

## The breeding habits of the European hedgehog (*Erinaceus europaeus* L.) in Denmark

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### Abstract

Information on breeding hedgehogs (*Erinaceus europaeus* L.) was collected during two successive summers. Reports of litters (n = 453) discovered fortuitously, derive from the whole country. However, records were particularly numerous from certain eastern provinces. It is claimed that built-up areas harbour the densest breeding populations. Among all litters encountered nearly 50 % derived from agricultural country, where breeding nests chiefly were discovered near to farmsteads, more rarely adjacent to arable land or in corn fields. 50 % of all families met with enjoyed protection from rain in some way or other. Nests frequently were located in buildings, e.g. in barns, stables and sheds. Straw constituted a substantial part of most nests.

90 % of all litters encountered were still dependant on maternal care, chiefly remaining in their breeding nest (289 litters). The number of young was 2–9, most frequently (73 %) 4–6, average family size being 4.75. Litters were chiefly (95 %) reported in August and September, while the actual discoveries mainly occurred during August (61 %). Among 102 litters detected within 14 days of birth, 78 were from this month.

In conclusion it is maintained that hedgehogs in Denmark breed between late in July and early in September, and that females do not produce more than one litter per year.

### Introduction

Our knowledge of the breeding habits of the free-ranging European hedgehog, *Erinaceus europaeus* L. 1758 is still fragmentary. Most studies mainly deal with litter size and derive from conditions in Great Britain (DEANESLY 1934, MORRIS 1977). From continental Europe and Sweden corresponding information is given by LIENHARDT (1979) and KRISTIANSSON (1981). Additional verifiable facts on hedgehog breeding in its natural habitat seem to be scattered and scarce in scientific literature, and derive from accidental discoveries of one or very few breeding nests (e.g. COLLETT 1912).

The present study originally aimed to demonstrate the optimal breeding period of the hedgehog in Denmark and the preferred sites of the breeding nests discovered. Additionally possible new knowledge on the development of the young was to be collected (cf. NIELSEN et al. 1978; WALHOVD 1981).

### Methods

Intensive field studies in an 8 ha built-up area during the summer prior to the present investigation gave no records of hedgehog litters and clearly indicated the very secretive behaviour of the females when breeding. Hence it was decided to base this study entirely on reports of hedgehog litters discovered fortuitously by the public. A nation-wide inquiry via public news media was made in two successive summers (Tab. 1). In order to encourage people to submit observations, a special pamphlet (WALHOVD 1980) was forwarded to persons who reported young. Records were received either on the telephone (75 %) or as letters (25 %). The obtained data regarding each single observation were put down on a special form.

Table 1

The nature and means of distribution of requests for information while organizing a recording-scheme of the breeding habits of the European hedgehog in Denmark

Time	Category of information	Destined for	Circulation	
1976	<i>Periodicals</i>			
June 30	Haven	Horticulturists	72 000	
Aug 27	Landsbladet	Farmers	107 000	
	<i>Newspapers</i>			
Aug 1	Aarhus Stiftstidende		98 000	
Aug 1	Fyns -	The general public	52 700	
Aug 11	Jyllandposten		74 500	
Aug 28	Sjællands Tidende		28 400	
Sept 25	Politiken		114 000	
	<i>Radio</i>			
Aug 30	Ud på landet	Farmers, amateur naturalists, etc.	≈ 500 000	
1977	<i>Periodicals</i>			
June 30	} Haven	Horticulturists	78 000	
Aug 30				
June 30	} Hunden	Dogkeepers	26 000	
Sept. 30				
July 6	Hundejournalen	-	5 200	
July 15	Natur	Young naturalists	1 500	
Aug 15	Dyrevennen	Protectors of animal life	48 000	
Aug 12	} Landsbladet	Farmers	106 000	
Oct 7				
	<i>Newspapers etc.</i>			
Sept 1	Ritzau Press Bureau	The general public	> 1 000 000	
Mid-Aug-	} All major Danish newspapers			
Mid-Sept				
	<i>Radio</i>			
Aug 16	} Ud på landet	Farmers, amateur naturalists, etc.	≈ 500 000	
Sept 1				

It was decided to divide the records of young from the two seasons in question into six groups depending on the situation under which they were discovered (cf. MORRIS 1977):

1. In nest, blind
2. In nest, eyes opened, unable to depart
3. In nest, able to depart
4. Out of nest, with adult
5. Out of nest, no adult present
6. Out of nest, myiasis detected.

Further these same litters have been divided according to the period of discovery and the number of young (cf. Tab. 3 and 4). Reports regarding motherless or abandoned young have chiefly been treated elsewhere (NIELSEN et al. 1978; WALHOVD 1981).

## Results

### Records of young

More than 1300 persons responded to our inquiry (cf. Tab. 1). In 640 cases records of young were reported, 66 being litters observed in previous years. Among the reports of litters from the two summers in question 453 were found sufficiently detailed and reliable

to permit further analysis (cf. Tab. 2–4). These litters were recorded by altogether 440 persons. Dogs detected 37 of the nests.

The observations derived from most parts of the country (Fig. 1 and 2). The rather extensive western areas contributed only some 10 % of the litters while reports from eastern provinces were far more numerous. Notably breeding hedgehogs were frequently encountered in built-up areas. For instance Copenhagen and its suburbs contributed 88 litters, i.e. nearly 20 % of all observations recorded.

### Nesting sites and nesting material

Nearly 50 % of the nests included in the analysis derive from agricultural country, slightly less from private residential area (Tab. 2). The reports also included litters discovered in the grounds of multi-storeyed houses in central areas of cities. Some were from parks and gardens, while a few nests derived from camping sites which according to several reports attract hedgehogs all the year around. Only one single nest was detected in a forested area.

The breeding sites preferred were situated in roofed areas (188), most commonly indoors. Typically litters were discovered in barns (79), in stables (31) or in sheds for

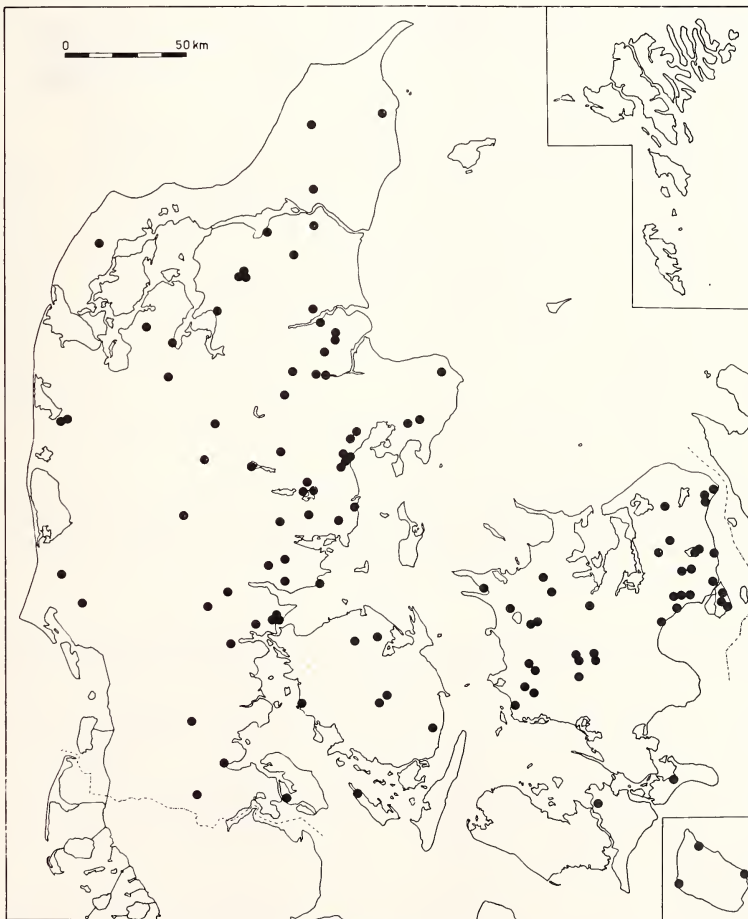


Fig. 1. Locations for 112 hedgehog litters recorded in 1976

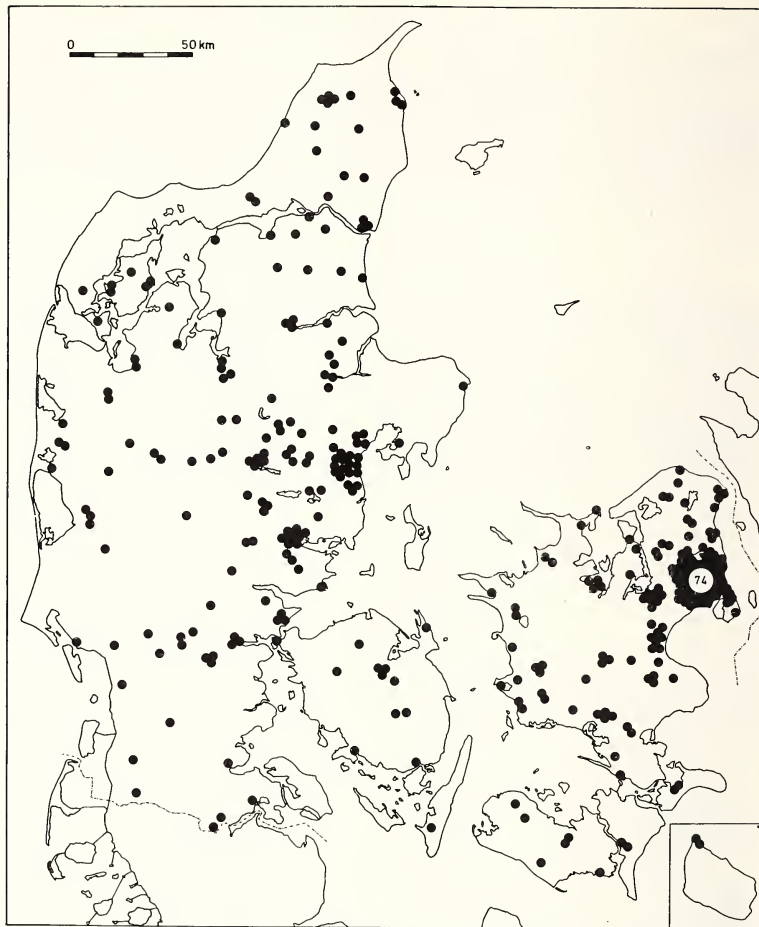


Fig. 2. Locations for 341 hedgehog litters recorded in 1977

agricultural machinery (29). Quite a few nests encountered away from buildings were definitely protected from the rain. Such litters (148) were frequently located in compost heaps, in shrubberies of gardens adjacent to farm buildings. 9 nests encountered in open farmland were mostly found in fields of barley.

Table 2

The recording sites for 453 hedgehog litters among which 289 derive from observations of nest young (cf. Tab. 3)

Habitat	Roofed area		Unroofed area		Nest location unknown	Total
		Rain-protected	At the base of house	Away from buildings		
Farm	139	18	3	48	14	222
Private house	45	14	20	84	38	201
Miscellaneous	4	4	1	16	5	30
Sum	188	36	24	148	57	453

Table 3

The family size of the hedgehog at various ages of the young based upon observations of 453 different litters deriving from two breeding seasons

Category of young	Family size								Total no. of litters	Total no. of young	Mean litter size
	9	8	7	6	5	4	3	2			
1. In nest, blind	0	2	10	21	33	21	12	3	102	503	4.93
2.       with eyes	1	2	9	14	35	24	13	0	98	482	4.92
3.       able to depart	0	5	3	16	34	18	11	2	89	436	4.90
4. Out of nest, with adult	0	1	7	14	27	36	25	7	117	509	4.35
5.       without adult	0	0	3	6	16	13	6	0	44	207	4.70
6.       with myiasis	0	0	0	0	2	0	1	0	3	13	4.33
Sum	1	10	32	71	147	112	68	12	453	2150	4.75

Nests made solely of straw appeared by far the most commonly met with. However, in some cases, when nests were located either in stands of bamboo (*Sinarundinaria murielae*) or fescue-grass (*Festuca eskia*), leaves of these plants constituted a substantial part of the nesting material. In quite a few cases plastic either hid the nest or formed part of the nesting material. Two nests were reported to consist mainly of rock-wool.

#### The family situation and size at the time of discovery

Most litters (289) were discovered while still in their breeding nest (Tab. 3). Young encountered out of the nest were usually recorded with an adult, the presumed mother. In a few litters the young suffered from blowfly myiasis (cf. NIELSEN et al. 1978). The litter size was 2–9, most frequently (73 %) the records referred to litters of 4, 5 or 6. The average family size appeared to be 4.92 and 4.45, respectively, depending on whether the young were counted in or away from the nest.

#### The breeding period

Hedgehog litters were reported during three months, chiefly in August–September (95 %), and with a marked bulk of records (50 %) in late August and early September (Fig. 3). The two earliest reports of litters given, were received over the telephone on August 9.

The actual discovery of the young most commonly occurred during the months of August (61 %) and Sep-

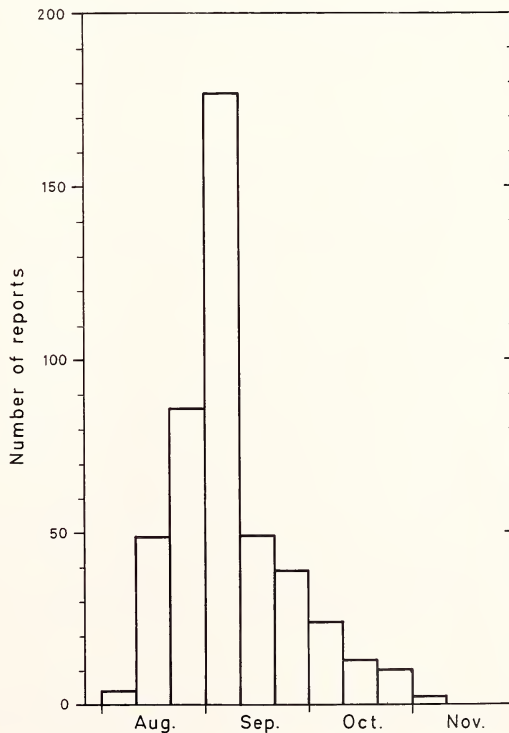


Fig. 3. Number of reports of hedgehog litters received during ten consecutive periods of equal length



Table 4

The periods of observation of 453 hedgehog litters and their distribution in six various categories (cf. Tab. 3)

Category of young Period of observation		1	2	3	4	5	6	Total
July	21-31	11	7	1	0	0	0	19
Aug	1-10	31	20	6	3	2	0	62
Aug	11-20	26	26	10	15	6	0	83
Aug	21-31	21	18	33	46	14	1	133
Sep	1-10	7	16	21	31	11	2	88
Sep	11-20	2	6	11	9	8	0	36
Sep	21-30	3	4	3	8	2	0	20
Oct	1-10	1	0	2	2	1	0	6
Oct	11-20	0	1	1	3	0	0	5
Oct	21-31	0	0	1	0	0	0	1
July 21-Oct 31		102	98	89	117	44	3	453

tember (Tab. 4). The frequency was particularly high (29 %) in late August. Nest young discovered while still blind and thus being two weeks of age or less (cf. MORRIS 1967), were chiefly encountered in August (77 %) or July (Tab. 4, category 1). Some few young remained with their mother until October.

## Discussion

The distribution pattern of breeding hedgehogs (Figs. 1-2) is consistent with what was previously demonstrated regarding hedgehogs encountered during the winter months (WALHOVD 1975). However, in 1977 hedgehogs were introduced to the islands of Askø (4 ♂♂, 2 ♀♀) and Hjarnø (3 ♀♀, 2 ♂♂). On these islands the entire population of hedgehogs was wiped out some 40 years ago, for unknown reasons. The reintroduced specimens and their descendants apparently have propagated successfully as hedgehogs today are reported to be commonly seen on these islands, which each covers nearly 300 ha.

Further, the distribution of records of young confirm numerous previous statements (e.g. BROCKIE 1960; GØRANSON et al. 1976; REICHOLF and ESSER 1981) claiming that the outskirts of built-up areas harbour very dense hedgehog populations. In agricultural districts there was a marked tendency for litters to be chiefly recorded quite near to farmsteads. On rare occasions hedgehogs bred in or adjacent to arable land. Six nests only were detected in corn fields, despite the fact that these fields in 1976 and 1977 comprised 62 % (1.8 mill. ha) of the entire agricultural area of this country, and that hedgehog litters are most frequently encountered during the period when the grain is harvested, i.e. from mid-August until early in September (cf. Tab. 4). When hedgehogs apparently are very sparse in corn fields the explanation may be that they tend to avoid very long grass, preferring pasture land instead (CAMPBELL 1973; PARKES 1975). Thus, the change in agricultural practice during recent years, involving for instance a considerable extension of grain-growing, clearing of hedges, abandonment of grassland and meadows (MØLLER 1983) is probably not beneficial for the hedgehog populations inhabiting rural areas.

The information available on the nesting habits of hedgehogs in the wild chiefly deals with winter conditions (MORRIS 1973; MOORS 1979). On the siting and construction of the summer nests almost no observations have previously been recorded. In an old general account, however, TAUBER (1878) maintains that breeding nests of hedgehogs are encountered in corn fields, among grasses and shrubbery, under woodwork and summer-houses.

In one nest, actually detected, grass and dead leaves were the main nesting items (COLLETT 1912). More recent literature contributes very little new in this respect (PARKES 1975). Obviously (Tabl. 2), the instinct of the female hedgehog to secure dry conditions for their offspring is more pronounced than previously known. The fact that more than 100 breeding nests were recorded indoor and that hedgehogs on rare occasions may breed their young inside human habitation (WALHOVD 1983), further emphasizes that protection of the nesting site from the rain is of fundamental importance for this species. This predominant requirement may be part of the explanation for hedgehog populations being particularly dense in suburban areas (e.g. REICHHOLF and ESSER 1981), and adjacent to farmsteads, as demonstrated in the present study.

MORRIS (1961) recorded a prenatal litter size of 4.6 in England while PARKES (1975) found an average of 5 young in autopsied hedgehogs from New Zealand. The mean number of young in postnatal litters have been reported to vary considerably. HERTER (1938) calculated an average number of 7 young in hedgehogs from continental Europe. More recently LIENHARDT (1979) recorded a mean litter size of 4–5 while KRISTIANSSON (1981) upon an inquiry found, on average, 5.2 young in Swedish litters. In contrast, English hedgehogs probably breed fewer young. MORRIS (1967) reported a mean value of 3 from captive births while MORRIS (1977) found an average litter size of 4.37–3.71, depending on their age.

The present investigation makes it probable that the mean litter size of the hedgehog in Denmark must be quite near to 5 (Tab. 3). Particularly so because the records of nest young given are minimum figures. Frequently it was emphasized when communicating records that the nest inspection had been brief in order not to disturb it unduly. Occasionally, additional young were discovered in such litters. Notably in the smallest litters the number of young is probably underestimated, partly because observations of some young were missed due to dispersal of the families detected out of the nests.

It has been claimed that hedgehogs sometimes breed 10 or 11 young (HERTER 1938; KRISTIANSSON 1981). More commonly however, the maximum litter size is reported to be 6 or 7 (DEANESLY 1934; PARKES 1975; MORRIS 1977; LIENHARDT 1979). The present data indicates that litters of more than 9 young must be rare, although some 10 % of the hedgehogs recorded bred 7–9 young (Tab. 3).

There is, from a number of causes, a pre-weaning mortality among the hedgehog young (MORRIS 1977, 1983; WALHOVD 1983). An exact calculation of postnatal losses is however problematical due to the difficulties of discovering a sufficient number of breeding nests. Furthermore, inspections of recently born young should be avoided because this disturbance may result in female hedgehogs neglecting or consuming their young (MORRIS 1967). During the present study it was frequently established that nest young, immediately upon discovery or a few days later were moved to a nearby site (cf. WALHOVD 1983). In some few of these cases one or two young were abandoned, but no record was ever obtained of hedgehog mothers committing violence towards their offspring. Losses of whole litters appeared not to be uncommon. This was chiefly due to accidental killing of lactating hedgehogs, leading to food deprivation followed by hypothermia and heavy affliction of blow-fly myiasis of the young (NIELSEN et al. 1978; WALHOVD 1981). 90 % of the litters recorded were in danger of losses, the young being still dependant on maternal care (Tab. 3). Considering this hazard, together with the litter losses recorded, a reasonable estimate seems to be that hedgehog females in Denmark on average rear 4 young per year, i.e. about twice the net reproduction rate suggested for British specimens (MORRIS 1983). There was found no indication (cf. Tab. 3) that large litters are particularly at risk, or that available milk of hedgehog mothers is sufficient to support no more than 4 or 5 young, as being recently maintained (MORRIS 1983).

The breeding season of the European hedgehog may be of considerable duration. For instance in New Zealand females with embryos have been recorded from November to

June (PARKES 1975). In England pregnancies occur between early in May and September (DEANESLY 1934), while testes correspondingly are fully active from April to the end of August (ALLANSON 1934). Former observations revealed that hedgehogs in Denmark attempt to mate between late in May and July 20 (DEGERBØL 1943; HAARLØV 1943; HVASS 1971). In a recent five year field study (unpublished) precopulatory behaviour was seen 71 times, chiefly (72 %) between June 1 and July 10.

DEANESLY (1934) maintains that no hedgehog becomes pregnant at its first mating and females are normally conceived weeks after the first mating displays (PARKES 1975; MORRIS 1983). Thus it is likely that pregnancies among hedgehogs in Denmark chiefly occur around midsummer. The records received (Fig. 3) and the observations made (Tab. 4) in several ways confirm this assumption. Despite the fact that the nationwide inquiry started late in June (Tab. 1) no records of young were received until August 9. Therefore earlier statements (e.g. JØRGENSEN 1970) claiming that Danish hedgehogs may mate in April and breed their young as early as June, must be rejected. Judging from the discoveries of the youngest litters (Tab. 4, category 1), being 15–16 days of age or less (MORRIS 1967), most hedgehogs in this country give birth to their young between late in July and end of August and occasional parturitions occur in September. This means that hedgehog litters in Denmark chiefly are born one month later (MORRIS 1983) and that the breeding season ends up earlier as compared to Great Britain (MORRIS 1966).

There is an indication that some hedgehogs in the wild may breed twice in one season (DEANESLY 1934), and among captive females more than one parturition during summer have been demonstrated upon losses or removals of sucklings (MORRIS 1966). It is unlikely, however, that hedgehog mothers in the wild survive if their young are succumbing (NIELSEN et al. 1978; WALHOVD 1981). Thus it is probable that the late born young recorded (Tab. 4) derive from mothers being conceived late in the season (PARKES 1975).

It is known that no immediate post-partum oestrous exists in the hedgehog, neither is there a cycle during the first part of lactation (DEANESLY 1934). For these reasons, and because young are not weaned until they are 40 days of age (MORRIS 1967) it must be concluded that the European hedgehog in Denmark does not produce more than one litter per year.

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#### Zusammenfassung

##### *Zur Fortpflanzung des Igels (Erinaceus europaeus L.) in Dänemark*

Informationen zur Fortpflanzung von Igel wurden mit Hilfe einer Umfrage in den Jahren 1976 und 1977 gesammelt. Die Angaben über 453 zufällig entdeckte Würfe kamen aus dem ganzen Land, vor allem aus bestimmten östlichen Provinzen. Die meisten Beobachtungen betreffen bebaute Gebiete. Fast 50 % stammen aus ländlichen Gegenden, in denen Nester vor allem auf Bauernhöfen, seltener im angrenzenden Ackerland oder in Getreidefeldern entdeckt wurden. 50 % aller angetroffenen Familien hielten sich an regengeschützten Stellen auf. Nester fanden sich häufig in Gebäuden, z. B. in Schuppen, Ställen und Unterständen. Die meisten von ihnen bestanden hauptsächlich aus Stroh.

90 % der Würfe betrafen Nestlinge (289 Würfe) oder Familien in Begleitung adulter Igel, nur 10 % isolierte Geschwistergruppen außerhalb des Nestes. Die Wurfgröße betrug 2–9, am häufigsten (73 %) 4–6. Das Mittel ist 4,75. 95 % der Würfe wurden im August und September gemeldet, während die aktuellen Entdeckungen hauptsächlich aus dem Monat August stammten (61 %). Von 102 im Nest gefundenen Würfen mit höchstens 14 Tage alten Jungen stammten 78 aus dem August.

Die zeitliche Verteilung der Würfe läßt darauf schließen, daß die Igel in Dänemark jährlich nur einen Wurf zwischen Ende Juli und Anfang September zur Welt bringen.

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