidae, Muscidae, Brachycera, Corixinae, Tipulidae, Symphyta, Staphylinidae, Opiliones, Stylommatophora, and Basommatophora. However, Unionoida species were not observed in the sparrow's diet. These findings provide valuable insights into the morphometric characteristics and feeding preferences of Sindh Sparrows, contributing to our understanding of the species' ecology and behavior in the study area.

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AUTHORS CONTRIBUTION

All authors contributed equally

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None

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