Breeding goals and breeding practices of French dog breeders: results from a large survey

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SUMMARY

Selection goals and management methods of French dog breeders were studied through questionnares sent to breeders registering litters with the French Kennel Club (SCC). The 985 breeders concerned are either occasional, regular hobby or professional, and breed 186 different breeds. Questions dealt with such subjects as the number of dogs owned, selection goals and tools, inbreeding, age of reproduction, and artificial insemination. The answers were analysed according to the breed owned and the number of litters produced, this parameter being linked with the status of the breeder (occasional breeder, professional…). Good conformation was declared as the first breeding goal by 39.7 percent of the breeders, ahead of behaviour. However, hunting selection was largely predominant for pointing dogs and scent hounds, declared as the first breeding goal by 55.7 and 40.9 percent of the breeders of these breeds, respectively. The kennel size was found to have a large effect on the selection method: for instance, proportions of breeders using line and close breeding were significantly higher for breeders producing more than one litter per year. There were also many differences about the use of artificial insemination, according to the breeds and litter production. When working on breed management, it seems important that breeding clubs and Kennel Clubs take those differences into account.

Keywords : Dogs, Breeders, Survey, Breeding goals.

RÉSUMÉ

Objectifs de sélection et pratiques d'élevage des éleveurs de chiens en France : résultats d'une large enquête

Les objectifs de sélection et les pratiques d'élevage des éleveurs de chiens en France sont étudiées à partir d'un questionnaire envoyé aux éleveurs enregistrant des portées auprès de la Société Centrale Canine. Les 985 éleveurs ayant répondu peuvent être occasionnels, réguliers ou professionnels, et élèvent 186 races différentes. Les questions concernent des sujets tels que le nombre de chiens possédés, les objectifs et les outils de sélection, les âges de reproduction, ou l'insémination artificielle. Les réponses ont été analysées en fonction du groupe racial possédé et du nombre de portées produites, ce paramètre étant lié avec le statut de l'éleveur (occasionnel, régulier, ou professionnel). La morphologie est considérée comme le premier objectif de sélection par 39,7 pour cent des éleveurs, devant le comportement. Cependant la sélection sur le travail reste largement prédominante pour les éleveurs de chiens d'arrêt ou les chiens courants, et est déclarée comme le premier objectif de sélection par respectivement 55,7 et 40,9 pour cent de ces éleveurs. La taille de l'élevage et l'importance de l'activité de reproduction ont un effet sur les méthodes de sélection : par exemple, la pratique de la consanguinité (line-breeding ou close-breeding) est significativement plus importante pour les éleveurs produisant plus d'une portée par an. La pratique de l'insémination artificielle est aussi très variable, en fonction des races et du nombre de portées produites. Au sujet de la gestion des races, ces différences devraient être prises en compte par les Kennels Clubs.

Mots-clés : Chiens, éleveurs, enquête, objectifs de sélection.

Introduction

Each year, about 15,000 French dog breeders produce more than 35,000 litters registered by the French Kennel Club (SCC: Société Centrale Canine). The aim of the SCC being to register and promote purebred dogs, it regularly tries to improve its database and services provided to breeders. Another objective is to optimise its breeding management methods to avoid a loss of genetic diversity within the breeds. Therefore it has to sample the opinions and methods of the breeders, for instance about the data written on pedigrees or about inbreeding, which is a selection tool commonly used by some breeders [3]. However there is no precise data about dog breeders, and it seems that there is a large diversity of methods among them. Professional breeders, who derive most of their income from dog breeding, seem to be a minority among the whole population of dog breeders. Among hobby breeders, differences can be recognized between occasional breeders, who register a litter from time to time, and regular breeders, who register several litters per year. Moreover, many different breeds (about 300) are reared in France and several different uses of dogs have to be considered (pets, hunting, security, …). This very large diversity of breeds and uses of dogs could also lead to large differences among breeders.

The aim of this work was to study the differences that can exist among dog breeders about their opinions and their practices dealing with breeding goals, selection tools, and livestock management and reproduction methods. Indeed, several surveys were conducted during the last few years to study the effects of selection on behaviour [5] and health [8, 10, 13]. New tools, based for instance on estimated breeding values, have also been proposed to improve selection [14] and criteria deduced from molecular and pedigree analyses have been proposed to monitor the within-breed variability [6, 7]. However there is no information on the scale of the national population and we do not know what differences precisely exist between the different kinds of breeders.

Materials and Methods

QUESTIONNAIRE

We constructed the questionnaire on the basis of preliminary interviews with 42 breeders. After a phase of correction and validation with 50 other breeders, the final questionnaire was sent in August 2005 to 20,263 breeders, together with a letter from the French Kennel Club ("SCC information"), which is regularly sent to all breeders having registered litters during the last few years.

The questionnaire was anonymous and composed of 55 questions. It dealt with subjects such as information about the breeder himself, his opinion and his practices about breeding, the breed(s) present in his kennel, selection, reproduction and suggestions for the improvement of the work achieved by the Kennel Club. According to the questions, the breeders were asked to give a number (e.g., Number of litters yearly produced, age at reproduction, …), to check one or several boxes, or to grade from 1 to 3 the best answers within a list of choices (for each breeder, the objectives that were not checked were graded as 5).

The time limit for returning the questionnaire was fixed to 3 months and no reminder was sent. Pre-stamped envelopes were not included. A copy of the questionnaire, written in French, is available on demand.

CATEGORIES

Many factors influence the selection methods of breeders. In this paper, we focus on the main two: the number of litters produced during the last twelve months and the breed.

The number of litters produced is an indicator of the size of the kennel and is one of the factors of the breeders' income. It therefore seems to be a good criterion to distinguish the different kinds of breeders. According to the SCC database, in 2004, breeders who had registered more than 10 litters during the year represented 3.7% of the breeders, but 28% of the registered litters. In comparison, 67% of the breeders had registered one single litter, which represented 27% of all registered litters. Thus, this parameter allowed us to take into account the size of the kennels, and differenciate occasionnal, regular hobby and professionnal breeders. Among the breeders indicating a single litter during the last year, it was not possible through the questionnaire to distinguish, on the one hand, the breeders who had a litter every year and, on the other hand, those who used to produce litters irregularly, i.e. not each year. This is why the first category was made of the 536 breeders who declared that they had one litter or less during the last twelve months. The second category, which represented regular hobby breeders, was made by the 333 breeders who answered that they had between 2 and 5 litters during the last twelve months. Those who had 6 litters or more constituted the third category. Some of these breeders (27%) declared that breeding was not their main activity, but because there were only 92 breeders in the category, it was not possible to divide even more.

Due to differences in the use of dog and breeding goals according to the breed, the breeds owned by the breeders were considered in this study. However, a total number of 186 breeds have been recorded in the answers, and there were 103 breeds with less than 5 answers and 46 breeds with only one answer. Therefore, the breeds were grouped for reasons dealing with data processing and accuracy of results. For that purpose, the nomenclature of the international dog federation (FCI) was used. This nomenclature is commonly used in most countries (except in Great Britain, USA, Canada and Australia). It splits the species into 10 breed groups, on the basis of morphology, use, and historical criteria (Table I). However, in our results, with only 16, 26 and 17 breeders respectively, the fourth, fifth, and tenth groups were considered too small to provide accurate results. Therefore, these three groups were merged into a single category called "other groups". Another problem related to the breeders of multiple breeds, which represented about 33% of the breeders. Assuming the hypothesis that breeding in one particular breed group had some influence on the opinion and methods of the breeder, it was difficult to take into account breeders who owned breeds from different groups. We decided to put into the breed group categories only the 775 breeders who declared that 80% of their adults and 80% of their litters belong to the same breed group.

STATISTICAL ANALYSIS

Analyses were performed using the SAS software (2004). The representativeness of the sample (breeders who answered) in regard to the categories was checked by using a Chi-square procedure in reference to the SCC registration data for the year 2004.

For answers where breeders had the possibility to check several boxes, for each box, the effect of categories were analysed using a logistic model with a logit link-function. For quantitative answers, according to the distribution of the results, a Normal or Poisson distribution was used. For the questions where breeders had to check one single answer among several, a multinomial distribution with cumulative logit link-function was used.

The models included the factors "number of litters produced" and "breed groups". For several questions, an analysis including the interaction "number of litters produced" x "breed group" could not be performed because of a problem of convergence of the estimation algorithm . In the other cases, the interaction showed no significant effect on answers except in relation to the number of dogs possessed. That is why the interaction was not added to the model except in this case.

In each case, the general result is given according to the whole sample but modelisation only takes the answers of breeders classified in the categories into account. Therefore a part of the breeders who had different breeds (see above) were not integrated in the modelisation.

Results

REPRESENTATIVENESS OF THE SAMPLE

In November 2005, a total of 1006 questionnaires had been returned giving a response rate of 5.0%. Some of these ques-

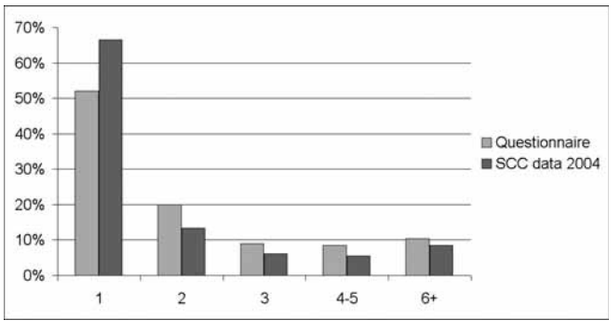

FIGURE 1 - Distribution of the breeders according to the number of litters produced, according to the sampling and to SCC database (2004).

tionnaires were photocopies and we decided not to take them into account in order to avoid double answers. Finally 985 questionnaires were analysed; these breeders did not always answer all the questions.

Figure 1 and Table I show the frequencies of the breeders among the defined categories (number of litters produced and breed groups respectively), in both the sample and the 2004 SCC data. The main result was an overrepresentation in our sample (P<0.001) of breeders who had produced more than one litter during the last year (Figure 1). This can be explained by the fact that professional and regular hobby breeders feel more concerned by dog breeding and were more disposed to answer the survey. Dealing with breed groups (Table I), our sample showed a slight overrepresentation of the 5th group (P<0.001), whereas the frequencies of the other groups were similar to those of the SCC data.

GENERAL CHARACTERISTICS OF THE BREEDERS

The average number of litters produced each year was 2.6 (s.d.=4.1). Using a Chi-Square test, differences in litter size between the breed groups were found to be significant (P<0.0001, see table II). Indeed respectively 48% and 58% of the breeders of the 3rd and 9th groups had produced two litters or more, and this rate fell to respectively 31% and 24% for the breeders of the 6th and 7th groups. The two factors, breed group and number of litters category, are therefore not independent. The repartition of the breeders between the different categories was unbalanced, specially among the category "6 litters or more", which involves professional breeders : for instance, in the 6th group only one breeder declared 6 litters or more. Such a distribution can explain the problems of convergence (see above).

Among the 985 breeders, 66.7% said that they had only one breed, 20.3% two breeds, 8.9% three breeds and 4.1% more than three breeds (0.6% of the breeders gave no answer). The coefficient of correlation between the number of breeds of a breeder and the number of litters produced, was found to be equal to 0.44 (P<0.001). There was no significant effect of the breed group on the number of breeds owned by a breeder.

We studied the differences in the number of sires (reproducing males), dams (reproducing females) and adults (reproducing animals, castrated adults, old ones…) declared by the breeders for the whole sample and according to the breed group. For each of the following results, the number of litters produced and breed groups show significant effects on size, with a P-value less than 0.001. The number of litters produced was found to be correlated with the number of stud dogs (r=0.54, P<0.001), the number of breeding bitches (r=0.88, P<0.001) and the total number of adults (r=0.80, P<0.001).

The average numbers of sires and dams were 1.35 (s.d.=1.70) and 3.33 (s.d.=3.81), respectively. Among the breed groups (table III), the average number of sires ranged from 0.76 (group 7) to 2.23 (group 6) and the average number of dams ranged from 2.01 (group 7) to 4.58 (group 3). The average number of adults possessed (including breeding and non-breeding animals) was 6.42, with a large standard deviation (6.16). Among the breeders of the sample, the total number of adults owned varied between 1 and 49 and among the groups, the average ranged from 3.85 (group 7) to 8.18 (group 3).

Group N°	Description of the group	According to the questionnaire		According to SCC data (2004)	Breeders who breed in one group according to the questionnaire	
		No	%	%	No	%
1	Sheepdogs and cattle dogs (except Swiss cattle dogs)	183	17.5%	15.2%	145	19.4%
2	Pinscher and Schnauzer - Molossoid breeds - Swiss mountain and cattle dogs and other breeds	151	14.4%	16.9%	120	16.0%
3	Terriers	123	11.7%	14.6%	73	8.7%
4	Dachshunds	27	2.6%	3.0%	16	1.8%
5	Spitz and primitive types	43	4.1%	2.2%	26	3.5%
6	Scent hounds and related breeds	110	10.5%	9.3%	91	11.3%
7	Pointing dogs	140	13.4%	14.2%	130	17.2%
8	Retrievers - Flushing dogs - Water dogs	110	10.5%	10.0%	65	8.7%
9	Companion and toy dogs	143	13.7%	13.1%	92	11.3%
10	Sighthounds	18	1.7%	1.4%	17	2.1%
Total		1048	100%	100%	775	100%

TABLE 1: Distribution of the breeders between the FCI groups, according to the questionnaire and to SCC data.

	1	2	3	6	7	8	9	4-5-10	Total	%
0-1 litter	77 *(-1,07)*	76 *(0,64)*	38 *(-0,92)*	62 *(1,04)*	98 *(2,28)*	40 *(0,22)*	37 *(-2,28)*	34 *(-0,27)*	462	60%
2-5 litters	55 *(1,25)*	35 *(-0,45)*	26 *(0,50)*	27 *(-0,38)*	25 *(-2,58)*	19 *(-0,37)*	39 *(1,91)*	21 *(0,45)*	247	*32%*
6 litters or more	12 *(0,45)*	6 *(-0,88)*	9 *(1,58)*	1 *(-2,18)*	6 *(-1,12)*	5 *(0,15)*	13 *(2,54)*	4 *(-0,15)*	56	7%
Total	144	117	73	90	129	64	89	59	765	
%	19%	15%	10%	12%	17%	8%	12%	8%		100%

TABLE 2: Repartition of the breeders according to the breed groups and the number of litters produced (The numbers in brackets represent the standardized residuals using a Chi-Square test).

Breed groups		1	2	3	6	7	8	9	4-5-10
Number of breeders having answered the question		136	109	71	83	121	63	82	5
Sires***	**Mean**	**1.02**	**0.81**	**1.70**	**2.23**	**0.76**	**1.35**	**1.54**	**1.36**
	s.d.	1.36	1.09	1.99	2.23	1.06	1.91	1.44	1.52
Dams***	**Mean**	**3.29**	**2.47**	**4.58**	**3.01**	**2.01**	**2.46**	**3.63**	**2.96**
	s.d.	4.49	2.38	6.26	2.23	2.22	2.76	3.46	2.49
Adults***	**Mean**	**5.65**	**4.45**	**8.18**	**7.88**	**3.85**	**5.84**	**7.38**	**6.38**
	s.d.	6.71	3.92	8.96	4.96	3.40	5.52	5.76	5.27

*** P< 0.001 (according to the model.)

TABLE 3: Number of sires, dams and adults owned by the breeders for the whole sample and according to the breed groups (Average sizes were smaller among the breed groups than the results found for the whole sample, because some of the breeders who had breeds from different groups were not included in these breed groups).

	Whole sample	1	2	3	6	7	8	9	4-5-10
Morphology***	**2.1**	2.4	**1.8**	**1.7**	2.1	2.5	2.6	**1.7**	**1.9**
Behaviour***	**2.4**	**1.9**	2.5	2.1	2.9	3.1	2.0	2.5	2.3
Health***	**2.9**	3.1	2.1	3.0	**4.2**	3.5	2.5	2.1	2.8
Work***	**3.7**	3.8	4.7	4.3	**1.9**	**2.2**	4.2	4.8	4.1
Others NS	**4.9**	4.9	4.9	4.8	4.9	4.8	4.8	4.9	4.9

NS non significant *** P< 0.001 (according to the model).

TABLE 4: Average rank of breeding goals declared by the breeders according to the breed group, the lower number being the best goal (there was no significant effect of number of litters produced on the answers).

	Total number of breeder	1	2	3	6	7	8	9	4-5-10
Number of breeders having answered the question	*950*	*141*	*117*	*71*	*87*	*126*	*64*	*86*	*57*
Sight NS	**34%**	40%	66%	39%	23%	25%	33%	37%	39%
Pedigree NS	**80%**	80%	89%	83%	54%	78%	88%	86%	88%
Offspring NS	**60%**	71%	70%	61%	45%	48%	61%	62%	68%
Relatives NS19%	**22%**	20%	8%	21%	17%	25%	19%	11%	
Work results*	**36%**	35%	5%	17%	76%	84%	34%	1%	23%
Dog shows NS	**31%**	33%	37%	39%	18%	25%	34%	47%	28%
Reputation * of the breeder	**27%**	20%	24%	32%	34%	18%	30%	42%	25%
Others (no test)	**7%**	11%	5%	4%	3%	6%	6%	3%	11%

NS non significant * P< 0.05 (according to the model).

TABLE 5: Answers of the breeders to the question: "When you choose a stallion outside of your own livestock, what information do you look at to make your decision?" according to the breed group (there was no significant effect of number of litters produced on the answers).

The interaction between the two factors were also found highly significant in each case (P<0.001) except with respect to the average number of sires (P<0.011).

SELECTION GOALS

Dog conformation was declared as the first breeding goal by 39.7% of the breeders. Each goal was ranked from 1 to 5. This characteristic appears as the main breeding goal, with an average rank equal to 2.1 (Table IV). It was followed by behaviour, health and work. The answer "others" which include such elements as feeling, reproduction or longevity, was seldom chosen. No significant effect of the number of litters produced was found on the declared breeding goal. On the contrary, the breed group significantly (P<0.001) affected it (Table IV). For instance, the main breeding goal was conformation for the 2nd, 3rd and 9th groups, behaviour for the 1st and 8th groups, and work for the 6th and 7th groups (about dogs, according to the interviews, for most of the French breeders, "work" means physical activities, and not only shepherd activity). In those two groups, work was declared as the first breeding goal by respectively 55.7% and 40.9% of the breeders.

One of the questions in the questionnaire was about the physical activities of the dogs "Do you make your dog work?". The breeders could also pick a box about the kind of work his dogs were doing (hunting, herding, protection, dog sports…). Nine hundred eighty-two breeders answered the question, and among them, 66% answered that their dogs did some work. The two main activities were hunting, which was done by 36% of the whole sample, and protection work (defence) with 11%. The other results are not presented here. There was no significant effect of the factor "number of litters produced". According to the breed group (Figure 2), differences were highly significant for work (P<0.0001). The statiscal analyses for hunting and defence were not performed, because the maximum likehood estimate could not be evaluated, due to the distribution of answers between categories. The proportion of breeders who said they were making their dog work dropped from 97% (7th group) to 21% (9th group). In the 7th group, also 97% of the breeders answered that their dogs were hunting. In the three groups (1st, 2nd, 9th), no one answered that their dogs were hunting, which was predictable. Finally, a large number of breeders had their dogs doing some defence activities only in the 1st (46%) and 2nd (18%) groups.

SELECTION TOOLS

Nine hundred and fifty breeders answered the question "When you choose a stud dog outside of your own breeding stock, what information do you look for to make your decision?" Eighty percent of the breeders quoted the answer "pedigree", maybe because it gives some data about ancestors, work results, dog shows, and disease tests (only about hip dysplasia in French pedigrees). Sixty percent of the breeders quoted "offspring". The rate for the other answers fluctuated between 36% (dog show) and 7% (others). The box "others" gathered such elements as price, results of diagnostic tests, or ancestors. A few significant effects of categories on answers were found (Table V). Indeed breed groups had a slightly significant effect only on "work results" and "reputation of the breeder".

ABOUT LINE-BREEDING AND CLOSE-BREEDING

Two questions were related to the practice of line-breeding and close-breeding, respectively. In the questionnaire, line breeding was defined as the mating of a sire and a dam sharing the same far ancestor, present several times in their pedigree, and close-breeding as mating closely related dogs, e.g. half- or full sibs. Among the 949 breeders who answered the first question, 49% declared they were using line-breeding. Amongst 962 answers, 24% of the breeders declared they were using close-breeding. These proportions were significantly higher (P<0.0001) for breeders producing more than one litter per year (Table VI). There was no significant effect of the breed group.

REPRODUCTION

For the dams, the average announced age at the beginning of the reproductive career was 2.4 years (959 answers, s.d.=0.8) and the average age at the end of the reproductive career was 6.7 years (917 answers, s.d.=1.1). For the sires, the corresponding parameters were equal to 2.1 years (659 answers, s.d.=0.7) and 8.4 years (581 answers, s.d.=1.5), respectively. The number of litters produced had a significant effect on age at the beginning for both dams (P=0.022) and sires (P=0.031) as well as on age at the end for dams (P=0.018) and sires (P=0.037). Our results suggest that sires and dams of regular hobby and professional breeders begin there reproductive career earlier and end it later. The breed group was also found to have a significant effect on age at the end of the reproductive career for both sexes (P<0.0001) but not on the age at the beginning (Table VII).

A total number of 942 breeders, owners of at least one dam, answered the question dealing with the ways to pay for the mating by a sire owned by another breeder (several answers to this question were allowed). The most used modalities were monetary payment (85%), the gift of a puppy from the litter that followed the mating (31%) and the "exchange of services" (11%). Less than 1% of the breeders wrote about other modalities (another gift, no compensation, …). There was a significant effect of the number of litters produced on these modalities (gift of a puppy being more used by the hobby breeders), and the "exchange of service" (more used by the breeders producing a large number of litters) (Table VIII). Table VIII also clearly shows some significant differences between breed groups. For breeders of all breeds' groups, except those of the 6th group, payment is largely the first modality used, followed by "exchange of service". For breeders of the 6th breeds' group, "exchange of service" is the favorite way. About "exchange of services", the 7th group shows intermediate results between the 6th group and the other groups.

To the question "Have you ever used artificial insemination (AI)?", breeders had to choose an answer among three propositions: never, occasionally or frequently. A majority

	Total number of breeder	1	2	3	6	7	8	9	4-5-10
Number of breeders having answered the question	*950*	*141*	*117*	*71*	*87*	*126*	*64*	*86*	*57*
Sight NS	**34%**	40%	66%	39%	23%	25%	33%	37%	39%
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Others (no test)	**7%**	11%	5%	4%	3%	6%	6%	3%	11%

NS non significant * P< 0.05 (according to the model).

TABLE 6: Answers of the breeders to the question: "Are you using line-breeding?" and "Are you using in-breeding?", according to the number of litters produced (there was no significant effect of the breed group on the answers).

	Breed group		1	2	3	6	7	8	9	4-5-10
Dams	**Age at beginning** NS	Number of answers	141	119	73	91	125	61	90	58
		Mean	**2.24**	**2.21**	**2.20**	**2.46**	**2.88**	**2.50**	**2.20**	**2.37**
		s.d.	0.53	0.50	0.62	0.71	0.84	0.74	1.17	0.65
	Age at the end* **	Number of answers	134	110	68	87	120	59	87	55
		Mean	**7.17**	**6.09**	**6.38**	**6.78**	**6.83**	**6.89**	**6.41**	**7.00**
		s.d.	1.01	0.82	0.93	0.90	1.14	0.95	1.19	1.15
Sires	**Age at beginning** NS	Number of answers	94	78	57	65	68	40	64	47
		Mean	**1.87**	**1.79**	**1.59**	**2.28**	**2.32**	**1.80**	**1.57**	**2.00**
		s.d.	0.64	0.44	0.51	0.81	0.83	0.56	0.63	0.71
	Age at the end* **	Number of answers	86	61	45	45	62	31	59	42
		Mean	**8.81**	**7.28**	**8.40**	**8.27**	**8.96**	**8.97**	**8.31**	**8.76**
		s.d.	1.22	1.16	1.56	1.15	1.45	1.16	1.53	1.51

NS non significant *** P< 0.001 (according to the model).

TABLE 7: Age of reproductive career given by the breeders according to the breed group.

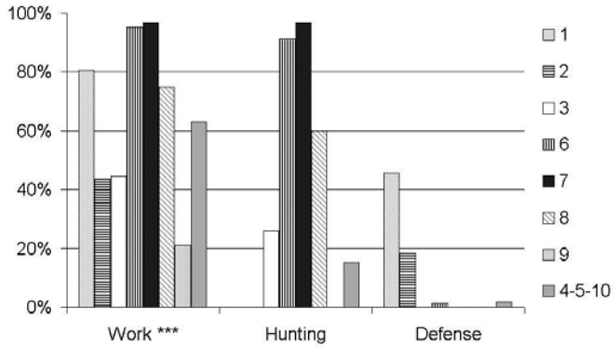

FIGURE 2 - Activities done by the breeders' dogs according to the breed group. Work includes hunting and defence. About hunting and defence, the statistical analysis was not performed, because the maximum likelihood estimate could not be evaluated (*** P< 0.001 according to the model).

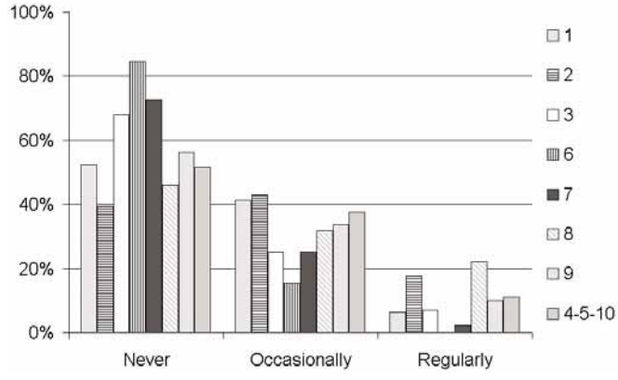

FIGURE 3 - Answer of the breeders to the question: "Have you ever used artificial insemination?" according to the breed group.

Number of litters produced	0-1 litter			2-5 litters			6 litters or more	
Number of answers	519			317			85	
Payment NS	82%			87%			93%	
Gift of a puppy*	35%			28%			13%	
Exchange of services***	9%			12%			25%	
Others (No test)	1%			1%			1%	
Breed groups	1	2	3	6	7	8	9	4-5-10
Number of answers	*141*	*113*	*71*	*84*	*129*	*62*	*85*	*57*
Payment***	94%	94%	90%	29%	86%	89%	91%	89%
Gift of a puppy***	18%	14%	24%	85%	45%	19%	14%	28%
Exchange of services*	8%	9%	17%	20%	7%	11%	13%	14%
Others (No test)	1%	0%	0%	1%	2%	2%	0%	0%

NS non significant * P< 0.05, *** P< 0.001 (according to the model).

TABLE 8: Answers of the breeders to the question: "When you are mating your female by a sire from outdoors, what are in general the payment methods?" according to the number of litters produced and the breed group (possibility to check several answers).

Behaviour of the sire	36%
Behaviour of the dam	45%
Ease of use	11%
Morphology of the sire	8%
Morphology of the dam	13%
Health reasons	68%
Quality of the sire	7%
Imported semen	5%
Others	7%

TABLE 9: Reasons given for the use of AI by the breeders who use it (382 answers).

(58%) of the 972 breeders having answered this question declared they had never used AI, 33% occasionnally and only 9% regularly. Regular hobby and professional breeders use significantly more AI than occasional hobby breeders (P<0.001). Figure 3 also shows the significant effect (P<0.0001) of the breed group on the use of AI: the proportion of breeders using AI is significantly lower for breeders of the 6th group (P<0.0001); it is also significantly lower for breeders of the 3rd and 7th in comparison with breeders of the 1st, 2nd and 8th groups (P<0.0001). Among the 382 breeders using AI, the main reason was health reasons (68% of the answers), mainly for protection against brucellosis, according to the interviews. The other frequently given reasons were the behaviour of the dam (45%) or sire (36%). The conformation of the dam or sire, ease of use, genetic qualities of the sire and import of the semen were more rarely given as reasons to use AI (see Table IX).

Discussion

Our goal was to analyse the diversity of breeding goals and methods among dog breeders on the scale of the French population. The response rate was equal to 5.0%, which is rather low in comparison with investigations of the same kind [10]. This could be explained by the very large diffusion of the questionnaire (about 20 263 breeders), by its length and by the fact that pre-stamped envelopes were not included. In our sample, occasional breeders were underrepresented. This fact does not create a problem about comparison between categories but we should be careful about generalising the results of the survey to the whole breeders population. This is the reason why the results have been mainly shown in term of comparison between breeders categories, rather than average values.

Our study underlines clear differences in breeding methods among dog breeders. Indeed, according to the breed and to the fact that the breeder is an occasional, regular, or professional one, kennel sizes, objectives and methods of selection can be totally different. The large majority of modern breeds were in the beginning working dogs, used as watchdogs, hunting dogs, shepherd dogs… This is why, nine of the ten groups of the FCI nomenclature are utility groups. Nowadays selection for conformation [2] seems to prevail over other kinds of selection. However our results suggest that, according to the breeders, a majority of pointing dogs and scent hound breeds are still mainly selected for work. The fact that in these two groups, the number of litters produced is significantly smaller than most of the other groups strongly suggests that breeders of the 6th and 7th groups are generally breeding dogs for their own hunting purposes. Therefore their expectations will differ from those of the other breeders, for instance about future improvements of pedigrees: breeders of these two groups are likely to be more

interested by an increase of information about work results than about results of dog shows or health.

Some previous studies [8, 11] have shown that there is a significant inverse correlation between body size and longevity among dog breeds, some giant breeds having a lower longevity than 8 years. This could explain the fact that, in the second group, which contains a large number of giant breeds, dogs have a significantly earlier end of reproductive career in comparison with other groups. Longevity is then liable to have some influence on the length of reproductive career.

Inbreeding is frequently used by dog breeders to fix some qualities of a particular dog within the breeding stock of a dog breeder [9]. We originally assumed that there were some differences of inbreeding management methods between breeds. Indeed in some breeds, close breeding can be forbidden by the breed club [4]. Besides some previous studies have shown that there are strong differences of inbreeding rate between breeds, independent of population size or pedigree knowledge [6, 7]. Our results did not show differences according to breed groups; however answers about inbreeding clearly suggest that breeders who make one litter or less per year use less line-breeding and close-breeding than more regular ones. This could be explained by the fact that the use of inbreeding increases the risk of the expression of genetic defects in a litter [3], and an occasional breeder cannot take such risk so easily as a regular one. Since, according to SCC data, those small breeders produced only one third of the litters, when loss of diversity has to be avoided in a breed, clubs should try to better communicate and advise regular breeders [6].

According to our results, male and female of regular breeders began their reproductive career earlier than those of occasional breeders, probably to test earlier the reproduction value of the animals. Although effects of early mating of bitches have never been investigated in-depth, it is well known in farm species that such practices may have some harmful effect on fertility and whelping. Therefore most Kennel Club, like SCC, impose a minimum age for the first litter bred. This limit should be chosen regarding the morphological specificities of each breed.

Conclusion

Our results suggest that although selection goals were clearly linked to the breed, the main factor which influences the selection method is the fact that the breeder is occasionnal, regular or professional. About reproduction methods, such as the use of AI, both factors seemed to have some influence. However, these factors are surely not the only ones that have some influence on selection. Some factors may play an important role in the decisions and should be investigated in further studies, e.g. population size of the breed, experience or social category of the breeder. The world of dog breeding is rather complex, with a great diversity of breeders. Studies and surveys on that topic are necessary to understand the breeders' motivations and so that kennel clubs can make useful propositions about breeding.

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