

„Polygamy“ in owls – an effort to classify after the literature the terms in connection with partnerships

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Introduction

The term polygamy in the ornithological literature mostly is used for all partnerships, which deviate from monogamy, yet sometimes considerably narrower for partnerships, in which of each sex more than one individual participates (GOULD & GOULD: 242). Likewise often a “successive biandry” is found, which in a stronger definition is a contradiction in itself (AEBISCHER 2008: 40). I here intend to order the terms, to discriminate them from each other, and to present the relations following the literature. Here only those terms are printed bold, which should be used in the future.

The partnerships

Partnership means the mutual tie of individuals with the aim to reach goals, which for the individuals alone are reachable more difficult or not at all. Here we are interested only in those partnerships connected with breeding and/or with reproduction. The difference between these two partnerships consist in whether the partners contribute genetically in the descendants of a brood (reproduction partnership) or not (brood-care partnership). In analogy to monogamy we could name the latter one as well as **social reproduction partnership** and to oppose it to the **genetic** one. For the first case besides the far spread term “helper” we also find “cooperative biandry” (in EPPLE 1985 for his helpers in Barn Owls in captivity and in MARKS et al. 2002 for helpers in the Long-eared Owl).

Helpers are known in the Barn Owl Tyto alba (♀: KNIPRATH et al. 2002; FRANK 2006), the Pygmy Owl Glaucidium passerinum (for two ♀: WIESNER 2010), the Long-eared Owl Asio otus (for one ♂: MARKS et al. 2002; after DNA-fingerprinting this ♂ was an close relative of the ♀), and also the Great Horned Owl Bubo bubo (for one ♀: MARTÍNEZ et al. 2005). BOENIGK (2000) describes unusual events, which he names bigyny: Here a ♂ had adopted a widowed ♀ together with it's brood, copulated with it (without resulting eggs), and fed itself and it's young. Simultaneously another ♀ at a distance of 70 cm from the site of the first ♀ laid eggs and incubated them. Yet here the interpretation as helper should be preferred (SCHERZINGER in litt.).

The far most important partnership in the avian world is the reproduction partnership. There do exist not only different forms but also the case that each partnership is lacking, all mutuality only consists of a number of copulations. In this case later only one partner is responsible for all brood-care, for example the ♂ in the genus *Phalaropus* or the ♀ in the Pheasant (*Phasianus colchicus*) and in many duck species (BERNDT & MEISE 1958: 329). To use a compatible term, this case should be named **agamy (no gamy)**.

Agamy does not occur in owls.

The most easily to define and in the avian world the most frequent case of reproduction partnership is **monogamy**. Here one individual of each sex do unite. Two levels are distinguished: **social** and **genetic** monogamy. The first one merely means that both partners genetically are involved in the offspring and that each partner plays a role in the rearing of the offspring. Occasional or yet frequent contacts outside the pair-bond

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are not excluded. Genetic monogamy however excludes these contacts outside the pair-bond: The two mates are the parents of all offspring of the pair in the respective brood.

Owls mostly are socially monogamous and up to very rare exceptions genetically monogamous as well. Due to the very strong role-partition between the two parents extra-pair fertilisations are very rare. Table 1 shows the results of the authors. As to MARKS et al. (2002) there should be added that the authors after DNA-fingerprinting also think other parent-ship models to be possible, as for example the entering of another ♂ into the ongoing brood after the death of the first one. This ♂ thus should be called helper.

Table 1 : Extra-pair fertilization in owls after DNA-fingerprinting

species	broods	young	EPF	authors
Barn Owl <i>Tyto alba</i>	54	211	1	ROULIN et al. 2004
Pygmy Owl <i>Glaucidium passerinum</i>		89	1	ROTHGÄNGER et al. 2006
Tengmalms Owl <i>Aegolius funereus</i>	32	109	0	KOOPMANN et al. 2007
Little Owl <i>Athene noctua</i>	16	53	0	MÜLLER et al. 2001
Long-eared Owl <i>Asio otus</i>	12	59	0	MARKS et al. 1999
Long-eared Owl <i>Asio otus</i>	1	7	2	MARKS et al. 2002
Screech Owl <i>Otus asio</i>	23	80	0	LAWLESS et al. 1997

For the circumstances in species, in which monogamous partnerships with different mates follow each other (within the same reproduction period or from one to the next), the term **serial monogamy** was introduced (after GOULD & GOULD also found in burying-beetle species and the Zebra Finch *Taeniopygia guttata* and following BAEYENS 1981 in the Magpie *Pica pica*). Here it is of no interest, whether the mate change was forced by the death of a mate or by divorce (dissolution of the pair-bond). If divorce occurs still during rearing of pulli and thereafter follows a new brood of the ♀ with another ♂, KNIPRATH et al. (2002) call this second brood **divorce-second-brood**. Even here it is the question of serial monogamy, as the ♀ never is involved in two broods at a time.

Barn Owls generally are monogamous, whereas divorce is not a to rare event (KNIPRATH et al. 2002; ROULIN 2002). Divorce-second-broods (in the literature mostly incorrectly called successive or serial biandry: among others EPPLE 1985; KORPIMÄKI 1989: 44) have been found in the Barn Owl (ALTMÜLLER 1976; KNIPRATH et al. 2002; ROULIN 2002), the Long-eared Owl (MARKS et al. 2002), and the Tengmalms Owl (HAASE & SCHELPER 1972; KONDRATZKY & ALTMÜLLER 1976; WAGNER & ZANG 1990; KORPIMÄKI 1989). In the case described by KORPIMÄKI, the ♀ at her divorce-second-brood simultaneously was the second-♀ of a bigynic ♂. WIESNER et al. (1981) stated that „ in all cases of double broods described hitherto, these second broods never were those of the same Tengmalms Owl ♂ ♀, as the ♀ ♀ always paired with the ♂ of a different territory.” (The ♂ indeed mostly not had been controlled.)

Then of course it is possible to call all other reproduction partnerships with more than two mates involved genetically and in the rearing of the brood as polygamy and then to name these following the special form with different terms. This term indeed suggests a

greater number of mates (poly- [Greek] = much, many) and should not be used if only two or three mates are involved.

The term bigamy generally indicates the participation of one individual of one sex and of two of the opposite one in the (genetic) reproduction partnership. As it always is uncertain, which sex participates with only a single individual, the terms bigyny and biandry should be used instead. For bigyny it is necessary by definition that the two broods of the ♀ overlap, so that the ♂ is forced to nourish both broods at a time, and for biandry that both ♂ furnish the same brood of one ♀.

*Bigyny, the partnership of one ♂ with two ♀, has been described as well for the Barn Owl (MARTI 1990; TAYLOR 1994; KNIPRATH et al. 2002) as for the Tengmalms Owl (KONDRATZKY & ALTMÜLLER 1976; SCHWERDTFEGER 1976, 1984, 1993; CARLSSON et al. 1987: 9 % bzw. 14 % der ♂ in two vole peak years; KORPIMÄKI 1988, 1989, 1991: 34 cases; HOLMBERG 1980, ZANG & RISTIC 1992) as being not to rare in years with a very good food supply (SCHWERDTFEGER 1976; CARLSSON et al. 1987, KORPIMÄKI 1989, 1991; SHAWYER 1998). One case each has been described by LEHTORANTA (1986) for the Great Grey Owl *Strix nebulosa* (after MARKS et al. 1989), by MARKS et al. (1989) for the Saw-whet Owl *Aegolius acadicus* und SONERUD et al. (1987) for the Hawk Owl *Surnia ulula*. For the Scops Owl bigyny at least in captivity has been observed (KOENIG 1973). From his observations NORGALL (1985) deduces bigyny in the Long-eared Owl. There are records for the Snowy Owl *Bubo scandiacus* (WATSON 1957, HAGEN 1960) and the (American) Flammulated Owl *Otus flammeolus* (LINKHART et al. 2008).*

In a bigynic partnership the ♂ has to be called bigynic, whereas the two ♀ behave monogamic.

KORPIMÄKI (1983) discriminates simultaneous or harem- polygyny from successive polygyny, which by v. HAARTMANN (1969) also is called „restricted polygyny“. These terms seem to be superfluous, if polygyny as well as bi- and trigyny exclusively are used for simultaneous broods. All other is serial monogamy.

*The two bigyny-broods of a ♂ may at least in the Barn Owl, which not is territorial, occur inside the same site (mostly nest box) (MARTI 1990; TAYLOR 1994) (= **monolocal**) as well as (in the Barn Owl and the Tengmalms Owl) at distances of several hundred meters or even some kilometres (= **bilocal**) (Barn Owl: TAYLOR 1994; SHAWYER 1998; KNIPRATH et al. 2002; KNIPRATH & STIER 2008; Tengmalms Owl: KONDRATZKY & ALTMÜLLER 1976; KORPIMÄKI 1988; SCHWERDTFEGER 1984, 1993). In the territorial Tengmalms Owl KORPIMÄKI (1988) discriminates monoterritorial from polyterritorial bigyny, depending on whether the two broods take place in only one or in two different territories of the ♂.*

How a monolocal bigyny-brood in the Barn Owl originates is described by TAYLOR (1994: 154): „... new females sometimes appear, spending anything from a few days to a week or two roosting alongside the incubating female. Very occasionally this association goes a stage further and the second female is mated by the male and produces a clutch.“ Exactly this stage could have been observed by FRANK (2006), if not the interpretation as helper is valid.

*MARTI (1990) found four bigynic trios in the Barn Owl *T.a. pratincola* and stated that the belonging ♂ were remarkably less successful than monogamous ones. For the Barn Owl *T.a.ssp.* DE JONG (1995) describes the faithfulness of a bigynic trio over two years. SCHERZINGER (1968) and KARSTINEN & AHOLA (1982) for the Tawny Owl, *Strix aluco*, TAUX (2006) for the Little Owl *Athene noctua*, and WATSON (1957) for the Snowy Owl as well once have found bigyny.*

The frequency with which bigyny is found for an owl species obviously is depending on the number of intensive studies to exist. These in fact are the immediate consequence of better control possibilities in species, which simply may be accustomed to nest boxes.

*MARKS et al. (1989) for the Saw-whet Owl *Aegolius acadicus* and KORPIMÄKI (1991: 3 Fälle) and SCHWERDTFEGER (pers. comm.) for the Tengmalms Owl have observed **trigyny** (i.e. one ♂ with three ♀).*

For biandry (one ♀ with two ♂) in the literature two rather confusing term are in use. EPPLE (1985) and MARKS et al. (2002) discriminate simultaneous from serial biandry, in GLUTZ & BAUER (1994) for the latter one we find the term “successive”. But as in owls the same ♀ cannot realize two broods at a time, as it is she alone to incubate and to brood, “serial” as well as “simultaneous” biandry are contradictions in themselves (AEBISCHER 2008). What remains is simultaneous biandry. Then indeed the “simultaneous” is superfluous. In analogy to bigyny the ♀ here is biandric, the ♂ are monogamous.

For the Barn Owl biandry simply is estimated (SCHÖNFELD & GIRBIG 1975), a proof does not exist. This latter obviously is valid for all owl species. Also the cases described by SOLHEIM (1983) don't be biandry in this sense.

The term polygamy also is used to name partnerships (GOULD & GOULD o. J.: 242), in which in each sex more than one individual participates. But as there as well a different definition is in use, the term should not be used here. We should use **polygynandry** (as common in the human biology).

A partnership of this kind until now not has been observed in owls.

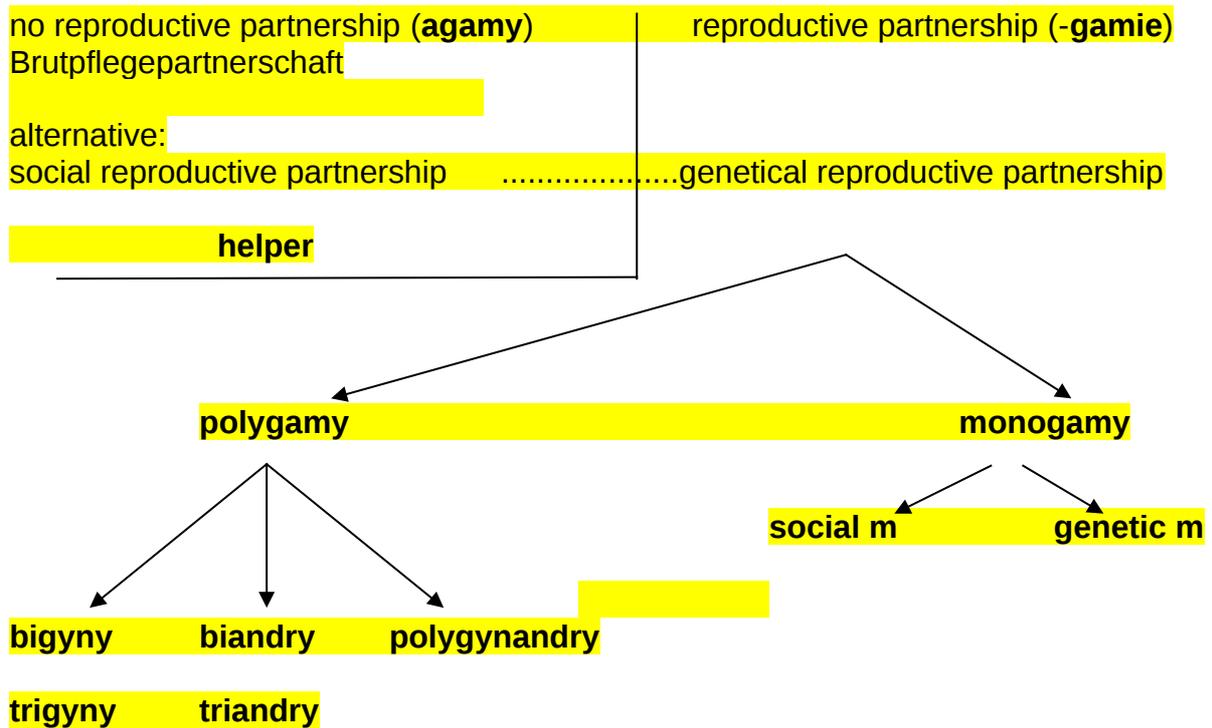
The temporal organization of partnerships

A monogamous partnership may last life-long (**permanent partnership**), it may as well last only for one year or only for one breeding season or brood (**seasonal or temporal partnership**). For species breeding only once a year the latter terms are of identical meaning (BERNDT & MEISE 1958).

Independent of the number of the individuals involved we may state in longer lasting partnerships, whether they last all around the year, the mates so stay together all the time, ore with interruptions outside the breeding intervals, the partners then go different ways. Partnerships without interruptions (as in Swans, some Geese and Cranes) are named **full-time-partnerships (permanent partnerships)**, those with interruptions **part-time-partnerships** (terms as in ENS et al. 1996).

In the Barn Owl KNIPRATH & Stier-KNIPRATH (2009) by the study of recovery analysis found distinct evidence for fulltime partnership. ROTHGÄNGER & WIESNER (2011) showed by telemetry that for a part of the Pygmy Owls part-time partnership is probable.

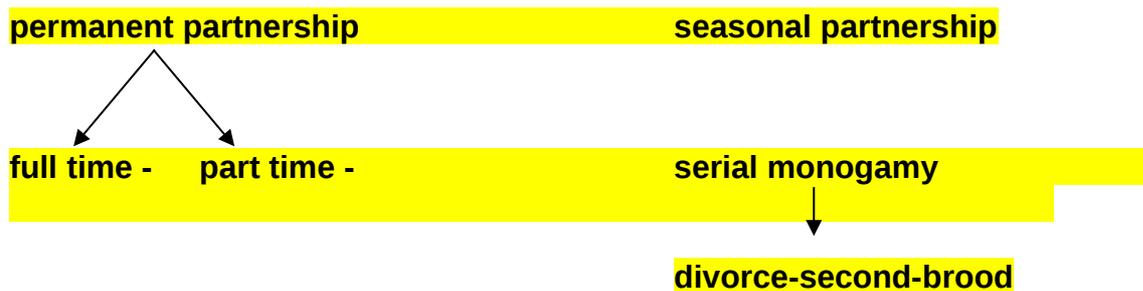
Graph of the partnerships in owls (birds?)



addition: Only the sex being present alone is „bi-„ or „tri-„, the other one is „mono“. In polygynandry all are poly- or perhaps not?

Beyond this system:

temporal organisation of the partnerships:



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