

Flapping rates of storks in level flight.—Relatively few data have been published on the rates at which birds flap their wings in flight (Meinertzhagen, *Ibis*, 97: 81, 1955). Such information may prove useful, when combined with anatomical data, in studies of the aerodynamics and biophysics of bird flight (Hartman, *Smithsonian Misc. Coll.*, 143, 1961; Greenewalt, *Smithsonian Misc. Coll.*, 144, 1962).

The records in Table 1 were made during a 10-year study of the comparative ethology of storks on five continents, and they include all 17 living species recognized by Peters (Check-list of birds of the world, vol. 1, Cambridge, Harvard Univ. Press, 1931, pp. 126–131). The only records used were those made of birds in level flight (i.e. neither climbing nor descending) during periods of little or no wind. Although soaring and gliding flight is the method of travel all storks use the most, they do resort to flapping flight for short trips, when searching for a suitable thermal air current, or when weather conditions are unsuitable for soaring (Kahl, MS).

I gratefully acknowledge support from the National Science Foundation, National Geographic Society, and American Museum of Natural History.—M. P. KAHL, *Department of Ornithology, American Museum of Natural History, New York, New York 10024*. Accepted 7 Jul. 70.

TABLE 1
FLAPPING RATES OF STORKS

Species	No. records	Ave. rate (/min)	Range	St. dev.	Locality	Wing length (mm)
<i>Mycteria americana</i>	44	177	158–200	11.4	Florida, USA	455–500
<i>Ibis ibis</i>	20	186	171–214	10.5	East Africa ¹	450–515
<i>Ibis leucocephalus</i>	70	190	168–213	9.8	India	490–520
<i>Ibis cinereus</i>	21	205	189–222	10.3	Java, Indonesia	450–503
<i>Anastomus oscitans</i>	44	208	180–246	17.3	India; Thailand	392–408
<i>Anastomus lamelligerus</i>	18	201	180–214	10.2	East Africa	376–436
<i>Sphenorhynchus abdimii</i>	28	189	173–210	10.2	Ethiopia	419–470
<i>Dissoura episcopus</i>	10	160	142–179	12.0	Uganda; India	419–525
<i>Ciconia ciconia</i>	27	170	156–183	7.6	Poland; East Africa	530–635
<i>Ciconia nigra</i>	22	159	140–168	8.3	Poland	516–605
<i>Euxenura galeata</i>	32	181	159–200	11.1	Argentina	540–550
<i>Xenorhynchus asiaticus</i>	20	167	148–184	9.3	India	547–645
<i>Ephippiorhynchus senegalensis</i>	13	150	135–170	11.4	East Africa	590–700
<i>Jabiru mycteria</i>	13	179	161–195	12.1	Argentina	610–630
<i>Leptoptilos dubius</i>	8	139	125–154	8.6	India	800–820
<i>Leptoptilos crumeniferus</i>	8	143	132–150	5.5	East Africa	650–786
<i>Leptoptilos javanicus</i>	8	153	150–157	3.0	India; Malaysia	580–660

¹ East Africa includes the countries of Kenya, Uganda, and Tanzania.