The Breeding Behaviour of Laughing Dove Spilopelia Senegalensis Linnaues, 1766(Columbiformes, Columbidae) In Al-Jadriyah and Umm-Alkhanazeer Island, Baghdad, Iraq

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Abstract

This study was conducted to identify the breeding behaviour of laughing dove *Spilopelia senegalensis* during their courtship, mating, nest building, egg brooding and chick growth in Al-Jadriyah and Umm-Alkhanazeer Island in Baghdad. The study began from February to August 2022. The surveillance was carried out using the binoculars ,digital camera,with the use of a 4-meter-high ladder to reach the nests and taking morphometric measurements of the eggs using a digital ver niar, and the digital scale for the weight of the eggs and the chicks. Descriptions of nest locations, nest construction, nesting materials, nest measurements, and nest height were also given. The male and female contributed to the construction of the nest, the incubation of eggs ,the breeding of chicks, the laying of eggs, , hatching and chicks were monitored through a surveillance camera installed on one of the nests as well as other imaging cameras.

Key words: *Spilopelia senegalensis*, Breeding behavior, Eggs laying, Chick growing.

Introduction

The recent study conducted on one of the invasive birds in Iraq, Laughing dove *Spilopelia senegalensis* Linnaues,1766 (Columbiformes,Columbidae) which belongs to the class:Aves which is one of the most important characteristics of its behaviour and breeding.(KBA,2010)

Laughing Dove *Spilopelia senegalensis* has been assessed as Least Concern. (Bird Life International ,2022). In recent years, a widespread of this species has been recorded in Iraq, which is an invasive species(The5th report), the species considered as invasive if it is introduced, deliberately or accidentally to a place where it did not occur naturally before, and able to form a population without human additional intervention, spreads and becomes as effective factor on the environment, local biodiversity, economy and society (Brochier,2010). The spread of invasive species has always been of interest in the environmental researchers (Strauss, 2006). The features of the invasive species are: Rapid reproduction growth, high-elastic phenotype dispersion capacity (ability to change the shape of growth to suit current conditions), with a wide range of environmental conditions (environmental efficiency), the ability to emerge alive from a wide range of food species (specialist), linking with humans (Williams, 1998) and previous successful invasions (Ewell, 1999).

DESCRIBTION OF BIRD

The laughing dove, also known as the palm dove, is a long-tailed, slim pigeon that is typically 25 cm (9.8 in) long,its underside is pinkish brown with a lilac tint, and its head and underparts are pinkish, fading to buff on the lower abdomen,adults also have a chequered rufous and grey patch on the sides of their necks that is made up of split feathers, the upper parts of the South Asian population are brownish with a bluish-grey band along the wing, the back is uniform and dull brown, the African populations *S. senegalensis* and *S. s. phoenicophila* have a bluish grey rump and upper tail coverts but differ in the shades of the neck and wing feathers, while *S. s. aegyptiaca* is larger and the head and nape (Hartert, 1916), the tail is graded, and the outer feathers are capped in white; in the field, the sexes are indistinguishable,young birds do not have the striped neck markings,the legs are bright crimson,the plumage of the populations varies slightly, with those from more dry zones being paler (Ali and Ripley 1981).

plate(1): The laughing dove or(palm dove)

The popular name is derived from of the laughing aspect of the song, whereas the particular component of the scientific name (senegalensis) refers to the region, Senegal, where the species was first documented. ,(Pizzeyand Knight 1997).

Ticehurs *et al*.(1921–1922) record that alone observation was exceedingly uncommon in Iraq until(1960), on a windy day, they only observed one bird; it was possibly a wanderer who had lost his way .
Allous(1960), noted dove was not found in the north of Iraq until 1970, when some pairs were seen in Sulaymaniyah, northeast of lraq, in 1980 had become common bird of this location, and infrequent in Kirkuk and Erbil west of Sulaymanyah, in 1990 had become popular in both of these two cities, and some pairs recognized in Baaqoba towards to the south, in 2005 they discovered several more pairs in Al-Sadr city in the east, Al-adameah and Taje, in the north of Baghdad show that this dove was starting to come from Iran toward the north east of Iraq, and from there it spread all over the country, *S. senegalensis* established a large and dense density on the building and the windows. Lahoney *et al*.(2008.)

It's a relatively common bird in Jordan and Syria. Disi (199), Shafeae (1998) (1987). When Bunni M.K. added this dove to the Iraqi fauna,

it became four doves: *Streptopelia decaocto, S. senegalensis, S. turtur,* and *S.orienralis* (1988) there was no new knowledge on this dove based on single specimens. Lahoney *et al*.(2008).

Doves and pigeons (Family: Columbidae) are almost found in all terrestrial habitats from temperate areas to the tropics including: lowland rainforest, highland forest, tropical forest, savanna, desert, cliff, mangroves, woodland edge, agricultural areas, suburban and urban areas, the highest diversity of pigeons and doves occurs in tropical rainforests (Baptista, *et al*., 1992; Gibbs, *et al*., 2001; Lack, 2003; Wells and Wells, 2001). The palm dove is found in dry scrub and semi-desert habitats where pairs can often be seen feeding on the ground (Lack,2003).

FOOD AND FEEDING

Doves and pigeons have been observed in flocks feeding frequently they eat fruit and grains primarily, although they also occasionally consume insects, snails, worms, lizards, leaves, buds, and flowers,seeds are extracted from the pounded and consumed,they primarily forage on the ground and are fairly terrestrial grazing land and farming,when drinking, pigeons and doves submerge their they do not scoop water in, instead sticking their beaks into the water and sucking it up,like most birds, they lift their heads and use their beaks to swallow Baptista *etal*. Lack, 2003; Wells and Wells, 2001; Gibbs, et al., 2001).pl.(6)

Doves consume a variety of cooked foods including cereals (Patil and Shende ,2015).

COURTSHIP

To attract mates, pigeons and doves utilize a range of songs and sounds, males have unique vocalizations that are only employed during courtship (Margani,2018). Smaller species of the columbidae have higher-pitched sounds than do bigger species, both sexes can sing, and the majority of songs are flute-like cooing noises with varying note lengths and note spacing.(Margani, 2018).

Some animals generate soft purring noises to help their mates bond (Gibbs, *et al*., 2001). Young birds make begging sounds, and the results of trials involving cross-fostering indicate that songs are innate in birds and are not taught to them by their parents,an hour before sunrise, according to King (1978), Early in the morning, an hour before dawn, and in the late afternoon till an hour after sunset, the laughing dove sings, the call made before to pair formation, as well as during nest construction and incubation,in Laughing Dove the chicks are naked, blind, helpless and wholly dependent on its parents ,they have dark grey skin grey color blunt beak and body covered with patches. of creamy white down filaments. (Nene,1979; Ali and Ripley, 1981).

In pigeon and doves chicks are fed by both parents. The chicks are usually fed crop-milk for three to four days and are then fed seeds and fruit, crop-milk is made in the crop of the adult male and female, milk is high in fat, protein,minerals and amino acid, chicks of pigeons and doves grow rapidly because the crop-milk reducing the most vulnerable period in the life cycle (Gibbs *et al.*, 2001).

Chicks fledge in 10 to 36 days (earlier if disturbed) and may continue to receive food from their parents for 30 to 40 days. (Baptista, *et al*., 1992; Gibbs, *et al*., 2001; Lack, 2003; Wells and Wells, 2001). Earlier observations of a nesting pair of pink-necked green pigeons (*Treron vernans*)Linnaeus 1771, showed that the male took up the day duty while the female, the night shift (Wee, 2005). As with incubation, both parents took turns brooding, changing shifts around the same times every morning and evening (Gibbs *et al.*, 2001).

Adult bird was not in the nest all the time but left for short periods when the chicks were a few days old but mostly stayed around the nesting tree, keeping a close watch. As the

chicks grew, the adult spent less and less time in the nest during the day. It is most likely that there would always be an adult in the nest at night,feeding of the chicks was regular(Ricklefs, 1969). The adult was constantly preening the chicks,adult feeding the chick, with the chick's bill buried deep inside the adult's buccal cavity or both may be fed at the same time, with the bill of each chick inserted from either side. When they had fledged,they moved to a nearby tree where the adults continued to feed them the male usually incubates the egg during the day, and the female incubates at night. Chickss, cared by both parents, fledge in about 12-14 days, the parents continue to care for the fledglings until they are 25 to 27 days old. (Hockey *et al*., 2005).This prolonged parental care in tropical birds may be a strategy against the high rate of egg and nestling mortality. (Ricklefs ,1969). Ashmole and Tovar (1968) suggested that prolonged parental care is developed in species in which the young might require an extended amount of time in learning foraging skills.

The aim of the study: Due to the lack of biological studies on Laughing dove,on our study aimed to identify the breeding behaviour of this invading species in Iraq, in AL-Jadriyah and Umm-Alkhanazeer site specifically, which was an important site for birds globally.

MATERIALS AND METHODS

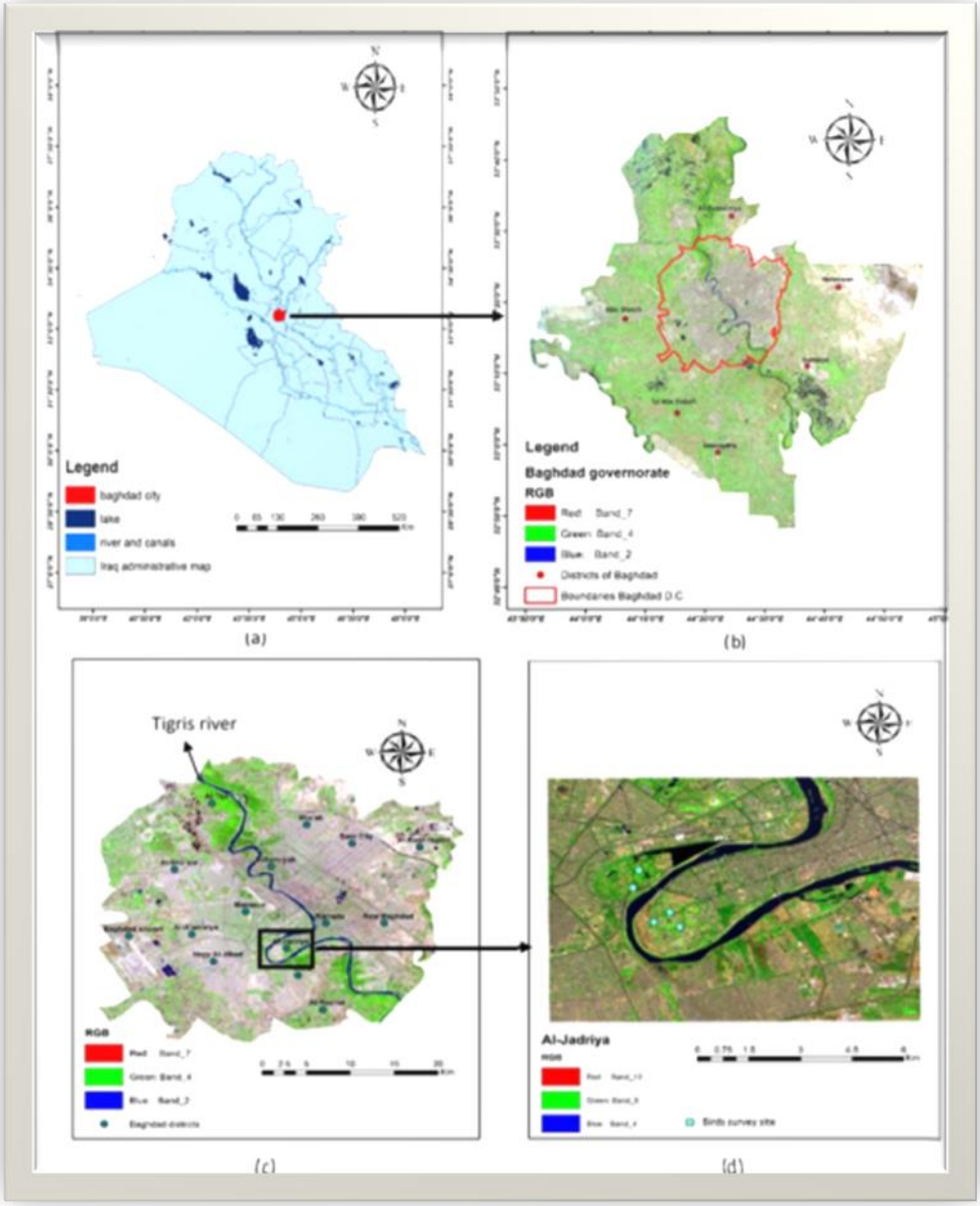
Study Area: Al-Jadriyah and Umm-Alkhanazeer island.

Coordinate:Baghdad N 16° 31' 44.5", E 22° 36' 34"

The site includes part of the Tigris River, which extends in a U-shaped inverted sideways, and the two areas located on its banks, where Umm Al-Khanazeer island is located on the Karkh side of the river, and the University of Baghdad in the Rusafa side, southeast of the capital Baghdad. The University of Baghdad is the main road to Al-Jadriyah, Al-Jadriyah Bridge links the University of Baghdad and Umm Al-Khanazeer island, most of which are restricted access (Map1).

Map1: The deleniation of Al- Jadiriyah and Umm Al-Khanazeer site (KBA,2010)

Map2: Iraq,Baghdad,AL AL-Jadriah -and Umm Al-Khanazeer (byFazaa, 2022)



BREEDING BEHAVIOUR STUDY

1 – Field Surveys: The daily surveys were conducted to search for nests on a daily basis during the study period from mid-February until the beginning of August 2022 according to (Bertman 1992). Using a binoculars (KL1040-66×52) to watch and reach high nests through the use of a 4-meter-long ladder and the use of digital caliper (Topex 150 mm 31C628) to measure the dimensions of nests (length, width and depth) as well as the use of digital cameras (Nikon D90) to photograph the shapes, locations and height of nests which was measured through a Laser Distance Meter

2 – Monitoring: The monitoring studies included:

a - Monitoring the behavior of the bird before mating through the process of flirting using a binoculars (KL1040) and a monitoring camera (UKPLUSPTZ2.4G). b - After mating. Monitoring the process of nest building.

c - Egg Laying Monitoring, using monitoring camera (UKPLUSPTZ2.4G),weighting of eggs by means of a sensitive digital scale(DIAMOND 500) pl.(2) and measuring its dimensions using a digital caliper. Pl.(3)

plate(2): Sensitive digital scale

plate(3): Digital caliper

d - Incubation period e- Eggs Hatching. f- Chicks feeding

g -Chicks growing and chicks movements

All operation Processes are carried out through a monitoring camera (UK PLUS PTZ2.4G) installed on the nest, and the temperature of the atmosphere was also measured by the laser thermometer (Infrared thermometer GM1150)

RESULT AND DISSCASION

COURTSHIP

After choosing each other, the male performs a mating dance to attract the female with inflating his feathers, dragging his tail when he moving in circular around the female as well as emits a specific vocalization for his ritual. In opposite the female will produce some behaviours like moving toward the male and raising her tail while lowering her head. This copulation process was noted since the mid of February till the end of this study. This behaviour can occur many times throughout the week.

The Courtship behaviour before mating seems to be widespread among species, especially in

birds,in monogamous doves and pigeons, male and female stay together year after year, during courtship, the male chases the female while cooing and begins to spread his wings to lure the female, who responds to him by bowing and begging him for food before intercourse (Manning and Dawkins 1992). Pairs could groom one another (Gibbs *et al.,* 2001). In courting, male groom females and feed them insects and caterpillars (Patil and Shende,2015).

THE MONITORING

Laughing Dove nests were monitored throughout regular visits to collect the requested data.

a – Nest building: Table 1 showed the calculation of the nests dimensions (Length, width and depth). The results appears that the average length was 11.2 cm, average width was 8.5 cm and average depth was 2.9 cm.

Table 1: Dimensions Measurements of the nests

No	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Length (cm)	**17**	**12**	**12**	**14**	**10**	**11**	**13**	**14**	**13**	**13**
Width (cm)	**12**	**10**	**9**	**11**	**10**	**9**	**10**	**14**	**7**	**10**
Depth (cm)	**3**	**2**	**3**	**2**	**3**	**2**	**4**	**3**	**2**	**3**

The parents build the nest by wood and stick materials (pl.4). This result agreed with the previous studies. Building the nest takes 3-4 days due to environmental factors such as wind speed or gusty winds, both sexes participate in building the nest, and in order to save time and energy, it takes two days to build the nest on rainy days (Margani, 2018). In India, Rao, (2014), reported the same outcome,the nest consists mostly of dry twigs and wooden sticks. Walsh *et al*,2009 have shown that birds build their nests according to the memory of the genetic template and do not deviate to a large extent from this approach. Patel and Shendi (2015) found that laughing pigeons in India collect soft, semi-dry materials as well as wires and plastic sticks in building their nests.

Plate (5): feeding of laughing dove

Plate (4):The structure of laughing dove nest

The recent study recorded that the laughing dove prefers to build the nests in buildings (windows , electricity wires, stairs and air conditioners) instead of trees pl.(6).Margani, 2018 mentioned that Laughing dove breeding around human habitation areas so it is due to the presence of nesting materials like plastic wire, dove breeding around human habitation areas is extremely adaptive.

plate(6):Nesting in the buildings

plate(7):Nesting on the electric wires

b - laying and weighing of eggs: after the completion of the nest building the reproductive stage began with laying the first egg by the female and start embracing it alternately between male and female and on the next day put the second egg. Table 2 showed the size and the weight of the eggs and different temperature of the breeding.

The results appears that the average of the egg length was 25.14 mm, Average width was 19.76 mm and the average of the eggs weight was 4.22 g.

Table 2: (Measurements of 10eggs) with temperature

No	1	2	3	4	5	6	7	8	9	10
Length (mm)	27.4	22.6	23.9	26.5	24.1	26.9	26.1	25.8	24	26.8
Width (mm)	21.8	19.1	19.3	19.4	19	20.8	20.3	18.9	20.2	18.8
Weight (g)	5.9	3.8	3.3	4.8	4.5	6	5.4	4.5	3.9	6.1
Month	Feb.	March	Apr.	Apr.	May	June	July	July	Sep.	Sep.
Temperature	20	24	32	38	39	.40	40	49	42	50

The Laughing Dove's clutch size in this study was two, which was well within the range noted for Africa and Asia, this fact was also reported by Margani,2018and Brahmia *et al.* 2015 in Algeria , Moon (2013) in Australia , Rao(2014), Patil and Shende (2015) in India.Clutch size is influenced by habitat, age of the bird and availability of food Brooke (1978). Vijayan (1980) has shown that fluctuation in clutch size depends on the amount of food available, with the largest clutch being positioned when sufficient and abundant food is available for the young. While Lack (1954) showed that the clutch is a trait inherited from the parents and has evolved through natural selection to coincide with a bigger number of the offspring and is linked to the amount of food the parents provides.

c – Incubation: Eggs incubation lasts approximately 15 ± 1days.The installed cameras monitored the rotation of male and female on the incubation of the until the hatchg of the eggs. The two eggs were daily weighed with a sensitive weight balance , length and width were measured also(Table 2). The incubation periods for the laughing dove varied from one study to another according to the place of study, it was lasted 12–14 days, on average 13 days (Margani,2018).Tarakini and Gamundani's (2013) discovered that the Laughing Dove's incubation period lasted between 11 and 14 days. This species is monogamous, male sharing the incubation time with the female. Increasing of the Night time incubation protects eggs from low temperatures, obviously. The male of pink-necked green pigeons *Treron vernans* (Linnaeus 1771), adopted the male took incubation duty on the day while the female took the night shift (Wee, 2005). As the reproduction continued from low temperatures in winter and moderate in spring to high temperatures in summer and this corresponds to (Margani, 2018) study in Sudan which indicated the continued reproduction of laughing chicks throughout the seasons of the year and at varying temperatures In Africa, there are some variations in breeding season for the laughing dove. In Malawi Breeding takes place in all seasons, primarily May to

November in Zimbabwe, with sporadic breeding in other cases Breeding occurs in South Africa during the months of August and April, and between February and June in Egypt, inNorth Africa the breeding season about six months in Morocco (Hanane *et al*,2011), according to Boukhriss and Selmi (2009) in Tunisia, the breeding season ran from February through August.

According to Moon (2013) in Australia, although the Laughing Dove's gonadal cycles were largely influenced by fixed yearly components, including photoperiodic, there were influences by environmental factors, such as feeding. Additionally, Frith *et al*. (1975) noted that urban inhabitants' nutritional levels were frequently above the cut off, which causes breeding of the laughing dove.

The parents started to fed the chicks, the chicks were weighed and monitored daily , the chick put it's beak inside the parent's beak and start to return the contents of the crop, the chicks began to grow and increase in size day by day, the parents continue feeding the chicks throughout the incubation period (Table 3) showed the growing stages of the chicks within incubation period. During the breeding season, the Laughing Dove in this study raised up to six broods while repeatedly using the same nest in a good location, these results corresponds with Margani(2018) while Blockstein *et al*. (1986) noted the same outcome, saying that the mourning dove (*Streptopelia capicola*) Sundevall, 1857 is well suited to a variety of brooding (4 to 6) because they provide food (crop milk) for the young, feed young nestlings and older nestlings. other elements, such as swift nestling growth, small clutch sizes and fledging at low weights enable females to start fresh clutches. In Diyarbakr, Biricik (1989) found that the reproductive start from the beginning of February to mid-November this is similar to the result we got may be repeated mating more than seven times for the same pair of dove (same result) and the begging behavior of food by the female before mating agrees with our research. The female lays an egg and after 38 hours the second lays , and the female helps the male carry the building materials for the nest build.

Table 3: Shows the age and weight of some chicks

No. of days after hatching	Weight of chicks (gm)	Chick features
1	5.6	The eye is closed and the body is covered with a little fluff
2	9.2	An increase in fluff
10	42	The beginning of the appearance of the beginning of the wings and the acquisition of feathers
17	95	The completion of the growth of the chick and its movement to the edges of the nest

CONCLUSION

The study reached to the important facts:

-The multiplicity of broods: where the first brood was recorded on 20-2-2022 at the 20˚C as average, and the last brood within the study

period recorded on 20-8-2022 at 50˚C, this indicates the ability of the laughing dove to make several broods at varying temperatures.

-Laughing dove prefers nesting in buildings instead of trees.

-In some nests, only one chick has grown because one of the eggs was failed to grow**.**

LITERATURE CITED

Ali, S. and Ripley, S.D., 1981. Handbook of the Bird of India and Pakistan Volume 3(2d). New Delhi, Oxford University Press., p.: 155-157.

Allouse, B, E. (1969-1962). Bids of Iraq. Arrabita press. Baghdad, 3vol

Ashmole, N.P. and Tovar, H. S. 1968. Prolonged parental care in Royal terns and other birds. *The Auk*, 85(1): 90–100.

Baptista, L. F., Trail, P.W.and Horblit, H. M.1992. Family Columbidae (Pigeons and Doves). p. 60-243 *in* del Hoyo, J. Elliott, A.,Sargatal, eds.Handbook of the Birds of the World, Vol. 4. Barcelona: Lynx Edicions.

BirdLife International. 2018. IUCN Red List for Birds.Species Factsheet: Alauda 77: 187–192.*Streptopelia senegalensis*. http://www.birdlife.org (Accessed12Decembe2018)

Biricik, M., Kılıç, A., and Şahin, R. ,1989 Fortpflanzungsverhalten der Palmtaube (*Streptopelia senegalensis*): Paarbildung bis Eiablage. *Journal für Ornithologie*, 130(2): 217-228.

Blockstein, E.D.,Westmoreland, D. and Best ,B.l. 1986.Multiple brooding as a reproductive strategy, time –conserving adaptation in mournin103:196-203.

Boukhriss, J. and Selmi,S. 2009.Nesting habits and reproductive success of the Laughing Dove *Streptopelia senegalensis* in the Oases Southern Tunisia. *Alauda* 77: 187–192.

Brochier,D.,V.,2010. Alien invasive birds revue scientifique et technique. *International Office of Epizootics* 29(2):217-25.

Bunni M. K. (l988). First record of rufous turtle dove *Streptopelia orientalis* (Latham) for Iraq, *Bull. Iraq. Nat. Hist. Mus* .

Bunni, M. K., (1979). Competition for nesting holes in feral pigeon Columba livia and house sparrow, Passer domesticus, *Bull ,Nat. Hist. Res. Center* .

Disi, A. Bouran A. (1987). Acheck list of the birds of the Hashemite Kingdom of Jordan, Univ. of Jordan Amman.

Ewell, J.J. (1999). "Deliberate introduction of species: research needs - benefits can be reaped, but the risks are high." Biology. 49 (8): 619-630. 10.2307 /1313438. JSTOR 1313438 . 8.

Fazaa, N. A., Ali, A. B., AL-Jabinawi, A. J., Francksen, R., & Whittingham, M. J. (2022). Land use change in Baghdad City and assessment of the Jadriyah Umm Al-Khanazeer Island Important Bird Area (IBA) from 1984 to 2020. *Baghdad Science Journal*, 58-73.

Fifth National Report to the convention of biological diversity of Iraq,March ,2014,Ministry of Invironment.

Fisher, R. A. 1958. The Genetical Theory of Natural Selection. Oxford University Press: New York.Geological Survey. P. 117-29. ISBN number 9780160532856 and de Juana, E. (eds.). Handbook of the Birds of the World Alive. Publisher: Lynx Edicions, Barcelona Publication Year: 2014

Gibbs, D., E. Barnes, and J. Cox. 2001. Pigeons and Doves: Aguide to the pigeons and doves of the world. Sussex: Pica Pres.

Greenberge, R.and Gradwohl,J.1983. Sexual role in the Dot-winged Antwren microhopias quixxensis, atropical forest Passerine. *Auk.* 100.920-925.

Hanane S, Besnard A. (2013). Nest survival of Woodpigeons (Columba palumbus) in NorthAfrican forests.Bird Study.60:202–210.

Hanane,S.,and.L.Baamal.2011."AreMoroccan Fruit Orchards OrchardsSuitable Breeding Habitats forTurtle DovesStreptopelia turtur?"Bird Study 58: 57–67.

Hockey, P.A.,R, Dean, W.R.,J. &Ryan, P.,G. 2005. Roberts Birds of southern Africa, VIIth ed. The Trustees of the JohnVoelcker Bird Book Fund, Cape Town.

Hooten, M.,B., and Christopher K. Wikle. "A hierarchical Bayesian non-linear spatio-temporal model for the spread of invasive species with application to the Eurasian Collared-Dove." Environmental and Ecological Statistics 15.1 (2008): 59-70

King.1978.CitedbyCramp,S.,Brooks,D.,Dunn, E.,Gillmors,R.,Hollom,p.,Hudson,R.,Nich olson,E.,Ogilvie,M.,Olney,P.,Roselear,C., Simmons,K.,Vo ous, K.,Wallace, D. Wattel, J.and Wilson,M..Handbook of Europe the Middle East and North Africa.The Birds of the western Palearctic.Vol.IV. pp.266-373.Oxford University.

Lack, D.(1954).The Natural Regulation of Animal Numbers. Oxford Unversity. Press.

Lack, P. 2003. Pigeons and Doves. Pp. 288-295. In: C Perrins,ed.The New Encyclopedia of Birds. Oxford:Oxford Univeristy Press.

Lahony, S.R., KM Mohammad & HA Ali. 2008. A new record of Goshawk Accipiter gentilis with short notes on distribution of Laughing Dove in Iraq. Bulletin Iraq Natural History Museum 10(3): 45–47

Manning ,A.and Dawkins , S. M. 1992. An introduction to animal behaviour . (fourth edition). Cambridge University.

Margani, N. N. (2018). The Status, diversity and some aspects of breeding behaviour of avian species in Khartoum State with emphasis on the Laughing Dove Streptopelia senegalensis 2013-2014 (Doctoral dissertation, Sudan University of Science and Technology .

Moon, D. L. (2013). A Study of the Spatial Dynamics of some Introduced Avian Species in the Southwest Region of Western Australia .A Thesis Submitted in fulfilment of the Requirements for the Award ofnDoctor of Philosophy for the Faculty of Communication and the Art Edith Cowan University, Mt Lawley Western Australia Submitted 30 June 2013.

Nature Iraq (2017) Key Biodiversity Areas of Iraq. Sulaimaniyah, Iraq. 297 pp.

Nene, R.V., 1979. "Incubation and incubation period in the Indian Little Brown DoveStreptopelia senegalensis". J. Bombay Nat. Hist. Soc 76(2): 362-363.

Patil, K.,G,and Shende, V.A .2015. Parental Care in Little Brown Dove, Streptopelia senegalensis. World Journal of Zoology.ISSN.1817 3098.

Rao,M.S. 2014. Breeding performance of Palm Dove (Streptopelia senegalensis)in and Around Sikar (Rajasthan),India.GlobalJournal for Research analysis:(3):1-3 -ISSN NO 2277-8160.

Roff, D. A. 1992. The evolution of life histories: theory and analysis. New York Chapman & Hall. Safriel, U. N. 1975. [19].Ricklefs, R. E. 1969. An analysis of nesting mortality in bird Smithsonian contribution to Zoology 9:1-48.

Shafae, D. (1998). WiIled birds of Jordan, Yermok Univ.pob. Jordan.

Strauss SY, Lau JA, Carroll SP. Evolutionary responses of natives to introduced species: what do introductions tell us about natural communities? Ecol Lett. 2006 Mar;9(3):357-74. doi: 10.1111/j.1461-0248.2005.00874.x. PMID: 16958902.

Tarakini,T.M., and Gamundani,T. P. 2013.Acompariso of breeding success of the laughing dove in the wild and in captivity in Mukuvisi wood land and lak Chivero Recreational park ,Harare , Zimbabwe. International journal innovative research and studies1 .SSN 2319-972.

Vijayan, V. S. 1980. Breeding biology of bulbuls (*Pycnonotus cafer* and *Pycnonotus luteolus*) Class: Aves, Family: Pycnonotidae with special reference to their ecological isolation. *J. BNHS*. 75: 1090-1117.

Walsh, P.T.,Hansell, M., Borello, D.W., and Healy, S.D.2009. Repeatability of nest morphology in Africa weaver birds. *Biol.Lett*. 6:149-151.

Wee, Y. ,C., 2005. Forging a closer relationship with pink-necked green pigeons. *Nature Watch*, 13(3): 16–22.

Wells, J.and A. Wells. 2001. Pigeons and Doves. p. 319-325.*in* : C Elphick, J,Dunning, D Sibley, eds. The Sibley Guide to Bird Life and Behavior. *New York: Alfred A. Knopf.*

Williams, J.D. (1998). "Non-native species" (PDF). The state and trends of the nation's biological resources. Reston, Virginia: U.S.