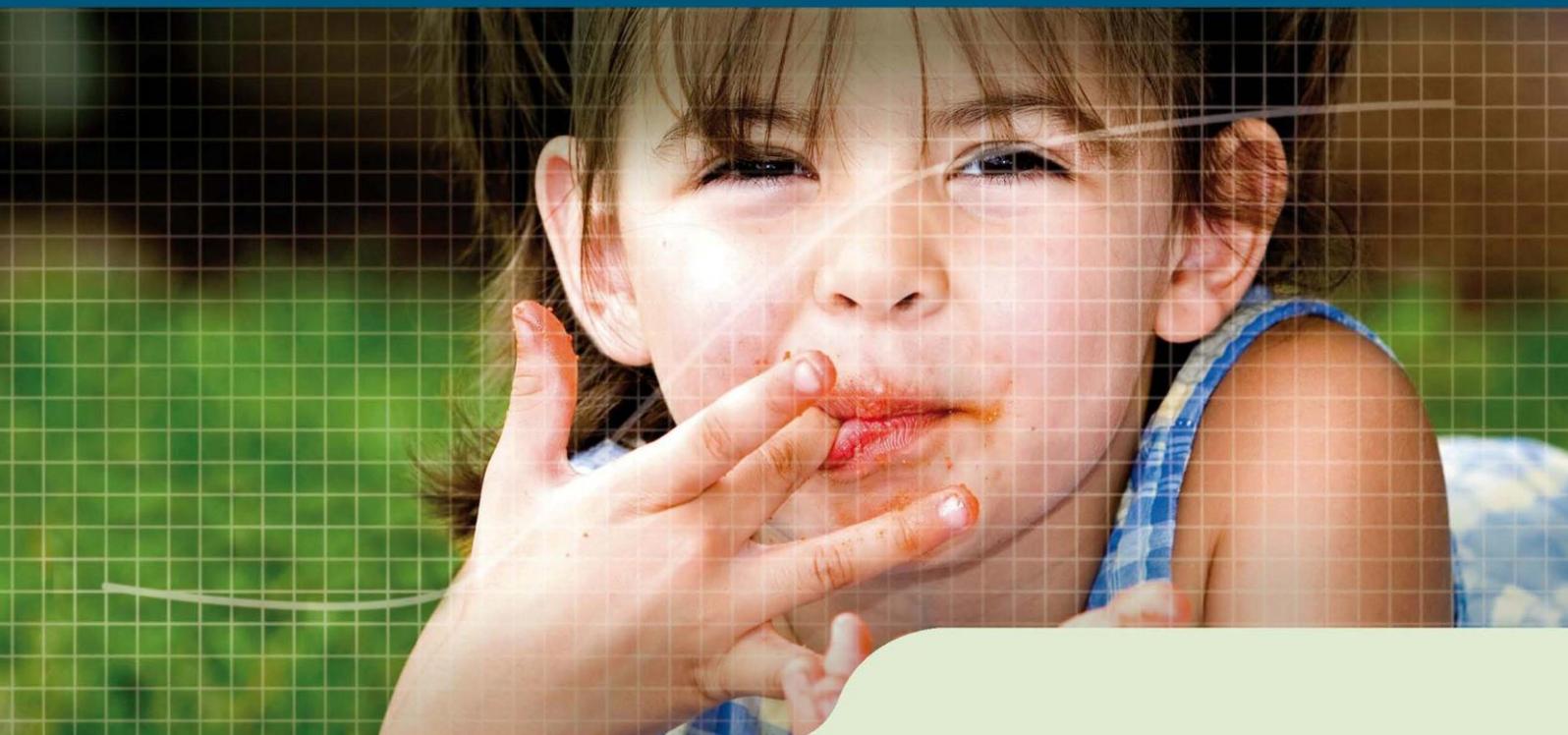


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Rapport 728

Separation ages for primates in new Dutch legislation

April 2013



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Abstract

This report describes expert views concerning
separation ages of specified primate species
(chimpanzees, rhesus, stump-tailed and long-
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squirrel monkeys) in view of a revision of the
Dutch animal welfare legislation.

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Title

Separation ages for primates in new Dutch
legislation

Report 728



LIVESTOCK RESEARCH
WAGENINGEN UR

Report 728

Separation ages for primates in new Dutch legislation

Scheidingsleeftijden van apen in nieuwe Nederlandse wetgeving

M.B.M. Bracke (Moderator) and H. Hopster

April 2013

This research project has been commissioned by the Ministry of Economic Affairs: BO-20-008-004.10-ASG-LR.

Preface

This report describes expert views concerning separation ages of specified primate species (chimpanzees, rhesus, stump-tailed and long-tailed macaques, marmosets, doucoulis and squirrel monkeys) in view of a revision of the Dutch animal welfare legislation. The authors wish to thank the Ministry of Economic Affairs for commissioning this project, the experts and AAP Rescue Centre for exotic animals for their views on the subject and related information. We are happy that his common effort resulted in clear recommendations for the improvement of the welfare of primates in the Netherlands.

Marc Bracke and Hans Hopster

Samenvatting

Een expert consultatie is uitgevoerd naar scheidingsleeftijden van enkele apensoorten ten behoeve van de Nederlandse wetgeving (chimpansees, Rhesus-aap, Beermakaak, Java-aap, Marmoset, Doeroecoeli en Doodshoofdaap). In totaal deden 25 senior deskundigen uit 7 verschillende landen mee in het project.

De 'mediaan' (middelste waarde) van de door de experts voorgestelde scheidingsleeftijden was 6 jaar voor chimpansees; 12 maanden voor makaken in onderzoek en 4 jaar voor makaken in fokkerij, dierentuinen en opvang; 12 -16 maanden voor marmosets; 18-24 maanden voor doeroecoeli's; en 10-18 maanden voor doodshoofdapen.

De belangrijkste argumenten waren gerelateerd aan de natuurlijke condities (bijv. op welke leeftijden de dieren kunnen overleven zonder melk of ondersteuning door de groep).

Het rapport presenteert een gestructureerde, transparante benadering voor ondersteuning van beleid, leidend tot een algemene aanbeveling aan de Nederlandse overheid om de bestaande scheidingsleeftijden op te hogen in overeenstemming met de leeftijden die voorheen in de wetgeving werden gespecificeerd voor het scheiden ('spenen') van primaten in individuele huisvesting.

Summary

An expert consultation was conducted on separation ages for several primate species mentioned in Dutch legislation (chimpanzees, rhesus, stump-tailed and long-tailed macaques, marmosets, douroucoulis and squirrel monkeys). In total 25 senior experts from 7 different countries participated. 'Median' (middle value) separation ages as suggested by the experts were 6 years for chimpanzees; 12 months for macaques used in research and 4 years for macaques used for breeding or kept in zoos or shelters; 12-16 months for marmosets; 18-24 months for douroucoulis; and 10-18 months for squirrel monkeys.

The main arguments related to natural conditions (e.g. at what ages the animals can survive without milk or group support).

The paper provides a structured, transparent approach for decision support, leading to the general recommendation to the Dutch government to upgrade existing separation ages in accordance with ages previously specified for separation ('weaning') of young primates into individual housing.

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1 Introduction: existing legislation and revision initiative

Existing welfare regulations in the Netherlands specify minimum ages for separation of five species/groups of primates (LNV, 1996). It concerns chimpanzees, rhesus macaques, bear/stump-tailed macaques, crab-eating/long-tailed macaques (Java-aap in Dutch), marmosets, douroucoulis and squirrel monkeys. The objective of the legislation is to avoid unacceptable welfare problems for an animal or its parent as a direct consequence of early separation. Different ages are specified for separation from the mother/natal group into either solitary/individual or group housing (see Table 1). Separation at an earlier age is allowed only when necessary for health and welfare of the animal or its parent.

Based on a recent report from Wageningen Livestock Research (van Dixhoorn et al., 2011), the proposed revision of the legislation (Besluit Houders van Dieren ['Keepers of Animals], EZ, 2012) has suggested continuing existing separation ages (Art. 1.20), with the exception of marmosets, which can be weaned in groups as of 8 months instead of 6 (Table 1).

Table 1 Separation ages for primates in existing Dutch animal welfare legislation for moving into group or individual (solitary) housing (LNV, 1996) compared to other sources including a review by Van Dixhoorn et al. (2011), AAP (original position, see Annex 3), EU legislation on scientific research (EU, 2010) and a recent review by Prescott et al. (2012).

Source	Conditions	Chimpanzee (Pan troglodytes)	Rhesus monkey (Macaca mulatta)	Bear macaque (Macaca arctoides)	Crab-eating macaque (Macaca fascicularis)	Douroucoulis (Aotus)	Squirrel monkeys (Saimiri)	Marmosets
LNV, 1996; EZ, 2012	Solitary housing	48 (4 yr)	24 (2 yr)	24 (2 yr)	24 (2 yr)	18	9	12 (1 yr)
^a EZ, 2012; ^b LNV, 1996	Group housing	36 (3 yr)	12 (1 yr)	12 (1 yr)	12 (1 yr)	12 (1 yr)	7	8 ^a 6 ^b
Van Dixhoorn et al., 2011	Group housing	36 (3 yr)	-	10-12	-	-	6	8-13
EU, 2010	Laboratory	-	8	8	8	-	6	8
Prescott et al., 2012	Minimum weaning age in laboratory	-	10-14	10-14	10-14	-	-	-
AAP (original)	Group housing	108 (9 yr)	48	48	48	12	7	8

Van Dixhoorn et al. (2011) presented a quick-scan of the literature primarily based on EC documentation (SCAHAW, 2002; EC, 2007). They suggested separation ages that were in line with the new EU Directive (2010/63/EU) on the use of animals for scientific purposes (EU, 2010) (see Annex 1 and 2). The ages suggested in the revised legislation (EZ, 2012) and by Van Dixhoorn et al. (2011), however, have been criticised.

Firstly, Foundation AAP, a European rescue centre and sanctuary for primates and other exotic mammals based in the Netherlands, supplied referenced information to the Ministry arguing for substantially older ages (chimpanzees: 9 years; macaques: 4 years). In addition, AAP emphasised that individual housing of primates is cruel and should not be allowed (Annex 3).

Secondly, the proposed legislation initiative raised parliamentary questions (EZ, 2013). These questions concern the rationale for the listed species, the specified ages, their scientific underpinning and enforcement. In her answers the minister referred to the former regulations and the review by Van Dixhoorn et al. (2011).

Thirdly, an anonymous Dutch expert agreed with the basic criticism brought forward by Foundation AAP and suggested that prevailing separation ages for primates were too early, as if based on weaning 'toddlers' from milk, rather than on 'adolescents' becoming independent from their mothers, which would be more appropriate. In line with this, it has been suggested that Van Dixhoorn et al. (2011) may have emphasised veterinary aspects (e.g. the ability to digest solid food) over (applied) ethological considerations, such as cognitive and emotional development.

Finally, the Dutch regulations must relate to existing EC Directives, including the use of animals for scientific purposes (EU, 2010). The latter identifies a need for a review of breeding non-human primates. The identification of suitable weaning ages for the primate species in the Dutch regulations may support part of that objective.

1.1 Objectives

The primary objective of this inventory was to consult international experts about suitable separation ages for non-human primates listed in the Dutch legislation (LNV, 1996; EZ, 2012). In particular, this report is intended to support the short-term political decision making by the responsible Ministry of Economic Affairs and by members of parliament in the Netherlands.

2 Methods

2.1 Background documents

This section describes the process of collecting background information for the experts participating in the Delphi expert consultation. Background information comprised a document presenting collected references, a draft table showing information about separation ages for different species and a draft report presenting further background information for the experts.

In order to generate the relevant information on the subject underlying documents and presented information were scanned. This included e.g. Van Dixhoorn et al. (2011), LNV (1996), EZ (2012), EZ (2013) and EU (2010). Next, initial information of the species involved and their natural weaning, independence and reproduction ages were collected from Wikipedia (<http://en.wikipedia.org/>) and Animal Diversity Web (<http://animaldiversity.ummz.umich.edu/>). This information was used to construct a preliminary table presenting information about various separation ages. Table 1 shows the basic structure. Then, additional references, e.g. as provided by Van Dixhoorn et al. (2011), Foundation AAP (see Annex 3) and incidentally encountered websites (e.g. <http://marmosetcare.com/>), were collected in reference-managing software (Endnote). These references were supplemented with several literature searches conducted in Google Scholar, Web of Science and Scopus (all conducted in February 2013). A separate background document was produced listing references and their abstracts sorted alphabetically as well as by topic.

Finally, a draft report was written to provide further background information to the experts. The draft report essentially comprised the introduction, this section, a brief outline of the Delphi consultation procedure, a section specifying aspects to take into account (Section: 'Further details...'), and AAP's original position (Annex 3).

2.2 Delphi expert consultation

As of Feb 15, 2013 a Delphi expert consultation procedure was started by email. The procedure involved asking a selected set of questions to experts, who participated anonymously by providing input and comments on each other's suggestions. The procedure was based on general Delphi principles (Linstone et al., 1975) as well as on earlier work formulating a consensus conceptual framework for welfare assessment and welfare priorities for cattle, pigs and poultry (Anon., 2001a; 2001b), on systematic literature reviews (Bracke et al., 2006) and on procedures used in an EFSA update on pig welfare (Spoolder et al., 2011a; Spoolder et al., 2011b).

Invitation mails (Annex 5) were sent to an initial set of 14 experts on the first day (15-02-2013). These experts were requested to list up to 10 other experts. Because of favourable responses the number was reduced to listing 5 experts in follow-up invitations and as of the second day only 3 names were requested, as prospects for eliciting expert opinion were favourable. Expert listing was intended to both identify the main experts (as indicated by the frequency with which the names were listed by colleagues) and whether we had correctly identified the experts.

The experts were informed about existing welfare regulations and initiatives in the Netherlands. They were asked to provide input by stating their opinion as to what they considered to be suitable separation ages for primates, and what were the main reasons for proposing these ages.

Correspondence with the experts is presented in Annex 5 (invitation mails, questionnaire and reminders) and Annex 6 (received responses from the participants).

The questionnaire contained the following questions (Q):

Q1: *Specify minimally required separation ages for the species listed in the Dutch legislation (chimpanzees, rhesus, stump-tailed and long-tailed macaques, marmosets, douroucoulis and squirrel monkeys).*

Q2: *Give main arguments for these ages*

Q3: *Other considerations*

Q4: *Considerations for objecting to specifying separation ages*

Q5: *Do you agree with the ages suggested by AAP: chimpanzees (9 years) and macaques (4 years), douroucoulis (1 year), squirrel monkeys (7 months), marmosets (8 months)?*

Q6: *Do you agree with AAP that individual housing (>30 days) creates most serious welfare problems and should be considered to be cruel?*

Q7: *Other relevant remarks/comments*

Q8: *Personal information*

The received input was processed as follows: Expert input was coded using expert numbers (E-number) followed by a dash (-) and a number indicating the date the input was received (e.g. E12-140313 was expert 12 responding on 14-03-2013). The text was edited such that it could be read stand-alone, and separation ages as well as more important statements were highlighted in bold. Where relevant, question (Q) numbers were added to refer to the questions in the questionnaire. The moderator (Mod) also added comments and questions, which were returned to the submitting expert before they were distributed to the other participants (in a separate section of repeatedly updated versions of the report).

2.3 Further details on the legislative revision

This section specifies the species involved, the domain of application and criteria to determine acceptability for specified separation ages of primates listed in the Dutch regulations. This section was formulated before the expert consultation started and was used as background information for active participants.

The list of **species** derived from the existing legislation (LNV, 1996), which was originally formulated for primates used in research in the Netherlands at the time. Since the formulation referred both to single species (e.g. rhesus macaques) and groups of species (e.g. douroucoulis and marmosets), an overview was made as to which species were de facto covered (Annex 4). In total 42 species were involved: chimpanzees (1 species; bonobo's were excluded), rhesus macaques (1 species), bear macaques (1), crab-eating macaques (1), marmosets (22), douroucoulis (11) and squirrel monkeys (5).

The **domain of application** refers to the type of animal owner to which the legislation applies. It concerns 'animal keepers' ('Houders van Dieren') in the Netherlands, excluding private owners. Hence, the legislation applies to institutions licenced to keep primates such as breeding institutions, research institutes, zoos and primate sanctuaries/shelters/rescue centres (e.g. Foundation AAP). Since most zoos in the Netherlands apply management practices involving extended separation ages, the main relevance of the existing regulation is for species of laboratory primates which are not mentioned in the Directive 2010/63/EU (EU, 2010), i.e. douroucoulis.

The domain of application of the legislation is restricted to animals kept in the Netherlands. However, the input requested from international experts was to apply more generally, esp. it should apply generally throughout Europe (for the most part) and other 'Western' countries (e.g. Australia, USA and Canada).

In this report the term 'separation age' is used to refer to the moment a young animal is separated from its mother/natal group. Though the term 'weaning' could formally be used, weaning normally refers to the moment a young animal stops drinking milk. At this point young primates generally start to become more independent from their mother, but the process of becoming independent continues until or even after puberty (cf E9-170213; E14-210213; E19-250213). In this respect, expert 28 (E28-120313) pointed out that separation may give the false impression that the animals are to be housed individually. That was not intended with the term 'separation age' as used in this report.

The type of environment in which separation takes place was recognised as a potentially relevant factor. The existing legislation already has different ages depending on whether the young animal is moved to either group or solitary housing. While individual housing was probably no longer considered acceptable, it was also acknowledged that the type of environment might have to be specified in

relation to revised separation ages (e.g. that different ages could apply to primates in research vs. zoos).

It was also emphasised that the legislation allowed for exceptions. Weaning at an earlier age is allowed when this is required for the health and well-being of the animals. Although this, of course, makes a lot of sense, it may also result in a loophole in the legislation, making the whole point of specifying separation ages more or less pointless. Therefore, it was suggested that the revised legislation may be specified, e.g. that documented authorisation of a specialised veterinarian is required to separate young at an earlier age.

Another aspect concerns the **criteria of acceptability**. The objective of the legislation is to avoid unacceptable welfare problems. In this respect the ultimate responsibility of what is considered acceptable lies with the Ministry and the Parliament. Enforcement is the responsibility of the nVWA (Dutch Food Safety Authority) and the police (e.g. when citizens call the alarm number 144 to report animal cruelty) (EZ, 2013).

To determine what is acceptable the former legislation (LNV, 1996) contains the following explanation (Nota van Toelichting Scheiden van Dieren 1996, Bijlage 1), as translated from van Dixhoorn et al. (2011):

- * The young animal should be able to ingest and digest food such that separation from the parent does not lead to illness or death;
- * The immune system of the young animal should be developed such that it can produce its own antibodies, such that separation does not lead to illness or death;
- * The young animals should be able to develop such behaviour that separation does not lead to long-term tension, stress or behavioural problems;
- * The suffering, which the parent animal experiences as a result from separation, should not be such that it leads to long-term stress symptoms of disturbed physiology, immunology or behaviour;

In order for the Ministry to decide on modifying separation ages for listed primates, experts were requested to provide available scientific information on the subject that could be listed in a table. Using this table, the Ministry should be able to select the most appropriate ages. In order to support this political decision making process, the experts were also requested to specify suitable separation ages. Given the concern that aspects of behaviour and welfare may have been given inadequate attention in the past, the experts were asked to give special attention to these aspects.

Relevant information concerns both short-term and long-term consequences for all aspects of welfare of both young and parent animals (including other group members). This includes indices of abnormal behaviour, (related) injuries, stress (e.g. HPA-axis activation) and motivation (e.g. deviation from natural behaviour and 'consumer demand', i.e. how hard animals are willing to work to avoid separation); see also Anon. (2001b) and Bracke (2001).

Furthermore, the experts were asked to acknowledge the need for practical feasibility, as it would not be possible to implement detailed academic considerations or tailor-made solutions into legislation. Finally, it was pointed out that even consensus among experts (e.g. expressed as average/mean separation ages) might not always convince decision makers. For example, in a previous study the scientific literature was reviewed and welfare scores were calculated for different enrichment materials for pigs (Bracke et al., 2007). International pig welfare experts suggested an average score of 5.0 as what they considered acceptable. Later, in most countries throughout Europe minimally required materials for pig farmers had enrichment scores of up to about 2.0 on a scale from 0 to 10. The final ethical responsibility for political decision making lies with the Ministry and its support in parliament.

2.4 General considerations

In the process of writing up the report, it became clear that the underlying considerations for formulating the recommendations needed to be specified. The following considerations were taken into account:

- Animal welfare is the quality of life as perceived by the animal itself (Bracke et al., 1999; LNV, 2002).
- Natural behaviour is important to assess animal welfare, but not all-important (Bracke, 2001; Anon., 2001b; LNV, 2002; Bracke and Hopster, 2006; LNV, 2007; Bracke, 2011).

- Animal welfare is not the only value that is relevant to determine legally-required separation ages. Other values may include the need to do scientific research, education, nature conservation (in zoos), public opinion, public health (zoonoses) and economics. The RDA (Dutch Council for Animal Affairs) assessment model for animal-related policy was used to support careful and transparent decision making based on (intuitions, principles and facts of) public morals and scientific knowledge (h.l. expert opinion) to determine how primates may be kept, in particular at what age young primates may be separated from their mother/natal group (RDA, 2010).
- The Golden Rule (don't do to others, what you wouldn't want others do to you) is a universal moral principle that can be used to determine in theory what is right and what is wrong (Hare, 1981). Ideally, separation ages for primates should (somehow) be in accordance with (the scientific and moral basis and justification for) separation ages formulated for other species.
- "Some animals are more equal than others" (Orwell, 1990), implying that primates may be compared with humans and other animals, but they should not be equated with each other. Animals may differ in morally relevant respects (e.g. welfare needs), and some animals (e.g. primates) may have a 'higher' moral standing than other animals.
- This research was conducted under the constraints of Wageningen UR Livestock Research, a contract research organisation in the Netherlands. One corollary of this was that it had to be conducted in a very limited period of time (less than 2 months).
- The fields of expertise of the first author (who acted as moderator) includes modelling of animal welfare, decision support and expert consultation. It does not include detailed knowledge of primate biology, husbandry and/or health care. Recommendations were formulated mainly based on (interpretation of) input from experts during the project. Except for Prescott et al. (2012), which contains much relevant information, no other publications were consulted in any detail.
- Recommended separation ages for primates have to take into account what is stated in various legislative texts, including the present regulations (LNV, 1996), the legislation initiative (EZ, 2012) and, most importantly, in Directive 2010/63/EU on the use of animals for scientific research (EU, 2010). The present (1996) regulations provide, for example, guidelines to determine what is considered acceptable (see above). In addition, as pointed out also by a participating expert (E1), the EU Directive: "seeks to harmonise practice and regulation across the EU". Setting higher restrictions on a member state's own sector (so-called gold plating) is not permitted (unless these restrictions already existed). (E1-120313). Therefore, considerably older ages are not allowed (or would require hard scientific evidence). Alternatively, it is not an option to specify lower ages than those listed in the Directive. In theory, however, the suggested separation ages could be omitted from the revised legislation (such that the Netherlands would simply follow the Directive concerning laboratory primates). However, this is not the Ministry's intention.

3 Personal information about the experts

Invitation mails were sent to 43 experts in total. Of these, 21 agreed to contribute. From the initial responders 4 did not submit input before the deadline. Those who did not respond to the invitation mail (n=22) received a reminder containing the questionnaire. Of the initial 'non-responders' in total 8 subsequently provided input. In total 25 experts contributed. Out of these 20 experts provided separation ages for one or more species.

In contrast to what was expected, contacted experts did not consistently point towards the same colleagues as relevant participants. Out of a total of 60 potential experts identified, 51 had only 1 reference, 7 had 2, 1 had 3 and 1 had 4 references. The last was the author of the recent review on weaning of macaques (Prescott et al., 2012).

Several respondents also specified the species expertise of named contacts. In the process it gradually became clear that expertise on douroucoulis (*Aotus*) and squirrel monkeys (*Saimiri*) would be limited. Therefore, expertise on these species was actively sought shortly before the deadline (March 14, 2013). This resulted in some additional input on squirrel monkeys, but not on douroucoulis.

Table 3 Overview of the number of participating experts, their species expertise, years of experience, age, nationality (AT: Austria; ES: Spain, IT: Italy, etc.), interest in being a section co-author and whether the expert agreed to have his/her name listed in the acknowledgements. Avg: average; M: male; F: female; Y: yes; N: no.

Number of experts	Species	Years of experience (avg)	Gender (M/F)	Avg age (yr)	Nationality (number)	Co-author?	Acknowledgement?
25	All except <i>Aotus</i> *	24	M: 18; F: 7	52	UK:7; USA:7; NL:6; AT:1; IT:1; ES:1; FR:1	Y:9; N: 6	Y:14; N: 2; Conditional: 2

* Number of experts stating expertise was 12 for chimpanzees; 10 macaques generally; 6 M mulatta, 1 M arctoides, 4 M fascicularis, 9 marmosets, 0 douroucoulis; 3 squirrel monkeys (however note several experts provided separation ages for species they had not listed as their particular species of expertise)

In addition to the information presented in the table, experts were also asked to specify their subject areas and primary affiliations. Main subject areas were: abnormal behaviour (n=4), social behaviour (9), welfare (5), behavioural management (6), behaviour (6) and cognition (3). Stated affiliations were breeding (8), lab work (13), field work (3), zoo (1) and conservation (1). (Note: more than 1 subject area/affiliation was possible per participant.)

4 Individual versus social housing

Question 6 (Q6) concerned welfare implications of individual housing. The experts were asked whether they agreed with AAP that individual housing (>30 days) creates most serious welfare problems and should be considered to be cruel. Their responses led to the following conclusion (further discussed below):

Though experts point out that there may be exceptions (requiring individual housing) and incidentally object to the word 'cruel', experts generally agreed that individual housing imposes serious welfare compromises to primates and should not be imposed routinely. It seems safe to conclude that according to most experts (and the EU Directive 63/2010/EU) individual housing (even when some sensory contact, e.g. auditory/visual/olfactory contact, with conspecifics remains possible) should only be allowed in primates in very exceptional circumstances and only for the shortest possible period of time. Individual and even pair housing should generally be avoided, unless this is in accordance with the animal's natural/individual needs. Management conveniences should not be allowed to overrule these requirements and an active plan should be in place for re-integration when solitary housing is nevertheless needed for well-justified veterinary, welfare and/or scientific reasons.

Main considerations for this conclusion are the following:

EU Directive 63/2010/EU (EU, 2010) regulates the use of animals for scientific research. It classifies complete isolation of primates for prolonged periods of time as 'severe' (i.e. the worst welfare class in the Directive). Other examples of severe procedures include fatal toxicity testing, inescapable electric shocks, immobilisation leading to gastric ulcers or cardiac failure in rats, and forced swim or exercise tests with exhaustion as end-point (see Annex 1).

Annex 7 lists the responses received from the experts to Q6, sorted as much as possible on their agreement with AAP. The responses indicate that the term 'individual housing' is not always used consistently, e.g. some USA-based literature defines social housing as having sensory contact (smell, sight, vision, touch) with conspecifics, not the more widely accepted cohoused definition (E1-120313). Perhaps the most opposing response to Q6 was received from E7, who emphasises that individual housing of marmosets does not cause 'most serious welfare problems' and is not cruel – as long as the singly housed animals have auditory, visual and olfactory contact with other marmosets (E7-080313). Exceptions allowing for individual housing may also involve animals that by nature (e.g. periodically) live alone (e.g. nocturnal prosimians; males having a period of solitary living; E21-010313).

On the whole, however, experts strongly object to single housing and would allow it only in exceptional circumstances. Some differences of opinion exist as to what constitutes an exception. For example, E27 emphasises that all kinds of social disruption, including all changes of group composition and placing animals individually, should be avoided for welfare reasons (E27-050213). E10, by contrast, considers individual housing acceptable when, after multiple pairing attempts, an animal is found to be incompatible with other animals, and when the individual animal is provided with alternatives to social enrichment, such as housing to see other animals, use of video, etc. (E10-100313). Several experts emphasise that management conveniences as regards grouping incompatibility should not be accepted, and E13 suggests prior individual monitoring of animal associations as a potential solution to prevent incompatibilities arising from separation of young animals from their natal groups (E13-090313).

Another relevant aspect concerns housing in pairs, a practice that was suggested being the norm in many US facilities (E13-090313). E13 emphasises that serious welfare problems are observed in both individual and pair housing (E13-090313). In line with this E1 specifies that one conspecific partner is insufficient in chimpanzees, macaques and squirrel monkeys, but not for douroucoulis (*Aotus*) and marmosets (*Callithrix*) (E1-120313).

E1 emphasises the need for a plan being in place when animals must be separated for therapeutic or well-justified scientific reasons (primarily veterinary or behavioural management). The plan should comprise the re-integration of the individual into a compatible social group at the earliest appropriate time. For infants options for cross-fostering with conspecifics or supplementary care should be considered before hand-rearing is used to deal with maternal rejection or other rearing difficulties (E1-120313).

Finally, it was noted that experts on chimpanzees seemed to object more strongly to individual housing compared to most other experts (see Annex 7).

5 Objections to specifying separation ages

The following summary statement was formulated based on the responses to Q4 asking about objections to specifying separation ages.

Experts generally agreed that specifying separation ages in legislation was important. Some objected for moral reasons. Several experts took a most natural stance (e.g. pointing out that when individuals of a given sex (e.g. male chimpanzees; female macaques) normally stay in their natal groups, they should do so in captivity as well. Others pointed towards a cost-benefit evaluation and the need for tailor-made decisions in individual cases.

In general, experts, including those saying they would not participate, indicated that the subject of specifying separation ages for primates in welfare legislation was important. For example, E22 stated "I'm sorry, I'm too much of a scientist to guess, and this is too important a question" (E22-010313).

The questions also elicited moral issues. For example, E13 stated that removal of weaning ages from the legislation would be "a disaster – especially given the lack of benevolence shown by a recalcitrant few in the research sector!" (E13-110313). E10 stated: "One of my concerns about providing input to the Dutch government on this is that I don't want to see regulations promoted that my own facility could be considered in violation of" (E10-110313). Conversely, E28 applied natural separation ages (4 years for macaques, in accordance with what AAP had proposed. Nevertheless E28 was concerned about the consequences for others when legal separation ages were raised to this level.

Several participants preferred that separation ages would respect the natural conditions, and this may imply that some animals should not be separated at all (e.g. since female macaques and male chimpanzees are philopatric, i.e. normally staying in the natal group).

One expert was explicitly objecting on moral grounds: "I am a field primatologist who has spent 40+ years studying wild chimpanzees. I am opposed to keeping chimpanzees in captivity, except when refuges are needed to care for them after release from labs or zoos. I am opposed to breeding chimpanzees in captivity for any reason. Therefore, why should I cooperate with any organisation that seeks to do such immoral things as separate offspring from parents?" (E20-010313).

Other experts pointed to the need for solving the issue of separating young from parents in a more tailor-made fashion, emphasising that primates are individuals (E9-170213; E13-090313) and that specific harm:benefit evaluations are called for (E13-090313), taking into account weight, health and behavioural criteria to determine the most appropriate weaning age for the welfare of each individual as indicated by Prescott et al. (2012). A final, related argument was that a sharp cut-off point is, of course, at odds with the fact that a gradual maturation towards independence takes place; that such prescriptions cannot be applied without understanding/knowledge; and that it is important, for example, to determine or monitor whether the placement group has individuals that could take the mother role (and will do so) (E25-020313).

6 Selected inputs from experts

Experts provided generally relatively brief input statements (see Annex 6). The level of discussion and feedback was limited. The input received was variable, i.e. relatively little overlap of arguments and suggested separation ages was observed.

In order to work towards recommendations for the Dutch Ministry we first present two main inputs. These illustrate the level of thought and argumentation as well as the level of discrepancy between experts.

The main inputs complement the input provided by Foundation AAP (section 3). AAP represented a rather 'nature-/welfare-minded' position, leading to some of the longest separation ages. The first main input came from E1, presenting a kind of middle-ground. In addition, E1 expressed background considerations in considerable detail. The second main input presented in this section was from E29, providing a clear contrast with AAP and E1. A main third input was from E12 (E12-140313). Though not cited in this section, it provided a detailed account of separation ages for macaques and background information on political decision making at the EU level (EU, 2010). The inputs presented here also show how received responses were edited and coded (e.g. with question numbers (Q), bold phrases and the use of dashes).

It should be noted, however, that in contrast to the rather lengthy contributions presented below, we also received some very short (but not as such less valuable) suggestions. One clear example of this is was received from a well known primatologist (E2) who suggested that the legal separation ages for individual housing were better, but still rather young (even for moving into groups). E2 suggested minimum ages of 6 years for chimpanzees and 3 years for macaques (E2-250213b). These ages imply a considerable elevation of the existing regulations (which were 3 and 1 year respectively).

6.1 First selected input (E1)

E1-120313 wrote:

This is a very complicated area of opinion and it is important to be aware of some of the key factors that are likely to influence opinion: culture, jurisdiction, purpose of animal keeping, scientific justification and intrinsic sources of variation. I will deal with these briefly first:

Culture and jurisdiction

By this I mean both the national culture from which the expert originates, and where they work as well as the organisational culture. There is a considerable difference of opinion across cultures that needs to be borne in mind when considering expert opinion in this area. Much of this difference is based in national attitudes to animals, existing guidelines/baselines, focus on financial aspects, misunderstanding of the costs/benefits of early weaning/separation, etc. For example I visited a mixed **macaque breeding facility in China** and was told, with some pride, that they **had just changed their weaning age from 6 months down to 3 months for productivity** reasons and they cohoused weanlings of different species! This despite the fact that the **literature establishes sufficient basis to believe that early weaning elevates maternal, and not just infant, stress that impacts body condition and therefore reproductive condition**. In the USA, the scale of operation is often so large that **mass production mentality and fear of disease can easily predominate** to impact on optimal management of the maternal-infant relationship. I think that given these sources of variation it would be vital to not only bear this in mind when collating opinions but also noting that **ethical consistency needs to be maintained** and the same restrictions should be applied to the authorisation of **importation of animals bred outside the Netherlands** as is applied to breeders within the Netherlands. Of course, there also needs to be awareness that an eye should be kept on the **EU Directive 2010/63** and the fact that this Directive seeks to harmonise practice and regulation across the EU. **'Gold plating'**¹ is not permitted that would place higher restrictions on a member state's sector (unless these restrictions already existed). This would open the authorities to **legal challenge** both from interested parties and the EU itself. I am assuming that sufficient legal advice is in place for this exercise.

Another important variable is that of **existing baselines**. If an expert works in an environment where, for example, the permitted separation age is low (e.g. 6 months), it would be considered radical to propose an elevation of >50% (to 9 months) and potentially outlandish to suggest a level 100% (to 12

1 Gold-plating is a term relating to European Union law, used particularly in the UK. It refers to the practice of national bodies exceeding the terms of European Community directives when implementing them into national law. Source: Wikipedia

months) higher than in their regulated environment, unless working in an animal protection/welfare organisation. Indeed the reality is that even some of the animal protection organisations, in somewhere like the USA, are so focused on the battle to ban the use of chimpanzees in research that issues such as the use of wild-caught monkeys or the merits of weaning ages over 3-6 months may not be a priority.

Purpose of animal keeping and scientific justification

The goal of any breeding programme, whether it is zoo- or lab-based **must be to produce animals that are as normal/natural as possible**. In a zoo abnormal (including species-atypical) behaviour is undesirable as the animal loses an element of its **educational** value for the visiting public and it becomes an unsuitable candidate for **reintroduction to the wild** as part of conservation efforts. In a breeder producing **research** models, even if the animal is destined to become part of the breeding population, it needs to exhibit normal/natural behaviour to be **socially acceptable and to be a viable breeder**. **We know that early weaning affects a range of behavioural and physiological baselines and responses that would impact on the animal's 'normality'**. Vitality, an animal destined for a research environment, must be the **best quality model** possible for the planned programme of research both for the successful **management** of the animal in a restricted, captive, social environment **and** for the **quality and reproducibility of the data** produced in the research (upholding the principles of the 3Rs). While this perhaps would lead to calls for a **harmonised separation age** across contexts there may be instances where deviations from this would be considered by the authorities to be acceptable. For example, the **precautionary principle** may suggest that an extended age of separation in a breeding (zoo or lab) context should be consistent and set for (e.g. a macaque) at 18 months, but given that some studies (e.g. in regulatory toxicology) are as short as 3 months it may be considered acceptable to include some animals separated at less than that age in order to keep them with simultaneously weaned half-siblings provided their body weights meet study parameters. On top of this, of course, are developmental studies that require animals that may be less than the prescribed separation age. Where such studies cannot be conducted *in situ* with the juvenile still in its natal group/with its mother (or are terminal) then this will of course be subject to separate and specific justification made to the regulating authorities and where relevant permissions/licences/permits are only granted on threshold balance of scientific/societal benefits outweighing the objectively considered costs to the animal of not only the programme of research but also the 'early' separation. This is explicit in **Directive 63/2010/EU** as it **requires justification based on the lifetime experience** of the animal.

Intrinsic sources of variation

It is vital that this area of regulation is examined with due consideration given to intrinsic sources of variation. Here I specifically refer to not only **species-specific life history factors** but also **sex** differences, **individual temperament** differences, and **institutional** conditions differences (management and facilities). You correctly identify an important variable in the process – that of whether the animal is removed to solitary or other social conditions. Of course for the former, where solitary conditions are planned this would, in lab conditions where **63/2010/EU** applies, require specific justification as the regulations **require animals to be kept in social settings** (note of warning here – **some USA-based literature defines social housing as having sensory contact (smell, sight, vision, touch) with conspecifics, not the more widely accepted cohoused definition**). In **zoos** or other settings there may not be regulations governing these processes. Of course separating an animal for **therapeutic reasons** (primarily veterinary or behavioural management) should not be barred but under these conditions **it is vital that a plan is in place for the re-integration** of the individual into a compatible social group at the earliest appropriate time. For infants options for **cross-fostering** with conspecifics **or supplementary care** should be considered before any option to hand-rear is taken where there has been maternal rejection or other rearing difficulties. **There is considerable evidence of deleterious effects of hand-rearing on a range of animal species**. In terms of **sex differences** – it is important to consider the **social organisation** of the species in question, specifically **which sex is philopatric**. Primates exhibit a range of social organisations: they may live in dispersed societies where animals spend most of their time foraging alone and where maturing offspring disperse differentially (daughters may remain closest to their mother's territory/range), family groups where both sexes of offspring migrate at sexual maturity, or in mixed-sex groups where one or the other sex emigrates at sexual maturity. In my feedback I am predominantly concerned with the **macaques** which **live in mixed sex groups where peer groups of maturing young males leave their natal group to seek inclusion in another group**. This acts well, together with limited adult male tenure of the group, to reduce inbreeding. It is also a possible reason for some important behavioural differences between **juvenile males** and females – the former being **more aggressive in play** in order to determine dominance in their peer group as once they leave the

natal group they can no longer count on support derived from the dominance status of their mother. **Daughters however, to a differing extent in different macaque species, derive their social status from that of their mothers in a matrilineal bonded society.** How is this relevant to the current review? Well, one might make a case (as I have done in my paper you cite on Selective breeding; (Honest et al., 2010)) that efforts should be made **not to separate daughters from their natal group at all and that only sons should be removed, in order to mimic the wild state.** While it is undoubtedly true that there are **considerable benefits in terms of behavioural management and reproductive learning and alloparenting** of such a strategy, it is also true that **few facilities have the capacity** to allow groups to grow in this way to the point where they would naturally split, and **therefore some selective removal of females may also be necessary** to stay within acceptable/regulated stocking density. If we are to be guided by what happens in the wild then we would have to consider a **natural separation age for juvenile macaque males of around 2.4-3 years of age** – the point at which they may leave their natal group in the wild. Indeed, this appears to be the approach of AAP and I have some sympathy with this as an ideal. While this may be ideal, it is **rarely practical** in reality, partly for stocking density reasons and for behavioural management reasons. In the lab sector **economics** also come into play – unless a customer wants older animals and is prepared to pay for their keep until >3 years old plus quarantine/health screening periods, the breeder needs to maintain a turnover by supplying the animals at the earliest safe, ethical and practical time point in order to minimise costs and maximise turnover. A good breeder will be able to achieve this while still maximising primate welfare. Such a strategy with animals (**macaques**) separated from their natal group into peer groups at **12 months** of age **would not necessarily indicate a departure from best practice.** Of course, the impact on an animal of a **well-managed separation** from its natal group is less than if it is managed poorly, even at the same age. The manner of the separation (quick, efficient, low impact vs. drawn out, inefficient, high impact [e.g. excessive pursuit and excessive restraint]), the composition of peer groups, the nature of destination housing (including levels and appropriateness of enrichment), and the level of supportive and interventive surveillance make all the difference for the experience of the animal. Older separation with poor practice is not necessarily better than younger (within reason) separation with good practice. Finally, serious consideration needs to be given not only to individual temperament but also to variation introduced by **epigenetic effects.** The latter is typified by some of Steve Suomi's work, e.g. Suomi (2006) but the literature is full of work pointing to differences in individual temperament and reactivity. By natural and logical extension **permanent separation from the mother will have a more significant impact on individuals that are more reactive or that have a more fragile temperament or are more closely bonded / behaviourally dependent on their mother.** There is therefore no substitute for **informed observation and knowledge** of the animals as part of the process of planning the appropriate time to separate juveniles from their mothers. Greater **independence and confident interaction with conspecific peers** is likely to predict a smoother, less stressful separation process and long-term adaptation. Determining behavioural suitability for timing of separation is something that is **impossible to regulate** – not every facility has suitably qualified, trained or **capable staff** to perform this accurately and objectively. Of course it is also vital to have **clear definitions** that identify what the opinion is being expressed on. Here the main terms are “*separation*” and “*weaning*”. It is important to be aware that some literature focuses on the age and process of establishing **nutritional** independence of the infant from the mother (as in field studies) and other (captive studies and management literature) uses weaning to describe the **forced** separation of the infant from the mother. It is also worth noting that many authorities believe that the **weight** at which the juvenile is separated from its mother is at least as important as its age. As Phyllis Lee points out (Lee, 1999) weaning weight is strongly predicted by birth mass: **lower birth weight predicts lower weaning weight.** This of course relates specifically to the establishment of **nutritional independence** from the mother rather than relating to any physical separation. However, it does indicate that **there should be some consideration of body mass (specifically birth mass) in the decision of when to separate.** A useful table of natural weaning ages that is more recent than the information supplied in Rowe (1996) is included in Ross and Jones (1999).

Q1: Chimpanzee (*Pan troglodytes*): 7-9 years, based on weaning age in Ross and Jones (1999) plus allowance for socio-behavioural development;

Rhesus monkey (*Macaca mulatta*): 12-20 months, based on Wolfensohn and Honest (2005) and pers. obs.;

Bear macaque (*M. arctoides*): 12-20 months. This is a guess (no experience) but based on being a congener of *M. mulatta/fascicularis* with similar life history and social organisation;

Crab-eating macaque (*M. fascicularis*): 12-20 months (pers. obs. and unpublished data in preparation for publication);

Douroucouli (*Aotus spp*): 10-18 months, based on weaning age in Ross and Jones (1999) plus allowance for socio-behavioural development;

Squirrel monkeys (*Saimiri spp*): 10-18 months, based on weaning age in Ross and Jones (1999) plus allowance for socio-behavioural development;

Marmosets (*Callithrix spp*): 8-14 months, based on weaning age in Ross and Jones (1999) plus allowance for socio-behavioural development;

Q1: I do not believe that any primate should be routinely removed to solitary conditions unless with specific veterinary or well-justified scientific reasons and so all figures above are for separation to social conditions (one conspecific partner is insufficient for all except *Aotus* and *Callithrix*).

Q5: As I said above – I have some sympathy with AAP’s position. They have clearly taken the normal **wild dispersal age** as a suitable separation age. Certainly, this applies a **precautionary principle** to minimise the impact on the animal. My ages are typically lower and this is for a number of reasons.

The **dispersal age** is determined by a **balance** of threats/risks to the individual including **aggression** in its natal group and the risk of aggression and even predation outside the **protection** of the group.

Certainly, the latter does not exist in captivity. The other important factor absent in captivity is the level of competition between groups for food and safe resting places. An animal may try to extend its life within a group as the **group may offer competitive advantages** in foraging against other groups. A lone individual or a smaller peer group is likely to always lose out in competition for food and safety to a larger group. With secure sources of food and safety from predators etc. an earlier age of dispersal may be safe and possible.

6.2 Second selected input (E29)

E29-110313 wrote:

Q8: I direct a large primate breeding facility and thus am in a position to comment on successful and humane husbandry strategies.

Q3/Q7: I see that there is no room to comment on several aspects of animal **husbandry** that your survey appears to overlook. It seems you are focusing on behavioural issues to the exclusion of health. For example, one reason to wean certain monkeys at **6 months** rather than **12 months** is that it is actually **healthier** for them **to be eating solid foods** rather than to persist in nursing. Like human infants if they persist in largely subsisting on breast milk, they will be more prone to **iron deficiency anaemia**, which is corrected by eating fortified commercial diets.

Similarly, there are some **viruses** that are more likely to be transmitted from mother to infant if you keep the infant with the mother for a year. In the case of the **rhesus monkey**, it is extremely rare for **Herpes B** to be transferred from mother to infant in the first **6 months** of life. Hence if you wean at 6 months, you **prevent the vertical transmission** of the Herpes virus that is a serious concern for human handlers. Conversely, if you let the infant stay with the mother for a full year, the odds are much greater that it will have been infected with Herpes B as the mother sheds the virus.

Q3/Q6: Finally, it seems that the plans ignore the long-standing evidence that the peer group and play becomes at least as important as the initial maternal care over time. Weaning infants, even at a younger age, into **juvenile peer groups**, is at least as important. In fact, **I would be disinclined to individual house monkeys even at 2 years of age, but rather would keep them in larger peer groups.**

The strategy at my facility is to wean at a younger age than in your plan (e.g. 6-8 months for macaques), but then to have them in peer groups all the way to adulthood, which occurs between 3-6 years of age in the rhesus monkey. I hope this information is of some help in your planning and regulations. Below I have completed the form and questions, but there may not be room to explain the rationales as completely.

Q1: Chimpanzee (*P troglodytes*): 3 years (although I would transfer to peer housing);

Rhesus monkey (*M mulatta*): 6-8 months providing that the weanlings are housed socially together;

Bear macaque (*M arctoides*): same as rhesus (i.e. 6-8 months providing that the weanlings are housed socially together);

Crab-eating macaque (*M fascicularis*): same as rhesus (i.e. 6-8 months providing that the weanlings are housed socially together);

Squirrel monkeys (*Saimiri*): 6-8 months, provided that the weanlings are transferred into small social groups comprised of peers of the same age;

Marmosets: 6-8 months, although given their family social structure, there may be socialization benefits of continuing with the family housing through **2 years** of age.

Q2: Macaques and squirrel monkeys can be entirely self-sufficient from the food/nutrition perspective by 6 months of age. In fact, there are some benefits of shifting onto solid foods entirely at this age because of the greater **iron** fortification of commercial diets. The important social transition is to **peer housing**, which **ideally includes 3 or more weanlings**. They can then live in the juvenile peer group **through puberty**, especially if comprised of **mixed sex** animals. If the goal is ultimately to create the next generation of **breeders**, then it is important to **move the monkeys into mixed aged housing by 2-3 years of age**. I do not recommend housing **macaques or squirrel monkeys alone**, but, if possible, to pair or group house them. In addition, individual housing of these species should certainly not take place before **adulthood, which is >3-4 years** of age.

Q3: Although it may seem benevolent to house infant monkeys with their mothers through **1 year** of age, it increases the likelihood that some **pathogens will be transmitted** from mother to infant, including one virus of particular concern, **Herpes B**. If weaned by **6 months** of age, most **macaques** will be free of Herpes B. Similarly for **squirrel monkeys**, if infants are weaned by **6 months** of age, they will not be likely to be infected with **Herpes saimiri**. The same concerns apply to other viral pathogens that are transmitted vertically.

Q4: I think **it is a serious mistake to house monkeys with just their mother for one year of age, and then to shift the weaned juvenile into individual housing**. Especially, if you are trying to create the next generation of **breeders**, this is an ill-conceived husbandry practice. In addition, once you have required this long mother-infant housing phase [of **1 year**], you have **compelled the females to be bred at 2 year intervals**. At our facility that would have **negative economic and practical consequences, reducing our fecundity and infant output by nearly 50%**. Many seasonally breeding monkeys can have infants at annual intervals rather than every 2 years.

Q5: In general, **I don't think primates should be individually housed unless it is essential for the research. But there is no reason why the infant must remain with the mother. Many studies have documented the added value of a transition into peer groups** comprised of other weanlings. In addition, **even if an adult should be present, it does not have to be the biological mother. The overseer of the peer group can even be an aged animal. In fact, from a practical husbandry perspective, it is a good use of the aging adults who are now past breeding age.**

Reply to Mod by E29-130313: **I would not house monkeys alone or just in pairs at the period when we keep them separate from the adults to avoid vertical disease transmission (i.e. between 7-24 months). Later as adults they can be pair-housed, but when young it is more ideal to permit social play in larger groupings, including both male and female juveniles together. Otherwise they don't learn about sex through play.**

Q7: Please be sure to consider nutritional and pathogen factors, not only behavioural ones.

Reply to Mod by E29-120313: Primate husbandry is a very specialized area of knowledge, just as the care of any other type of animal requires special insights into its behaviour, nutrition and diseases. Even two experts on primates would likely disagree on the optimal age for weaning an infant monkey. My own husbandry perspectives **take into account not only behavioural needs, but also disease transmission, nutritional needs, and the economics of running a large breeding program.**

If in our desire to promote animal welfare, we create **restrictions** that make the husbandry cumbersome and excessively costly, then it **will be counter-productive**. For a breeding program, it is not a minor consideration to **reduce** a breeding female's **reproductive success by nearly 50% (if one requires that the infant stay with her past one year)**.

I don't know if the others who have responded to your request were considering all of these issues together. **Often many think that just extending the mother-infant phase is good without even knowing why.**

7 Nature as guiding principle

AAP (E17ab) suggested using subadult, migration ages in the wild as indicated separation ages for primates in captivity. This resulted in rather high separation ages. AAP's ages were only exceeded by several experts who seemed to be taking a more ethical stance by suggesting that young primates should '**never**' be separated from their mothers. A 'nature-minded' orientation was generally widespread among the experts, including in particular among the Dutch experts involved (including AAP).

Only incidentally an expert would formulate a position without implicit or explicit reference to natural conditions (perhaps exemplified by E27-050213). Several experts, however, emphasised that the nature-based ages would not be feasible in practice (E1-120313; E13-090313; E29-110313; E8-250213). These experts tended to emphasise that other factors need to be considered as well. For example, E29 wrote: "My own husbandry perspectives take into account not only behavioural needs, but also disease transmission, nutritional needs, and the economics of running a large breeding program" (E29-110313).

That said, widespread support could be detected for taking natural conditions into consideration when establishing separation ages for primates (e.g. E9-170213; E19-250213; E21-010313). For some experts this was evident only indirectly, e.g. from the (high) separation ages they suggested (e.g. E2-150213) or from emphasis on field observations and rejection of practices in captivity (E20-010313 ; E26-020313).

Several others expressed it more explicitly (see e.g. E1-120313 above; first main input; section 7.1). Secondly, even rather 'conventional' separation ages (i.e. related to nutritional independence, rather than social independence) can include a reference to 'natural weaning ages' (E14-210213). Thirdly, E19 takes natural conditions in the wild as a starting point (implying older separation ages), but then points out that when continued normal group housing is not possible, early separation may be indicated so as to avoid binding/attachment to social living conditions (E19-250213). E21 makes a fourth suggestion, namely to use migration ages based on natural demographic processes as preferred separation ages and use the natural ages at which an orphan can survive in the wild as bottom line of what should be considered acceptable (E21-010313). In line with this E28 suggests using the animals' ability to be self-supporting (i.e. can survive in nature without their mother) to establish separation ages (**about 1 year for macaques, marmosets, douroucoulis and squirrel monkeys**). This is suggested in response to AAP's (later) migration ages. Regarding individual housing E28 also emphasises that the natural living conditions of the animals should be the leading principle (E28-120313). E26 proposes to maintain natural group compositions and allows separation at an age when young animals would normally migrate in the wild (E26-020313). Such dispersal ages (as suggested by AAP) apparently apply a precautionary principle to minimise the impact on the animal (E1-120313). However, as E1 points out as well, captive conditions may differ (e.g. concerning predation and food availability) and hence allow for (somewhat) younger separation ages.

At the other end of the spectrum, several experts seemed to be 'struggling' with the idea of applying nature-based criteria. E10, for example, first points out that "attempts to replicate all features of an animal's natural environment are unnecessary for good welfare, as anyone who runs a zoo can attest" (E10-100313). Subsequently, E10 suggests: "The approach that has been taken by zoos regarding the limitations of captivity (which might be summarized as "finding some minimum approximation to features of the wild that will lead to good welfare in the majority of captive animals") can apply as well to the social attributes" (E10-100313).

In conclusion, *natural behaviour, conditions and adaptations provide important guiding principles to determine suitable separation ages, but other aspects need to be taken into account as well.*

8 Overview of separation ages for different species/groups

The table below summarizes the information collected in this project on separation ages for the primates listed in the Dutch welfare legislation.

Table 4 Overview of relevant ages for separation of selected primates. Separation ages suggested by experts (E) have been sorted by age and median values are shown in bold.

Source / Expert	Conditions	Chimpanzee (Pan troglodytes)	Rhesus monkey (Macaca mulatta)	Bear macaque (Macaca arctoides)	Crab-eating macaque (Macaca fascicularis)	Douroucouli, Night monkeys (Aotus)	Squirrel monkeys (Saimiri)	Marmosets	General
Expert opinion: E11; E2; E8; E15; E20; E23; E25; E26; E27; E7; E24; E13; E18b; E18c; E10; E29; E4; E28; E1; E17ab (AAP); E12;	Group housing	E29: 3yr; E8: 4yr; E25: 4yr; E4: 4-5yr; E24: 5-6yr; E2: 6 yr ; E1: 7-9yr; E15: 8 yr (4-5 yr with mother and/or peers); E17ab: 8-10yr; E20: 'never'; E26: 'never';	E29: 6-8mo; E10: 6-12 mo; E4: 1yr; E27: 8 mo (in familiar group) or never; E28: 1 yr (practice: 4 yr); E13: 12-15 mo ; E12: 12 mo (research, 4 yr (breeding, zoos & shelters); E1: 12-20mo; E25: 18 mo; E2: 3 yr; E17ab: 4 yr; E26: 'never';	E29: 6-8mo; E27: 8 mo (in familiar group) or 'never'; E1: 12-20mo; E12: 12 mo (research, 4 yr (breeding, zoos & shelters); E1: 12-20mo; E25: 18 mo; E2: 3 yr; E17ab: 4 yr; E26: 'never';	E29: 6-8mo; E27: 8 mo (in familiar group) or 'never'; E1: 18b: 1 yr; E4: 1yr; E28: 1 yr (practice: 4 yr); E12: 12 mo (research, 4 yr (breeding, zoos & shelters); E1: 12-20mo; E25: 18 mo; E2: 4.5 yr; E26: 'never';	E29: 6 mo?; E1: 10-18 mo; E25: 18 mo; E2: 24mo[?] ; E17ab: 2-3yr; E26: 'never';	E29: 6-8mo; E25: 9 mo; E1: 10-18 mo ; E2: 12mo[?] ; E17ab: 2.5yr; E26: 'never';	E29: 6-8mo; E1: 8-14 mo; E25: 9 mo; mo? E23: 12-14 mo ; E2: 16 mo ; E18: 18 mo (1.5-2yr practice); E1: 18 mo; E17ab: 1.8 yr; E26: 'never';	
EZ, 2012; LNV, 1996;	Solitary housing	48 mo (4 yr)	24 mo	24 mo	24 mo	18 mo	9 mo	12 mo	
EZ, 2012; LNV, 1996;	Group housing	36 mo (3 yr)	12 mo	12 mo	12 mo	12 mo	7 mo	8 mo (EZ, 2012); 6 mo (LNV, 1996)	
Van Dixhoorn et al., 2011	Group housing	36 mo (3 yr)	-	10-12 mo	-	-	6 mo	8-13 mo	
EU, 2010	Laboratory	-	8 mo	8 mo	8 mo	-	6 mo	8 mo	6-12 mo (NHP)
Prescott et al., 2012	Min. weaning age in lab.	-	10-14 mo?	10-14 mo?	10-14 mo?	-	-	-	10-14 mo (macaques)
ADW*	Typical or average weaning age (in nature)	48-56 mo (4-5 yr) ¹² ;	4.6 mo (M); 330 d; 321 d; 365 d; 192 d; 1 yr; 4.6 mo ¹³ ;	9 mo; 393 d; 398 d; 13.1 mo ¹⁴ ;	420 d; 7.6 mo (M); 330 d; 420 d ¹⁵ ;	A azarae: 231 d ³ ; range=5-12 mo ³ ; A lemuringus: 75 d ⁴ ; A nancymaae: 13d, range=12-15d ⁵ ; A nigriceps: 19 wk ⁶ ; A trivirgatus: 2.5mo (M), 75d, 179d, 0.21yr, 2.5mo ⁷ ;	S sciureus: 8 mo (M), 168d, 183d, 0.14yr, 8mo ⁸ ; S boliviensis: range=4-6mo ⁹ ; S vanzolinii: 6 mo ¹⁰ ; S oerstedii 12 mo ¹¹ ;	C. jacchus: 60d; 77d; 90d; 0.25yr ¹ ; C. kuhlii: range=4-6 mo ² ; C pygmaea: 91 d, 90d, 0.25yr ¹⁶ ; C argentata: 6 mo ¹⁷ ;	
ADW*	Independence (in nature)	72 (6 yr) ¹² ;		18 mo ¹⁴ ;		A nancymaae: 18d ⁵ ; A nigriceps: 18 wk ⁶ ;	S boliviensis: 1yr ⁹ ; S vanzolinii: 1 yr ¹⁰ ;	C. kuhlii: 12 mo ² ;	
ADW*	Sexual/reproductive maturity (in nature)	10-13 yr (F), 12-15 yr (M) ¹² ;	2.5 to 4 yr (F), 4.5-7 yr (M) ¹³ ;	4 yr (F); 3.84 yr (F); 3.73 yr (F); 3.25 yr (M); 4.5 yr (M); 4.5-5yr (M) ¹⁴ ;	4 yr (F); 1238 d (F); 6 yr (M); 1544 d (M) ¹⁵ ;	A azarae: 2 y (M&F) ³ ; A lemuringus: 2.5 yr (F) 2 yr (M) ⁴ ; A nancymaae: 211-400d (M&F) ⁵ ; A nigriceps: 3-4yr (F), 2 yr (M) ⁶ ; A trivirgatus: 821 d (F), 730d (M) ⁷ ;	S sciureus: 2.5yr (F), 1003d (F), 4yr (M), 1826d (M) ⁸ ; S boliviensis: 2.5-3yr (F), 5yr (M) ⁹ ; S vanzolinii: 2.5yr (F), 2.5-4yr (M) ¹⁰ ; S oerstedii: 1yr (F), 4-6 yr (M) ¹¹ ;	C. jacchus: 477d (F); 382d (M) ¹ ; C. kuhlii: 12-15 mo (M) ² ; C pygmaea: 684d (F), 638 (M) ¹⁶ ; C argentata: 304d (F), 334 d (M) ¹⁷ ;	

Notes to the table:

Ages in months (mo), years (yr), days (d), or weeks (wk); F: females; M: Males; NHP: non-human primates; ADW: Animal Diversity Web; E[number]: expert number; #: 'never' means no separation when this is not natural, i.e. when animals normally stay in the social group in the wild; *ADW references: 1: Cover (2000); 2: Keeley (2004); 3: Smith (1999); 4: Soderman (2000); 5: Graf (2006); 6: Davis (2008); 7: LaValle (2000); 8: Rhines (2000); 9: Sipahi (2006); 10: Williams (2006); 11: Ambrose (2002); 12: Shefferly (2005); 13: Seinfeld (2000); 14: Erfurth (2008); 15: Bonadio (2000); 16: Wade (Wade, 2012); 17: Garza (2001).

As a general rule younger separation ages (e.g. 6 months for macaques) were suggested by experts from the US. This probably reflects transatlantic differences in colony management (E12-240213).

9 Species-specific considerations

The input received from experts (presented in chronological order of receipt in Annex 6) is presented again in Annex 8, but then sorted by species and suggested separation age. The sections below summarize the experts' contributions. Potentially relevant ages are shown in bold. Incidentally, suggestions of the first author are inserted indicated as 'Mod:'. General points of concern for recommended separation ages are identified in italics.

9.1 Chimpanzee (*Pan troglodytes*)

Present Dutch regulations (LNV, 1996; EZ, 2012) state separation ages of **3 years** for group housing and **4 years** for separation into individual housing of chimpanzees. EU Directive 2010/63/EU (EU, 2010) severely restricts the use of great apes for scientific research, and in line with this does not specify separation ages for chimpanzees.

Table 4 shows that separation ages suggested by experts varied from **3 years** (E29) to '**never**' (i.e. separation only incidentally and in accordance with natural migration tendencies) (E20; E26). The 'median' value is **6 years** (E2). E29, who suggested the lowest age, directed a chimpanzee facility in the past.

Some experts emphasise flexibility (E8-250213) and that at an earlier age (e.g. as of **4 years**) the role of the mother can be taken by peers (E25-020313). Others pointed out that chimpanzees are socially dependent on their mothers until puberty (as of **8 years**) and beyond (E9-170213). Also regrouping of males is highly problematic due to fighting, esp. in small enclosures (less than one hectare). In large spaces (25-100 hectares) with many hiding places integrations are much less of a problem (E9-170213).

The AZA Chimpanzee Care Manual (AZA, 2010) gives a minimum age of at least **4 years** and indicates that there is no evidence of negative effects of staying too long in the natal group other than the *difficulty of integration at a later age* and the necessity to *avoid inbreeding* (cited by E8-250213). Furthermore, mother-raised infants show greater adult social and sexual competence when reared in the presence of cycling females (AZA, 2010) (cited by E8-250213).

From the AZA Chimpanzee Care Manual (AZA, 2010): "In the wild, offspring may typically stay with their mothers for at least **six years**, sometimes longer. At the age of adolescence, females may transfer from one community to another. In zoos and aquariums, it may be easier to introduce a young female developing her first sexual swellings to a new group before she is at the age where established females may consider her "*competition*" for the males' attention. It is also important to remember the potential threat from the resident adults if the young female is carrying an infant when she is introduced (there is a risk of infanticide). In addition, an adolescent male may be considered a threat to an adult male as well. This is considered an extremely difficult age to introduce a male. If breeding recommendations call for the emigration of a young chimpanzee from one group to another, it is recommended that young chimpanzees, in particular males, be transferred and introduced in a new group **by the age of 5**, when they are still considered juveniles, and their presence may not seem so threatening (McNary, 1992). In all cases, the relative risks of the social introduction should be weighed against the relative benefits for both the immigrant and resident individuals." (AZA, 2010) (Cited by E8-250213).

E8 furthermore points out that a minimum requirement of **9 years** as suggested by AAP may handcuff managers when attempting to make inter-group transfers that will ultimately benefit the individual and group dynamics. Ensuring that chimpanzee infants get at least **4-5 years** of time in their natal group should be sufficient to ensure development trajectories, but still allow some of the management flexibility necessary to facilitate cooperative population management (E8-250213).

E24 suggests a minimum of **5-6 years**. E24 writes "We have been unable to separate a **3 year-old** from her mother for an extended period without *much distress* from both mother and infant. One can separate them at earlier ages but they do not do so voluntarily. Only older infants are comfortable doing this, which is when we start testing them individually" (E24-110313).

E15 suggested **8 years (adolescence)** when moved to another group as individual, and **4-5 years** (i.e. when weaned from milk) only when moved with the mother and/or with peers (E15-260213).

E15 states: "For the development of the primate infant's arousal-modulation abilities it is necessary not to disrupt the infant's attachment-exploration balance which is facilitated by the mother (Ainsworth et al. (1971), for humans) and which in turn is vital for the development of socio-emotional and cognitive skills (Bowlby, 1969/1982). Negative outcomes of social separation in primate infants caused by disturbances in attachment such as impaired affective development and behavioural coping were

reported by e.g. Kraemer (1992), and Reite and Capitanio (1985). For chimpanzees, in particular, reports on negative outcomes of maternal loss are provided by Goodall (1986) (p.101 ff) and Boesch et al. (2010) (E15-260213).

Early stages of the life cycle of chimpanzees according to Goodall (1986) (p.81) are:

Infancy: **0-5 years**

Childhood: **5-7 years**

Early Adolescence: Males: **8-12 years**; Females: **8-10 years**

Late Adolescence: Males: **13-15 years**; Females: **11-14 years**

In conclusion (and given the considerations specified in Section 2.4): *Based on the input received from the experts, the separation age for **chimpanzees** should be raised beyond weaning (4-5 years) when moved with peers, and preferably be raised to 6 years of age in other cases. However, especially re-grouping of males is to be avoided as much as possible.*

9.2 Macaques

Present Dutch regulations (LNV, 1996; EZ, 2012) state separation ages of **12 months** for group housing and **2 years** for separation into individual housing of macaques (specified for rhesus, bear and crab-eating macaques separately). EU Directive 2010/63/EU (EU, 2010) specified separation ages for this species at **8 months**. E12 explains that this age was the product of negotiation between welfare experts and industry. The former argued for the biologically normal weaning age of **10-14 months**, while representatives of industry and commercial breeders argued to maintain the status quo at **6 months** (see Prescott et al. (2012) – basically the infants can survive without milk, and it was claimed to increase colony productivity) (E12-140313).

Table 4 shows that suggested separation ages for macaques generally (most right column in Table 4) varied from **6-12 months** (E10) to **3 years** (E2), with **18 months** (E18c) taking the middle position.

Median values for the three species separately (i.e. *M. mulatta*/rhesus macaque, *M. arctoides*/bear macaque, and *M. fascicularis*/cynomolgus monkey/crab-eating/long-tailed macaque) shared the suggestion of E12: **12 months** for research and **4 years** for breeding, zoos and shelters. Generally, experts specified similar ages for the three species of macaque, and for this reason the information on the different macaque species was integrated into a single overview.

Annex 8 specifies expert input sorted by separation ages for macaques. The text below presents expert considerations related to progressive separation ages. All statements preceding a reference can be attributed to that expert. As much as possible, we first list the arguments in favour of separating at this point, then the arguments against it.

6 months: is successful for the majority of separated animals, provided they are put in a rich social and physical environment (E10-100313; E29-110313); young can do without the mother's milk (E29-110313); helps prevent iron deficiency anaemia due to prolonged nursing (E29-110313); reduces vertical disease transmission (e.g. Herpes B virus in rhesus macaques is rarely transmitted from mother to infant in the first months of life; E29-110313); may be indicated for welfare reasons when the mother is living (mostly) individually in a relatively small cage (E10-100313); long-standing evidence shows that the peer group and play becomes at least as important as the initial maternal care over time, and that the role of the biological mother can be taken by an 'overseer' (an aged animal, e.g. adult past breeding age; E29-110313). Monkey breeders generally regroup just weaned monkeys too soon (**before 8 months**), resulting in stress-induced disease susceptibility (E27-050213)

8 months: nutritionally independent (E18c-120313; E27-050213, for rhesus and long-tailed macaques); have built their own social networks (E27-050213); can be separated at this age, provided they are kept with known partners of the same age or much older (E27-050213).

10-14 months: biologically normal/natural weaning age (Prescott et al., 2012); this review adds to the growing evidence base for behavioural, physical and immunological disturbances following early separation (before 10-14 months), which can compromise animal welfare in the short and long terms (E12-140313); as of weaning animals can already function reasonably independently and the mother is not needed (although it is nice if she is still around) and her role can be taken by peers, esp. individuals of similar age (E25-020313).

12 months: most can survive in nature without their mother (E28-120313); they are nutritionally self-sufficient (E18b-090313); they can manage in the group (E28-120313); the mother will often be heavily pregnant so will have been weaning the infant off already (E18b-090313, on *M. fascicularis*); the next baby requires the mother's attention (E28-120313); the infant is free-ranging in the colony (E18b-090313, on *M. fascicularis*); separation at 1 year is too early for breeders because these animals need more effort and attention as they may reject their first babies and they need contact with older animals

to let them learn about reproduction (E28-120313); also E29 stated that breeders need to learn about sex through play beyond 1 year of age (E29-110313);

12 – 15 months: this is the range of separation ages suggested by E13 for rhesus macaques destined for research (E13-110313). However, ideally, siblings/half siblings from a group should be kept together and separated at around **18 months**, but *inevitably in the group some will be a bit older and others a bit younger*. It is then better to keep them in the group assuming they are healthy and well grown even if they are only **12 months** than leave them behind (E13-110313, on rhesus macaques).

Mod: this suggests that 12 month weaning is indicated only in exceptional cases and when the animals are kept with (at least some) familiar peers. Furthermore, the argument is at risk of a so-called slippery slope argument: with a legal minimum age of 12 months (perceived) economic pressure may lead to weaning at even younger ages (as e.g. happens in pig production, see Van Dixhoorn et al. (2011)). As to economics and productivity: while E29, who directs a large breeding facility, stated that weaning at **1 year** would reduce fecundity and infant output by nearly 50% compared to weaning at 6 months (E29-110313), Prescott et al. (2012) was cited showing that productivity does not have to be affected. Prescott et al. (2012) provided new data on *M. mulatta* and a very large colony of *M. fascicularis* demonstrating that separation before 10-14 months does not increase colony *productivity*.

18 months: is preferred over 12 months as the infant is a little more robust and able to cope better with a new peer group (E18b-090313, on *M. fascicularis*); whereas **8 months** may be sufficient for nutritional independence, **a year** is often quoted when considering the emotional development component “but I'm not sure of any great evidence for this”, and 18 months may be better (E18c-120313; see also E13-110313).

3 years: E2 suggested 3 years as minimum separation age (E2-250213b).

4 years: at this age males start to migrate to other groups in the wild (E28-120313; E1-150313; E12-140313); E28: separation at 4 years is our policy, because it is the most natural breeding configuration and because in principle we use all infants for breeding (as well as for research) and restlessness starts at this age (E28-120313, had breeding colonies of *M. mulatta* and *fascicularis*, previously *M. arctoides* as well); the immune system is more mature at 4 years, i.e. younger animals are more susceptible to disease (E28-120313); is unrealistic for research (E10-100313); not beneficial for welfare compared to weaning at **3, 2 or 1 year** (E10-100313); causes problems, because females can become pregnant as of **2.5 years** and males can mature and become sexually active as of **3.5 years**, so could come into conflict with the dominant male (E18b-090313); before **4 years** conflicts can arise, which may require moving animals into other groups (E28-120313). At **4 years** many males and females will already be sexually mature. This may lead to *inbreeding (incest)*, esp. in females since few facilities move breeding males between groups. Furthermore, sexually active young males may create uncertainty about *parentage* (which is required e.g. in selective breeding and MHC typing) (E1-150313). Mod: Is *birth control* possible? E18 replies: “we have no experience of methods other than male vasectomy which is not what you are after. It may be that there are appropriate implants that provide hormone control you could use for such females but it is not something we would contemplate” (E18b-120313). Also E1 objects to birth control in breeding facilities: Implants did not work adequately in Monkey World, a UK-based ape rescue centre, and implants involve interventions, potential complications and welfare costs for the animals compared to separation at a slightly earlier age (E1-150313, recommended 12-20 months). Apparently in contrast to the previous comments from E1 and E18b, E28 actually has a practice of separation at **4 years** in the breeding and research facility, where females may get pregnant as of **3 years** and they have satisfactory experiences with subcutaneous anti-conception implants (Implanon^(r)), e.g. it works well when they don't want to breed with individual females for genetic reasons (E28-120313). Mod: Impregnation of very young females may not always be best for their long-term welfare.

Males for breeding, and males in zoos and shelters, can stay in the natal group until they would naturally disperse in the wild, i.e. **4-5 years** old, taking into account that most captive breeding groups are comprised of 1-2 breeding males only, for ease of management. This is likely to be beneficial for their behavioural development and lifetime welfare, provided they have sufficient space, environmental enrichment and proper management systems (E12-140313).

‘Never’: In nature the females stay in the natal group (E28-120313; E13-090313); Females for breeding, and females in zoos and shelters, can stay in the natal group sometimes **permanently** with stable matrilineal breeding groups, provided inbreeding can be avoided, e.g. by periodically replacing the breeding male(s) as happens in the wild (E12-140313). Staying in the natal group is likely to be beneficial for the females' behavioural development and lifetime welfare (E12-140313); the practice of separating young from the mothers for breeding purposes is unethical (E26-020313).

Other, more general points for consideration:

Group composition: In the wild, macaques live in larger gangs (made up of smaller sub-groups; this differs from the family groups seen e.g. in marmosets). This social structure facilitates the animals' ability to deal with separation (E28-120313); living in peer groups is a normal part of social life in wild macaques, contrary to e.g. marmosets (E7-080313). Preferably, separation should be with familiar peers (of similar age) and if they are going to be held together for a long time, same sex (E18b-090313); single animals going to a newly formed group should be a little older than the mean (E18b-090313; E13-110313). Even better than mere familiarity, is keeping 'friends' together – "selection of these groups is vitally important if we are to stop ending up with them singly housed with the excuse that they keep fighting" (E13-110313).

Body weight: Optimum separation ages vary between animals - small infants are often left with their mother for longer than may be usual in the belief that this will be better for them but often earlier than usual separation will be physically if not emotionally better for the infant if good nutrition is provided (E18c-120313). (For more background on body weight considerations, see also Prescott et al. (2012)). In conclusion (and given the considerations specified in Section 2.4): *For macaques used in research the minimum separation age should be 12 months provided the animals are kept together with at least one familiar peer, otherwise 15 or even 18 months is more suitable. When used for breeding, or kept in zoos, sanctuaries or shelters, this age may be raised safely up to 2.5 years, but should ideally be around 3-4 years for males and 'never' for females (i.e. they should stay in their natal group). Raising the age for macaques generally to 2 years, as presently regulated for individual separation of macaques, but now applying to separation in groups, is a real option, also because this would be in line with recommendations for the other species and no important arguments to the contrary were found to apply to the Dutch situation.*

9.3 Marmosets

Present Dutch regulations (LNV, 1996; EZ, 2012) contains separation ages of **6 months** for group housing and **12 months** for separation into individual housing of marmosets. The legislation initiative (EZ, 2012) suggested **8 months** (for weaning into group housing only), in line with EU Directive 2010/63/EU (EU, 2010).

Table 4 shows that separation ages suggested by experts varied from **6-8 months** (E29) to **1.8 years** (E17ab, i.e. AAP) or '**never**' (i.e. only when animals are inclined to separate themselves from the natal group; E26). The median values are **12-14 months** (E23) or (a tentative) **16 months** (E2).

E29 recommended **6-8 months**, but added that socialization benefits of continuing with the family housing may extend through **2 years** of age (E29-110313).

E1 suggested **8-14 months** (*Callithrix* spp), based on weaning age in Ross and Jones (1999) plus allowance for socio-behavioural development (E1-120313). In addition, E1 suggested that pair housing may be adequate for young marmosets (*Callithrix*; E1-120313).

E7 (with over 30 years of experience) suggested **9 months** as by then marmosets are completely weaned from nursing and have begun puberty, resulting in minimal welfare problems (E7-080313). However, when used for breeding, marmosets should remain in their natal groups for as long as possible (ideally until mating) to facilitate parenting behaviour (cooperative rearing of younger siblings). This does not reduce the reproductive output of the parents (as it might do in macaques; E7-080313). E7 argues that there is little or no evidence that individual housing of marmosets (with visual, auditory and olfactory contact) causes 'most serious welfare problems'. Despite extensive experience, E7 has witnessed only one incident of self-injurious behaviour and extremely limited signs of any other 'serious welfare problems' (E7-080313). Tardiff et al. (1994) found ovulatory suppression effects in singly housed females within a room similar to that seen in marmoset social groups. E7 states that the best way to house marmosets that are removed from natal groups prior to breeding age is unclear. In the EU, marmosets are sometimes housed in same-sexed peer groups of youngsters. However, according to E7 this is a totally artificial arrangement. Marmosets in the wild would never be found in such peer groups (but they are a normal part of social life in wild macaques). There are significant risks associated with same-sex housing of socially unfamiliar marmosets – particularly females, who can be extremely *aggressive* toward each other (E7-080313).

E25 suggested **9 months** (E25-020313); E24 **12-14 months**, based on extended parental care (Abbott et al., 2003) (E23-010313&020313). At the age of **12-14 months** common marmosets (*C. jacchus*) are reproductive and can start a new family (E23-010313&020313). E11 suggested **18 months** as earlier separation from the natal group is likely to be uncommon in nature (E11-200213). Also E28 recommended **1.5 years** (E28-120313). E28 keeps marmosets (*C. jacchus*) in the natal

group until **1.5-2 years** of age and then places them in *same-sex groups* when not used for breeding (usually after **2 years**, sometimes earlier depending on the stability of the natal family group (E28-120313). Mod: Note that this arrangement appears to be rejected by E7 as 'a totally artificial arrangement' (see above).

E17ab (AAP) suggested **1.8 years** for *C jacchus*, *C pygmaea* and *C argentata* (E17ab-090313). In conclusion (and given the considerations specified in Section 2.4): *For marmosets separation ages should be raised to 12 months. This age was previously specified in legislation for separation into individual housing, but should in the future apply to separation into group housing. However, raising to 18 months may be more appropriate, esp. when animals are used for breeding or are kept in zoos, sanctuaries or shelters.*

9.4 Douroucoulis, night monkeys (*Aotus*)

Present Dutch regulations (LNV, 1996; EZ, 2012) state separation ages of **1 year** for group housing and **1.5 years** for separation into individual housing of douroucoulis. EU Directive 2010/63/EU (EU, 2010) does not specify separation ages for this genus.

Table 4 shows that separation ages suggested by experts varied from **10 months** (E1) to **3 years** (E17) or '**never**' (i.e. in accordance with their natural behaviour; E26). The median age was **18-24 months** (E25; E2). It should be pointed out, however, that separation ages were listed for only 6 experts, and none of these listed the douroucoulis as their species of expertise.

Annex 8 presents expert input on douroucoulis sorted by suggested separation ages.

Referring to New World monkeys generally, one expert points out that the breeding strategy should be taken into account, e.g. a family breeding strategy would benefit from a longer socialization with the monogamous parent pair (E29-110313). E1 specifies **10-18 months** and adds that for these species (*Aotus*) separation into pair housing (with one conspecific partner) would be acceptable. AAP (E17ab) specifies separation ages for two species of douroucoulis: *Aotus trivirgatus* (**2 years**) and *Aotus nigriceps* (**2-3 years**) (E17ab-090313). *A. trivirgatus* has formerly been used for scientific research in the Netherlands, so separation ages in the existing regulations mainly refer to this species. The degree to which a separation ages for each of the 11 species of *Aotus* should be species-specific cannot be determined from this research. However, it was noted that natural weaning and independence ages may differ considerably between species of *Aotus*. For example, for *A. nancymaae* (Ma's night monkey) these ages are **13 and 18 days** respectively (Graf, 2006). By contrast, for *A. azarae* (Azara's night monkey) the mean weaning age is **231 days**, and both males and females reach sexual maturity at **2 years** of age (Smith, 1999).

In conclusion (and given the considerations specified in Section 2.4): *For douroucoulis separation ages are recommended to be raised to 18 months, i.e. previous legislative ages for separation into individual housing, but now applied to group housing.*

9.5 Squirrel monkeys (*Saimiri*)

Present Dutch regulations (LNV, 1996; EZ, 2012) state separation ages of **7 months** for group housing and **9 months** for separation into individual housing of squirrel monkeys. EU Directive 2010/63/EU (EU, 2010) specifies **6 months** as separation age. Table 4 shows that separation ages suggested by experts varied from **6 months** (E29) to **2.5 years** (E17ab, i.e. AAP) or '**never**' (i.e. no forced separation). The median values were **10-18 months** (E1) or (a tentative) **12 months** (E2).

Annex 8 presents expert input on squirrel monkeys sorted by suggested separation age. It should be noted that the number of experts listing squirrel monkeys as their species of expertise was limited. E29 had probably the most extensive experience, having spent over 10 years studying and breeding squirrel monkeys (E29-110313). This expert also suggested relatively low separation ages for all species, including squirrel monkeys: **6-8 months** provided young are weaned into small social groups comprised of (ideally 3 or more) peers of the same age. They can then live in the juvenile peer group through puberty, especially if comprised of mixed-sex animals. If the goal is ultimately to create the next generation of breeders, then it is important to move the monkeys into mixed-aged housing by **2-3 years** of age.

According to E29, individual housing should certainly not take place before adulthood, which is **>3-4 years** of age, and pair or group housing is always preferred over individual housing. Because squirrel monkeys are seasonal breeders, raising separation ages to **1 year** may reduce infant output by nearly 50%, as weaning induces the oestrus cycle of the mother, allowing her to be rebred (E29-110313).

E29 also pointed out that the 'early' weaning (at **6 months**) is beneficial for preventing *iron deficiency anaemia* and to reduce the *vertical transmission* of pathogens (e.g. Herpes saimiri). However, it is possible to supplement iron to young primates (e.g. by providing a highly fortified diet to the pregnant female; E29-140313) and in general breaking pathogen transmissions across generations should generally only require a 'one-time' intervention, rather than a continued practice of early weaning (e.g. as when SPF animals are produced using caesarean section in the most extreme form of breaking through vertical transmission problems; Mod).

E25 suggested **9 months**, arguing that as of the moment of weaning the mother is no longer 'needed', 'although it is nice if she is still around', and her role can be taken by peers (E25-020313).

E1 suggested **10-18 months**, based on Ross and Jones (1999) plus allowance for socio-behaviour development (E1-120313). In addition, E1 considers pair housing adequate for young squirrel monkeys (E1-120313).

It was noted that relatively large differences in weaning and maturation ages may exist between the five *different species* of squirrel monkeys in the wild. Female squirrel monkeys reach sexual maturity at age **2-2.5 years**, while males take until age **3.5-4 years** old (Walker et al., 2009). Perhaps in line with this, E17ab (AAP) did not specify ages for the group as a whole, but specified separation ages for *S sciureus*, *S boliviensis* and *S oerstedii* (all at **2.5 years**; the two last species based on sexual maturity) (E17ab-090313).

In conclusion (and given the considerations specified in Section 2.4): *For **squirrel monkeys** separation ages for weaning into group housing should be raised to at least 9 months (previously used for separation into individual housing) or to 12 months. However, further raising to 18 months appears to be more appropriate, esp. when animals are to be used for breeding or are kept in zoos, sanctuaries or shelters.*

10 Discussion

10.1 A unique case?

The expert consultation was to supplement the quick-scan conducted by Van Dixhoorn et al. (2011), who may have placed limited emphasis on certain aspects of welfare.

Van Dixhoorn et al. (2011) reviewed weaning ages in a wider range of species, including pets and farm animals.

Comparing their discussions of weaning ages in various species to the case of weaning and separation in primates, several differences can be identified.

Firstly, the level and quality of the scientific 'evidence' differs. Here we consulted experts with a considerable number of years of experience. We did not dig into the scientific literature (e.g. on weaning ages or survival ages of orphans in the wild). Compared to other farm animals, the number of controlled studies examining separation ages in primates in the relevant range appears to be limited (Prescott et al., 2012). A lot of work has been done on early separation, e.g. related to the work by Harlow et al. (1960), and more is known about the natural behaviour of primates. Relatively few studies have looked at the semi-natural behaviour of even a main farm species like the pig. Survival ages of piglets without sows, for example, have probably never been reported.

A second difference is that primates are intelligent animals and have not been domesticated. The ministry has actively promoted the expression of natural behaviour in domestic animals (LNV, 2002; 2007), suggesting e.g. housing systems should be adapted to the animals rather than vice versa. Primates also show more elaborate social and cognitive behaviours, and for most people they are higher up the ladder of moral concern. In accordance with our 'natural' inclination to show higher levels of moral concern for animals that are more like us, the criteria for protecting primate welfare may be set at a higher level compared to other animals.

A third and final difference is that the **economic impact** of even high-level welfare regulations for primates is much smaller than the most basic regulations for main species of domesticated animals. In total only 345 primates were used in research in the Netherlands in 2011 (nVWA, 2011) (0 great apes like chimpanzees, 316 Old World monkeys like macaques, and 19 New World monkeys which includes marmosets, douroucoulis and squirrel monkeys). By contrast, Dutch pig farms, for example, produce more than 20 million piglets each year (Agrovision, 2009; CBS, 2013). This means that small steps have big consequences in the pig sector, both in terms of welfare and economics. By contrast, the issue of regulating separation ages for primates in the Netherlands is unique in that no major economic concerns are anticipated when separation ages are raised substantially. At an international level, however, discussions continue as regards economic impact of separation ages on primate husbandry (see Section 10.3 'Macaques'; E29-110313 and E12-140313).

10.2 Delphi consultation

Should have got the Dutch government to offer Amazon vouchers to contributors - they would have bitten your hand off! (E1-120313).

Experts were consulted anonymously (Delphi procedure) to specify (arguments for) minimum separation ages for primates listed in the Dutch legislation. In this study the experts could also be regarded as subjects under investigation, e.g. to examine if experts working in research labs had different opinions about weaning than experts working in zoos. However, this was not the objective of this study. The primary objective was to find the 'best possible' arguments and separation ages based on expert opinion (and personal observations) with special attention to aspects of emotionality and behavioural development of non-human primates, including personal observations from experts working in the field.

In total 25 experts from (at least) 7 different countries provided input. The response rate was 58%. The average stated age of the experts was 52 years (n=14). So the experts were truly senior experts: with an average of 24.2 years of experience (n= 19) the estimated total was 604 years of relevant experience! That is impressive and stands in sharp contrast to the limited experience of the moderator on primates. Another discussion point, therefore, concerns the question whether more knowledge about the biology and husbandry of primates would have been beneficial for moderation. The answer is probably yes, though moderation primarily requires other skills as well as. This was a pioneering study in transparent decision support. The elicitation and transparent integration of the different

opinions into recommendations was a rather demanding task. The reader should judge whether this has been sufficiently successful. We believe that, within the constraints of the study, the present description is about as transparent as it can get. The challenge was to find an optimised synthesis between what may be called 'nature-guided' and 'industry-guided' approaches (RDA, 2010), without actually confronting these positions explicitly. This approach may have potential for other policy-related questions in the future.

The expert contributions in this study were generally short and diverse. However, the degree of reflection on each other's input, intended in the Delphi consultation, was limited. This differed considerably from previous Delphi-like studies we conducted in the past (Anon., 2001b; Spoolder et al., 2011a; Spoolder et al., 2011b). Various factors may have contributed to this, such as the limited time frame, suboptimal formulations (e.g. containing several errors), a 'distant' task (Dutch legislation) and competing priorities. Accordingly, several potentially relevant points of dispute were not considered in detail. This may concern in particular the issues of birth control, disease transmission and impacts on productivity and economics (see Section 9.2). It is unlikely, however, that the Delphi approach, even with more resources, would have been able to fully resolve some of these more fundamental points of dispute (see also E12-140313).

In politics and in science often something like the 'average' or 'middle position' is used to represent the 'common ground'. Here, the median expert scores were presented, but they were not binding for the formulation of the recommendations. A considerable effort was made to bring out the underlying arguments. To this end, expert contributions were decomposed (Annex 6), sorted by species and separation age (Annex 8), integrated (Section 9) and evaluated against explicitly formulated background considerations (Section 2.4).

As expected most experts strongly objected to individual housing of primates. The experts also identified potential exceptions, e.g. when conditions would resemble periods of solitary life in the wild. Nevertheless, the general consensus allows the conclusion that, also in accordance with Directive 2010/63/EU (EU, 2010), the revised Dutch legislation should no longer include specific separation ages for moving primates into solitary housing. This is now considered generally unacceptable for welfare reasons (while allowing exceptions to the general rule). This also provided a base line for species-specific recommendations for separation into group housing, as any change in social conditions is potentially stressful in primates, in particular the weaning of infants (Prescott et al., 2012). A related methodological point concerns the decision to allow including the value 'never' (i.e. no separation unless in accordance with natural inclinations of the animals themselves). Sometimes, especially in more quantitative approaches, such points of view would not be incorporated into the evaluation. The practice of eliminating 'non-responders' (e.g. because they don't fit in the statistics), however, may be questioned. If only for this reason, they were included here.

The experts suggested a rather wide range of separation ages (e.g. from 6 months to 4 years/'never' in macaques). This may be regarded as a lack of consensus. To some extent, of course, that is correct, but it is important to realize that the objective of this study was to compile a 'table'/text listing various possible separation ages along with what is known about the different ages in terms of welfare (Sections 8 and 9). We actively facilitated divergence among participants by asking experts to identify other experts and by including in the questionnaire the rather 'diverging/progressive' ages suggested by AAP (4 years for macaques; 9 years for chimpanzees). We did this, because personal observations (MB) had indicated that respondents may tend to 'line up' with others, even if this appears to be contraindicated. Social factors are important in humans too. This was also illustrated by one respondent who expressed reluctance to provide high separation ages in accordance with own policies (4 years for macaques), because of potential consequences for others.

For the different species/groups specific recommendations for incorporation in the revised Dutch regulations were formulated in Section 9. These ages generally matched the ages that were previously specified for separation into individual housing (chimpanzees: 4 years; macaques: 2 years; douroucoulis: 1.5 years; squirrel monkeys: 9 months; marmosets; 1 year).

These ages may be considered 'progressive' from the perspective of political decision making. In formulating these recommendations considerable emphasis was placed on the constraints set by the existing regulations and Directive 2010/63/EU.

The recommended ages take the specific Dutch situation into account. In particular, Dutch experts (n=4) generally provided (support for) higher separation ages than the median values of the group as a whole. In addition, the practical implications for primates in the Netherlands are probably limited. The recommended ages may also apply to other countries and species, provided the particular circumstances are taken into account.

As to the range of species, recommendations have been given for one species (*P troglodytes*) and 4 genera (*Macaca*, *Aotus*, *Saimiri* and marmosets (comprising *Callithrix*, *Mico*, *Callibella* and *Cebuella*)).

The main focus has been on the species more commonly used in scientific research (e.g. *M. mulatta* and *M. fascicularis* for macaques, and *C. jacchus* for marmosets). Since species may differ considerably, the specified ages may not be fully appropriate for the less prevalent species, especially when they have considerably older/younger natural weaning and dispersal ages in the wild.

Several general considerations are relevant to determine separation ages in particular cases. Besides natural behaviour (see also Section 7) individual, social, environmental and developmental parameters need to be taken into account (see also Section 9.2). Individual parameters include e.g. body weight, age and differences in temperament/personalities (Prescott et al., 2012). Social factors include aspects like moving into social or individual housing, with or without familiar conspecifics, similar age, same/mixed sex and history of association ('friends'; E13-110313). Environmental factors include the level of enrichment provided (e.g. male chimpanzees can integrate better in more natural environments, Wobber and Hare (2011); see also Prescott et al. (2012)). Developmental factors may relate to the purpose of the animal (e.g. whether they will be used for breeding or not; will be needed for research in individual housing and therefore may not benefit from social bonding, cf E19-250213) and perhaps a parameter like age-related perspective (e.g. when older individuals are more difficult to re-group).

'Species-specific' recommendations for minimum separation ages in legislation differentiate between animals used for research and other animals (i.e. animals used for breeding and animals kept in zoos, sanctuaries and shelters). This specifically applies to macaques, marmosets and squirrel monkeys. Another differentiation concerns separation from the mother/natal group with and without familiar conspecifics. The general reasons for including these distinctions relate to specific animal requirements (especially reproductive problems in breeders not seen in other animals), practical feasibility (economics, management possibilities and legislative constraints) and specific expert input (Section 9).

A drawback of the present approach is that the expert statements only allow for a limited quantification of the degree of discomfort related to early separation. While this is apparently also largely absent from the literature (Prescott et al., 2012), it may be desirable to estimate how much welfare improvement would be derived from weaning at various ages. Though not an easy task, a semantic modelling approach may succeed in doing this (Bracke, 2001; Stien et al., 2013). Semantic modelling is especially indicated when a range of factors is to be taken into account that are able to compensate for each other, at least to some extent. This seems to apply to separation ages for primates as well. For example, E10 pointed to alternatives for social enrichment, including visual contact and use of video (E10-100313). E29 recommended using animals past breeding age as 'overseers' of the peer group as a good husbandry alternative (E29-110313). In its most extreme, E9 pointed out that male chimpanzees have been observed to integrate in other groups with ease in large forested enclosures (25 – 100 ha of tropic forest) whereas in standard captive environments like zoos integration is highly problematic and often lethal (E9-170213). So, what is unacceptable in one situation, may be acceptable in another.

10.3 Further research

One expert (E21-010313) recommended reviewing the literature not only for ages at which the different species (and sexes) migrate in the wild, but also when orphans are able to survive in the wild, as this may indicate a certain minimally required level of independence. Furthermore, Prescott et al. (2012) recently reviewed weaning ages for laboratory macaques. The present study concerned more widely (not only research) some other species as well (chimpanzees, marmosets, *douroucoulis* and squirrel monkeys). Further work may examine a wider range of species. This may require similar literature- and/or expert-based approaches, but a statistical (meta-)analysis is also possible. An advantage of the latter approach is that it is much less interpretative and much more quantitative. A concern may be to find ways to incorporate potentially relevant (perhaps unpublished) husbandry experiences (e.g. on abnormal behaviour, health and mortality) and exceptional cases (cf 'non-responders').

As indicated in the previous section, a semantic modelling approach could be used to make a more quantified assessment of the welfare impact related to different separation ages (Bracke, 2001). Such an approach could also include weighing in potentially negative side-effects of older separation ages (as when this could lead to iron deficiency, health risks, weight loss of the mothers; premature pregnancies and interventions such as required for birth control).

Finally, the Delphi method developed here for transparent decision support may be applied to other policy issues.

11 Summarising statements

An expert consultation was conducted to collect arguments and suggested separation ages for primates in Dutch legislation. The following questions were considered

Q1: *Specify minimally required separation ages for the species listed in the Dutch legislation (chimpanzees, rhesus, stump-tailed and long-tailed macaques, marmosets, douroucoulis and squirrel monkeys).*

Q2: *Give main arguments for these ages*

Q3: *Other considerations*

Q4: *Considerations for objecting to specifying separation ages*

Q5: *Do you agree with the ages suggested by AAP: chimpanzees (9 yr) and macaques (4yr), douroucoulis (1yr), squirrel monkeys (7 months), marmosets (8 months)?*

Q6: *Do you agree with AAP that individual housing (>30 days) creates most serious welfare problems and should be considered to be cruel?*

Q7: *Other relevant remarks/comments*

Q8: *Personal information*

Q8: Personal information

Experts generally confirmed that specifying minimum separation ages for primates in legislation was important. In total 25 senior experts from 7 different countries participated.

Q1: Specified minimally required separation ages

*For **chimpanzees** 'median' suggested separation ages was **6 years**.*

*For **macaques** generally: **18 months**.*

*For the three species of macaque separately (i.e. *M mulatta*/rhesus macaque, *M arctoides*/bear macaque, and *M fascicularis*/cynomolgus monkey/crab-eating/long-tailed macaque): **12 months** for research and **4 years** for breeding, zoos and shelters.*

*For **marmosets**: **12-14 months** or (a tentative) **16 months**.*

*For **douroucoulis**: **18-24 months**.*

*For **squirrel monkeys**: **10-18 months** or (a tentative) **12 months**.*

Q2: Main arguments for these ages

The main arguments related to natural conditions (e.g. at what ages the animals can do without milk, can survive or migrate to other groups; see Section 7). Also considered were health (e.g. iron deficiency due to prolonged nursing and vertical transmission of disease) and practical consequences (e.g. economic implications; unwanted pregnancies of young females; see Section 9).

Q3: Other considerations (for specifying separation ages) and Q7: Other relevant remarks/comments

Points were raised on the selection of species (e.g. whether bonobos were included; they were not), social conditions, enrichment (e.g. availability of hiding places), early separation (e.g. for specific research, animal welfare or health reasons) and breeding (e.g. that young marmosets need to be able to learn parenting skills). Enrichment and social conditions may be able to compensate (to some extent) for welfare risks imposed by early/earlier weaning or individual housing. Also points were made about the legal context, e.g. regarding Directive 2010/63/EU (EU, 2010).

Q4: Objections to specifying separation ages

Experts generally agreed that specifying separation ages in legislation was important. Some objected for moral reasons. Several experts took a most natural stance (e.g. pointing out that when individuals of a given sex (e.g. male chimpanzees; female macaques) normally stay in their natal groups, they should do so in captivity as well. Others pointed towards a cost-benefit evaluation and the need for tailor-made decisions in individual cases.

Q5: Do you agree with the ages suggested by AAP: chimpanzees (9 years) and macaques (4 years), douroucoulis (1 year), squirrel monkeys (7 months), marmosets (8 months)?

*Unfortunately, in this question the ages for douroucoulis, squirrel monkeys and marmosets should have been missing values. Later, AAP provided alternative ages (**chimpanzees: 8-10 years; M arctoides and M mulatta: 4 yr; Macaca fascicularis: 3.5-4.5 years; Marmosets: Callithrix jacchus, C pygmaea and C argentata: 1.8 years; douroucoulis: Aotus trivirgatus: 2 yr; Aotus nigriceps: 2-3 yr; squirrel monkeys: S sciureus, S boliviensis and S oerstedii: 2.5 years**).*

The experts generally pointed out that they expected that AAP had selected natural dispersal ages. Several experts considered these ages to be (much) too high, for various reasons (e.g. because captivity differs in relevant respects from the wild, e.g. predation and food availability; because these ages were not considered feasible; unwanted pregnancies of young females; aggression). However, there was also more than incidental support for the position formulated by AAP. Some experts even went one step further in that they rejected practices of forced separation of young inherently deviating from natural, self-initiated dispersal.

Q6: Do you agree with AAP that individual housing (>30 days) creates most serious welfare problems and should be considered to be cruel?

Though experts point out that there may be exceptions (requiring individual housing) and incidentally object to the word 'cruel', experts generally agreed that individual housing imposes serious welfare compromises to primates and should not be imposed routinely. It seems safe to conclude that according to most experts (and the EU Directive 63/2010/EU) individual housing (even when some sensory contact, e.g. auditory/visual/olfactory contact, with conspecifics remains possible) should only be allowed in primates in very exceptional circumstances and only for the shortest possible period of time. Individual and even pair housing should generally be avoided, unless this is in accordance with the animal's natural/individual needs. Management conveniences should not be allowed to overrule these requirements and an active plan should be in place for re-integration when solitary housing is nevertheless needed for well -justified veterinary, welfare and/or scientific reasons.

12 Recommendations

Based on this research the following recommendations were formulated:

- Given general consensus among experts, the revised legislation should not allow for routine separation into individual housing. This in accordance with EU legislation for animals used in research, where individual housing of primates is considered to be a serious welfare infringement. All suggested separation ages concern weaning into group housing, preferably with (at least some) familiar conspecifics.
- Natural behaviour, conditions and adaptations provide important guiding principles to determine suitable separation ages, but other aspects need to be taken into account as well.
- Given the ambition of the Dutch government to promote animal welfare, including the need for animals to perform natural behaviour, given the existing legislative framework (including Directive 2010/63/EU), and given the fact that enhancing the Dutch welfare regulations do not appear to have major economic or practical consequences for primate owners in the Netherlands, the expert consultation indicates that separation ages for the species examined should be raised in accordance with the 'species-specific' recommendations below.
- Rather than formulating separation ages for the three main species of macaque used in research, suggested separation ages can be formulated for macaques generally (as is also done for douroucoulis, marmosets and squirrel monkeys in the existing legislation). This means that other species of macaques, such as Barbary macaques, would be included as well.
- When separation ages are formulated for species groups (macaques generally, douroucoulis, marmosets and squirrel monkeys) an exception clause may be formulated that younger separation ages may incidentally be allowed in less prevalent species provided this is indicated from their documented natural behaviour. This, however, may also fall under the exception clause that under special circumstances earlier separation may be allowed.
- While it is recommended that exceptional weaning at younger ages remains possible (e.g. for welfare or medical reasons), it is also recommended to specify under which conditions this may take place, e.g. that it requires documented authorisation of a specialised veterinarian or similar.

'Species-specific' recommendations:

- *Based on the input received from the experts, the separation age for **chimpanzees** should be raised beyond weaning (4-5 years) when moved with peers, and preferably be raised to 6 years of age in other cases. However, especially re-grouping of males is to be avoided as much as possible.*
- *For **macaques** used in research the minimum separation age should be 12 months provided the animals are kept together with at least one familiar peer, otherwise 15 or even 18 months is more suitable. When used for breeding, or kept in zoos, sanctuaries or shelters, this age may be raised safely up to 2.5 years, but should ideally be around 3-4 years for males and 'never' for females (i.e. they should stay in their natal group). Raising the age for macaques generally to 2 years, as presently regulated for individual separation of macaques, but now applying to separation in groups, is a real option, also because this would be in line with recommendations for the other species and no important arguments to the contrary were found to apply to the Dutch situation.*
- *For **douroucoulis** separation ages are recommended to be raised to 18 months, i.e. previous legislative ages for separation into individual housing, but now applied to group housing.*
- *For **squirrel monkeys** separation ages for weaning into group housing should be raised to at least 9 months (previously used for separation into individual housing) or to 12 months. However, further raising to 18 months appears to be more appropriate, esp. when animals are to be used for breeding or are kept in zoos, sanctuaries or shelters.*
- *For **marmosets** separation ages should be raised to 12 months. This age was previously specified in legislation for separation into individual housing, but should in the future apply to separation into group housing. However, raising to 18 months may be more appropriate, esp. when animals are used for breeding or are kept in zoos, sanctuaries or shelters.*

- *In general therefore, these recommendations support raising separation ages for the listed species in the Dutch legislation to the ages previously specified for separation into individual housing (chimpanzees: 4 years, macaques: 2 years, doucoucoulis: 1.5 years, squirrel monkeys: 9 months and marmosets: 1 year).*

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Annexes

Annex 1: EC (2010) legislation on the use of primates for scientific research

EU Directive 2010/63/EU (EU, 2010) sets restrictions on the use of non-human primates, and prescribes separation ages for specified species. The directive is effective as of 1-1-2013. Relevant citations of the directive are given below.

(17) ... the use of non-human primates should be permitted only in those biomedical areas essential for the benefit of human beings, for which no other alternative replacement methods are yet available.

(18) The use of great apes, as the closest species to human beings with the most advanced social and behavioural skills, should be permitted only for the purposes of research aimed at the preservation of those species and where action in relation to a life-threatening, debilitating condition endangering human beings is warranted, and no other species or alternative method would suffice in order to achieve the aims of the procedure. The Member State claiming such a need should provide information necessary for the Commission to take a decision.

(19) The capture of non-human primates from the wild is highly stressful for the animals concerned ... , only animals that are the offspring of an animal which has been bred in captivity, or that are sourced from self-sustaining colonies, should be used.

(49) ...It is ... necessary to provide for a review of this Directive. Such review should examine the possible replacement of the use of animals, and in particular non-human primates, as a matter of priority where it is possible, taking into account the advancement of science.

[Note: The above has been formalised into a number of specific legislative articles, esp. Art. 8, 9, 28, 31 and 32, 34, 39, 42, 54, 55 58.]

Section B: Species-specific section

6. Non-human primates

Young non-human primates shall not be separated from their mothers until they are, depending on the species, **6 to 12 months** old.

The environment shall enable non-human primates to carry out a complex daily programme of activity. The enclosure shall allow non-human primates to adopt as wide a behavioural repertoire as possible, provide it with a sense of security, and a suitably complex environment to allow the animal to run, walk, climb and jump.

Marmosets and tamarins*

(* Animals shall be kept singly only in exceptional circumstances.

For marmosets and tamarins, separation from the mother shall not take place before **8 months** of age.

Squirrel monkeys*

(* Animals shall be kept singly only in exceptional circumstances.

For squirrel monkeys, separation from the mother shall not take place before **6 months** of age.

Macaques and vervets*

(* Animals shall be kept singly only in exceptional circumstances.

For macaques and vervets, separation from the mother shall not take place before **8 months** of age.

Baboons*

(* Animals shall be kept singly only in exceptional circumstances.

For baboons, separation from the mother shall not take place before **8 months** of age.

Section III:

Examples of different types of procedure assigned to each of the **severity categories** on the basis of factors related to the type of the procedure

1. Mild ...

2. Moderate ...

3. **Severe** ...

(a) toxicity testing where death is the end-point, or fatalities are to be expected and severe pathophysiological states are induced. ...

(b) testing of device where failure may cause severe pain, distress or death of the animal ...

...

(j) inescapable electric shock (e.g. to produce learned helplessness);

(k) complete **isolation** for prolonged periods of social species e.g. dogs and non-human primates;

[Note: In other words, this Directive specifies that social isolation of primates is severe discomfort, equivalent to toxicity testing and unavoidable electric shocks.]

(l) immobilisation stress to induce gastric ulcers or cardiac failure in rats;

(m) forced swim or exercise tests with exhaustion as the end-point.
[End of citations from EU, 2010].

Annex 2: Report Van Dixhoorn et al. (2011) (in Dutch)

The section below contains a number of shorter and longer citations from Van Dixhoorn et al. (2011): Relevant ages are shown in bold.

3.1.2 Ontwikkeling van diersoort specifiek, sociaal en afwijkend gedrag (mentale ontwikkeling)
De eerste wetenschappelijke aanwijzingen over de blijvende effecten van maternale deprivatie stammen van onderzoek van Harlow et al. (1960), waaruit blijkt dat de afhankelijkheid van moederdieren meer is dan de afhankelijkheid van melk. Levine (1967) en Meaney (1985) toonden aan dat moederzorg gedurende de post natale periode het leervermogen en geheugen verbetert, de emotionaaliteit reduceert en de stress reactie reguleert. Maternale deprivatie kan een groot effect op het gedrag op latere leeftijd hebben, zoals op het ontwikkelen van stereotypieën (Latham and Mason, 2008). Recenter onderzoek heeft een verhoging van stereotype gedrag en zelfgericht gedrag bij rhesus apen en chimpansees aangetoond bij individuen, die zijn opgevoed in zogenaamde incubators, gedurende de eerste maanden van hun leven (Hook et al., 2002). Ook worden verschillen gezien in het optreden van abnormaal gedrag tussen primaten gehouden in dierentuinen en circussen. Er wordt minder abnormaal gedrag gezien bij de zogenaamde „erkende dierentuinen”, waarbij meer sociaal contact mogelijk is en waar dieren onder meer natuurlijke omstandigheden gehouden worden (Mallapur and Choudhury 2003).

4.2 Primaten

Primaten worden in Nederland enkel gehouden in dierentuinen en in steeds mindere mate als proefdier.

4.2.1 Natuurlijke speenleeftijd en praktijk

Het spenen bij primaten is een gradueel proces waarbij de jonge aap geleidelijk aan steeds minder afhankelijk wordt van de moeder, eerst voor wat betreft nutritionele behoeften en vervolgens wordt autonomie verworven voor wat betreft gedrag. De leeftijd waarop het zogen stopt, varieert afhankelijk van het lichaamsgewicht en de soort. Het vindt plaats op een leeftijd van **2-6 maanden bij marmosets, tamarins, doeroecoelies en doodshoofdapen**, maar bij **meerkatten, makaken, bavianen en capucijnapen op een leeftijd tussen 6 en 15 maanden**. Gedurende de laatste maanden van het proces, is weliswaar het jong wat voedsel betreft niet meer afhankelijk van de voeding, maar zoekt het nog ter bevestiging, aangezien psychologisch gezien ze nog steeds afhankelijk zijn van de moeder. De geboorte van het volgende nageslacht maakt vaak het speenproces volledig. Het spenen is een stressvolle fase voor het jonge dier door de afwijzing van de moeder. In de context van een sociale groep wordt dan ook steun gezocht bij andere groepsleden (Fragaszy, Baer et al., 1991; Mendoza, 1991). Onder natuurlijke omstandigheden zal er geen scheiding plaatsvinden tussen ouderdier en nakomelingen en zullen de dieren in een familiegroep samenleven. Wanneer apen gehouden worden voor onderzoeksdoeleinden, wordt er getracht zoveel mogelijk nakomelingen te krijgen en daarmee bestaat er een economische druk. Er is echter geen specifiek wetenschappelijk criterium om te bepalen wanneer de speenleeftijd optimaal zou zijn om het welzijn van de dieren te garanderen.

4.2.2 Optimale of minimale leeftijd

De leeftijd waarop de nakomelingen worden gespeend, kan effect hebben op de reproductieve productiviteit van de moeders, vooral bij de soorten die seizoensgebonden reproductie hebben (Baskerville, 1999). Het interval tussen opeenvolgende geboortes bij vrouwelijke rhesus apen blijkt ook significant gerelateerd te zijn aan speenleeftijd. Vrouwelijke apen hebben een hoger reproductie ratio wanneer de nakomelingen op een leeftijd van **6 maanden** worden gespeend vergeleken met een speenleeftijd op **8, 10 of 12 maanden** (Goo and Fugate, 1984), verondersteld wordt dat dit economische voordelen heeft.

Reinhardt (2002) verklaart daarentegen dat deze veronderstelde economische voordelen van het vroeger scheiden van moederdier en jong niet worden ondersteund door wetenschappelijke data en er geen economisch voordeel bestaat om eerder te spenen dan in de natuur gebruikelijk is.

Ook toonden andere studies aan dat het scheiden van nakomelingen bij **bavianen voor 6 maanden** niet leidde tot een beter productiviteit, aangezien de meeste vrouwelijke dieren hun hormonale cyclus hadden hervat nog voor ze van de jongen gescheiden werden. De voordelen van vroeg spenen lijken marginaal te zijn.

Aangezien het scheiden van de moeder negatieve consequenties heeft voor de jonge apen, weegt het slechts geringe voordeel wat reproductie betreft niet op tegen het ontwikkelen van abnormaal gedrag bij het nageslacht. Daardoor bestaat ook het risico dat dit abnormale gedrag het onderzoek zou kunnen beïnvloeden (Scientific Committee on Animal Health and Animal Welfare, 2002).

Studies uit de jaren '60 en '70 hebben al aangetoond dat het te vroeg spenen erg stressvol is voor apen en dat dit resulteert in slechte reproductie, slecht maternaal gedrag en verhoogde agressie wanneer ze volwassen zijn geworden. Ook meer recent onderzoek laat zien dat ten gevolge van de stress bij spenen op een leeftijd van **4-5-6 maanden bij makaken**, naast gedragsafwijkingen, ook slaap stoornissen en fysiologische veranderingen kunnen ontstaan gedurende 28 dagen na het spenen (Scientific Committee on Animal Health and Animal Welfare, 2002).

Er wordt een compromis gesuggereerd door Baskerville (1999) om de meeste apen te spenen op een leeftijd van **6 maanden**, waardoor goede reproductie cijfers gehaald kunnen worden, maar de jonge aapjes die het minder goed doen vergeleken met hun peers langer bij hun moeder te laten dan 6 maanden.

De impact van het scheiden bij apen is groot bij de jongen en is goed gedocumenteerd bij makaken. Zowel psychologische effecten, zoals hyperactiviteit of depressies, zijn beschreven, als lichamelijke effecten zoals veranderingen in hartritme, lichaamstemperatuur, slaap patronen, cortisol secretie en immuunsysteem. De mate van effect hangt af van leeftijd van scheiden, mate van verandering van de rest van de omgeving, en aanwezigheid van soortgenoten. De aanwezigheid van soortgenoten kan het maternale verlies verlichten.

Volgens de richtlijnen van de IPS (International Primatological Society, 1993), zouden jonge apen niet op een jonge leeftijd (jonger dan **6 maanden**) van de moeders moeten worden gescheiden. **Makaken**, **Bavianen** en **Capucijn apen** moeten in contact blijven met hun moeder tot **minimaal 1 jaar á 18 maanden**.

De richtlijnen van de Primate Vaccine Evaluation Network (Poole, 1995) schrijven voor dat apen niet gespeend mogen worden voor een leeftijd van **6 maanden** en adviseren een scheiding van moeder en kind op **12 maanden**.

Jonge apen te laten opgroeien met hun moeders in een sociale groep is essentieel om een normale gedragsontwikkeling te garanderen. In afwezigheid van de moeder, kan de aanwezigheid van soortgenoten en of leeftijdgenoten, vanaf jonge leeftijd helpen bij een relatief normale ontwikkeling. In het official Journal of the European Union (Commission of the European Communities, 2007) worden de volgende aanbevelingen gedaan betreffende de scheiding van apen: "Jonge cercopithecoids (primaten) hebben een langzame postnatale ontwikkeling gedurende meerder jaren met een periode van afhankelijkheid van hun moeder totdat ze een leeftijd hebben bereikt van **8-12 maanden**, afhankelijk van de soort. Gedurende deze periode leren ze de omgeving verkennen onder de bescherming van de moeder en te socialiseren door interacties met een diversiteit aan partners. Het scheiden van de jonge apen uit een kolonie veroorzaakt stress bij jong en moederdier. Het heeft daarom de voorkeur de dieren bij de kolonie te laten totdat ze volledig onafhankelijk zijn geworden. Wanneer ze, voor eigen welzijn eerder gespeend of verwijderd moeten worden uit de kolonie, wordt sterk geadviseerd ze in een goed georganiseerde groep te plaatsen om te voorkomen dat er schade wordt aangericht wat betreft sociale ontwikkeling, fysiologie en immuniteit ontwikkeling. De geschikte leeftijd om te spenen varieert per species".

Speenstrategieën moeten ontwikkeld worden om minimale stress te garanderen bij moeder en nageslacht. Het spenen van jonge dieren in groepen met gelijke leeftijd vergemakkelijkt daarbij de ontwikkeling van stabiele sociale structuren. Een ander systeem voor het management is om de aanwezige vrouwelijke dieren geleidelijk te vervangen, door de vrouwelijke nakomelingen in de maternale groep te houden, maar de mannetjes periodiek te vervangen, om inteelt te voorkomen. Dit systeem lijkt het meest op wat er in wilde troepen gebeurt, maar heeft de laagste reproductie productiviteit vergeleken met andere management systemen. Het voordeel is echter dat de dieren in dit systeem weinig sociale abnormaliteiten laat zien (Baskerville, 1999).

4.2.3 Conclusie

In de huidige AMvB (1996) is sprake van een tweetraps-termijn, waarbij dieren, indien ze na het scheiden in een groep gehouden worden in plaats van individueel, eerder gescheiden mogen worden. Aangezien apen sociale dieren zijn en het risico groot is op het ontwikkelen van afwijkend gedrag wanneer apen niet in een sociale groep opgroeien, wordt het individueel houden van apen sterk afgeraden. Het houden in een familiegroep heeft de voorkeur boven het introduceren van een jong in een vreemde groep. Gezien de risico's op welzijnsschade en ontwikkeling van afwijkend gedrag, wanneer jonge dieren na de scheiding van hun moeders individueel worden gehouden, kunnen geen conclusies getrokken worden over een scheidingstermijn, waarna het jong individueel gehouden

wordt, aangezien niet kan worden bepaald of het afwijkend gedrag bij individueel huisvesten een gevolg is van een verkeerde scheidingsleeftijd, dan wel van het individueel opgroeien. Wanneer vanuit dierexperimenteel oogpunt een jong (al dan niet tijdelijk) van de moeder gescheiden wordt, is de Wet op Dierproeven van kracht aangezien het hier onderdeel is van een dierproef. De onderzoeker moet motiveren waarom er geen alternatieven mogelijk zijn en een Dierexperimenten commissie moet het belang van de proef afwegen tegen het te verwachten ongerief voor het dier.

4.2.3.1 Makaken en meerkatten

Makaken dienen niet gespeend of gesepareerd te worden van hun moeders voor ze een leeftijd van **10-12 maanden** hebben bereikt en moeten vervolgens in zogenaamde "peer-groepen" (met sociale metgezellen) worden gehouden. Dieren die bestemd zijn om in de toekomst mee te fokken moeten bij hun moeders blijven totdat ze niet meer afhankelijk zijn van voedsel en voldoende tijd hebben gehad om belangrijk gedrag aan te leren zoals maternaal gedrag. In principe is dit waarschijnlijk voor alle aapsoorten van belang, maar daar is minder wetenschappelijke onderbouwing over beschikbaar. Meer onderzoek is nodig over de welzijnsaspecten van spenen en separeren van de moeder bij apen (Scientific Committee on Animal Health and Animal Welfare, 2002). Wanneer door ziekte, dood of slechte lactatie de nakomelingen met de hand grootgebracht moeten worden, moet re-integratie met soortgenoten zo snel mogelijk plaatsvinden om gedragsverstoringen te voorkomen. Scheiden voor een leeftijd van **6 maanden** leidt tot ontwikkeling van blijvend afwijkend gedrag en fysiologische afwijkingen.

Als het uitvoerbaar is grote groepen te houden, moet dit gestimuleerd worden. Groepen van gelijk geslacht zijn het makkelijkst te creëren op het moment dat de nakomelingen van de moeders gescheiden worden.

Wanneer de dieren in groepen gehouden worden is onderlinge agressie een risico. Meerkat kolonies zijn erg vatbaar voor uitbraken van agressie, met name na verstoring binnen de groep.

Gehouden „breeding groepen” horen te bestaan uit één mannelijk en 6-12 vrouwelijke dieren. Bij grotere groepen kunnen twee mannetjes gehouden worden om bevruchting te verhogen. Competitie tussen de mannetjes kan gereduceerd worden door een groot verschil in leeftijd tussen beide mannetjes aan te houden (Commission of the European Communities, 2007).

4.2.3.2 Marmosets en klauwaapjes

De geschikte leeftijd is afhankelijk van het gebruik waarvoor ze bestemd zijn, maar spenen moet niet voor een leeftijd van **8 maanden** plaatsvinden. Wanneer de dieren voor meer nageslacht moeten zorgen, moeten ze in de familie-groep blijven tot ze minimaal een leeftijd van **13 maanden** hebben bereikt om zo goede opvoed kwaliteiten te ontwikkelen (Commission of the European Communities, 2007).

4.2.3.3 Doodshoofdapen

Pasgeboren aapjes worden op de rug van hun moeders gedragen totdat ze **6 maanden** oud zijn. Ze verlaten hun moeder wel in eerdere stadia, om de omgeving te onderzoeken of om door familie gedragen te worden. Op deze manier leren ze te socialiseren en te ontdekken wat wel of niet gevaarlijk is. De dieren nemen **vanaf 3 maanden** leeftijd in toenemende mate vast voedsel op. Geadviseerd wordt jonge dieren niet eerder dan **6 maanden** leeftijd te scheiden. Adoptie door een ander vrouwelijk dier valt aan te bevelen wanneer op een of andere manier de moeder daar niet toe in staat is.

4.2.3.4 Bavianen

Volwassen en jonge dieren moeten samen met sociale metgezellen gehouden worden. Productie dieren kunnen in groepen gehouden worden met sexe-genoten. Dieren voor experimentele doeleinden moeten zo veel mogelijk in paren van gelijk geslacht of groepen gehouden worden. De zogenaamde „breeding groepen” moeten bestaan uit één mannelijk en 6-7 vrouwelijke dieren of twee mannetjes met 12-15 vrouwelijke dieren. Grote groepen worden lastiger te managen. Het risico op agressie is dan groter en er zal nauw op moeten worden gelet om agressie te minimaliseren.

Bavianen kolonies zijn vatbaar voor uitbraken van agressief gedrag, met name na verstoring van buitenaf. De jonge dieren moeten niet gescheiden worden van hun moeders voor ze een leeftijd van **8 maanden** hebben bereikt, voorkeur heeft een leeftijd van **12 maanden**, uitgezonderd de dieren die afgewezen zijn door hun moeders, of wanneer de moeder niet voldoende melk geeft of andere veterinaire redenen.

4.2.3.5 Chimpansees

In de EU recommendations worden chimpansees niet genoemd. Bij chimpansees wordt zooggedrag tot wel een leeftijd van **3 jaar** gezien (De Lathouwers and Van Elsacker, 2006) en vindt het speenproces vanaf een leeftijd van **2-4 jaar** plaats (Horvat and Kraemer, 1982). Tot wel een leeftijd van **10 jaar** zijn de nakomelingen nog afhankelijk van hun moeder voor het aanleren van diersoort specifiek gedrag. Het handhaven van een minimale leeftijd van **3 jaar** kan op basis van deze quickscan worden verdedigd, echter voor het aanleren van diersoort specifiek gedrag is het van essentieel belang dat de jonge apen samen met andere apen samen leven.

5 Conclusies

Kan de onderbouwing worden achterhaald voor de destijds gemaakte keuzes voor diersoorten en leeftijden, zoals vermeld in de huidige AMvB (1996) betreffende scheiden van dieren?

Kunnen eenduidige conclusies getrokken worden omtrent diersoorten die opgenomen dienen te worden en een minimale/maximale leeftijd?

Voor de primaten geldt dat indien de dieren na het scheiden in groepen gehouden worden, de genoemde termijnen in de AMvB (1996) ook niet tot welzijnschade zullen leiden, voor individueel gehouden primaten kan echter op basis van dit onderzoek geen termijn geadviseerd worden. Het is niet alleen belangrijk een optimale (speen)leeftijd te hanteren. De speenmethode, de manier van scheiden en de sociale structuur voor en na het scheidingsmoment, zijn van cruciaal belang voor een goede ontwikkeling van de jonge dieren en het minimaliseren van negatieve gevolgen van het scheiden bij zowel moeder als nakomeling(en).

Wat zijn de consequenties van een voorgestelde actualisatie (voor wat betreft gewijzigde leeftijden en/of opnemen van andere diersoorten)?

Voor apen wordt geen leeftijd geadviseerd indien ze separaat worden gehuisvest en komt de in dit rapport geadviseerde leeftijd overeen met de in de AMvB gestelde leeftijden indien ze in groepen gehouden worden. Het separaat huisvesten van primaten is een ander vraagstuk dat in dit onderzoek niet aan de orde is gekomen.

Annex 3: Foundation AAP

Foundation AAP disagreed with the Ministry's proposal and formulated alternative separation ages, especially for chimpanzees and macaques. In the process of the Delphi expert consultation, in which AAP was invited as a participant, AAP complemented this with more information and also specified separation ages for marmosets; douroucoulis and squirrel monkeys. The next sections describe AAP's 'original' and 'updated' position on separation ages for primates.

a) AAP's original position

In initial correspondence Foundation AAP proposed the following alternative separation ages to the Ministry: **chimpanzees: 9 years; (rhesus -, bear – and crab-eating) macaques: 4 years**. As of these ages the young can be separated in an acceptable way from their mother, according to AAP. This section summarizes the underlying evidence provided by Foundation AAP.

In support of the proposed ages AAP referred to its own experience as an active rescue centre for primates (<http://www.aap.nl>) as well as to 'The pictorial guide to the living primates' (Rowe, 1996). AAP argues that separation ages for primates should be based on subadult ages, indicating an ability to leave the group. Rowe (1996) was presented as a reliable textbook (and related website <http://www.alltheworldsprimates.org>) listing the following subadult ages: **96-132 months for chimpanzees** (p 231); **48-72 months for rhesus macaques** (*Macaca mulatta*, p. 126); **48-96 months for bear macaques** (*Macaca arctoides*, p. 121) and **42-54 months for crab-eating macaques** (*Macaca fascicularis*, p 123). For the other primates AAP did not provide information and suggested agreeing with the with separation ages specified in the revised legislation. Later (during the Delphi expert consultation process) information on these species was provided as well (see the Section 'AAP's updated position below).

AAP pointed out that considerable differences exist between species of macaque. These probably relate to differences in reaching adulthood between males and females. Because ages listed in Rowe (1996) for macaques are as of 3.5 – 4 years, AAP suggested that 4 years should be the lower border of which age is to be considered minimally acceptable.

AAP also included references to a number of other publications: (Harlow et al., 1965; Lewis et al., 1990; Nash et al., 1999; Lyons et al., 2000; Capitanio et al., 2005; Latham and Mason, 2008; Novak and Suomi, 2008).

In addition Foundation AAP strongly objects to the suggestion in the original legislation that primates may be separated into solitary housing (with reference to its own daily experience, the above publications, and Reinhardt and Reinhardt (2003)). AAP proposes to include 'social deprivation' in the list of (very serious) maltreatment (Art 1.3). AAP recognises that sometimes animals have to be kept in solitary conditions temporarily, because of quarantine or other medical necessity. However, long term solitary housing (>30 days) of animals belonging to a social species can generate serious welfare problems, e.g. that some animals start performing abnormal behaviour (Spijkerman et al., 1994; Lutz et al., 2003; Latham and Mason, 2008; Feng et al., 2011). Because the underlying suffering of solitary housing may be difficult to recognise and AAP experiences the consequences of social deprivation in daily practice, this supplementation to the revised legislation is most necessary.

In further correspondence to the Ministry, AAP presented the following information:

Maternal deprivation is known to increase sensitivity to stress and the performance of abnormal behaviour later in life (Dienske and Griffin, 1978; Lyons et al., 2000; Latham and Mason, 2008). Also, when primates are not raised in relatively natural social groups and experience periods of social deprivation, their social skills and behaviour are known to be adversely affected (Harlow et al., 1965; Suomi et al., 1974a; Nash et al., 1999; Lutz and Novak, 2005; Novak and Suomi, 2008). The negative effects of unnatural social rearing circumstances persist even long after the previously solitary housed individuals are housed in a social group.

Other references supplied by AAP: (Dienske and Griffin, 1978; Clarke, 1993; Hol et al., 1999; Dettling et al., 2002a; Fone and Porkess, 2008).

b) AAP's updated position

This section describes AAP's updated position, kindly provided by Godelieve Kranendonk and David van Gennep. The revision was initiated by the Delphi expert consultation. E17ab is AAP's expert number. 090313 is the date the information was received (March 9th). Q1-9 refer to the questions in the questionnaire.

In response AAP's original position (previous section), AAP points out that there may have been some misunderstanding as regards the suggested separation ages and species. AAP recommended ages for chimpanzees and macaques and didn't examine the other species in detail. This is corrected in the updated position. AAP also specified its expertise with abnormal behaviour and weaning in primates (see E17ab-090313 in Annex 5). There AAP also points out that an upper limit may be relevant too as most animals are easiest to introduce into another social group when not adult yet. However, AAP believes that such upper limits cannot be regulated by law.

E17ab-090313-Updated position

Q7: AAP is in favour of looking at **subadult ages** to determine when animals can leave their mothers. In many species, offspring that disperse from their natal group, do so at subadult age. At this stage, it is also relatively easy to introduce animals into new social groups (AAP experience). Once adult, that may be more difficult (AAP experience).

The reason for AAP's opinion in this matter is very accurately phrased by Dunbar (1988) "*There are two important stages of development of an infant primate. The first is the period during which it is totally dependent on its parent(s) for nourishment, care and transport. The second period begins at the point where the infant is no longer dependent on its parents for food and transport, and ends when it can effectively fend for itself in adult society. In Old World monkeys, this lasts from about the end of the first year up to the age of four years. During this period, the animal is largely dependent on its mother and close relatives for social support against other group members, as well as for protection against predators.*"

In addition, compared to other mammals, primates have the longest juvenile periods for their body size (Pereira and Fairbanks, 1993; Strier, 2000). The juvenile phase spans from the period of weaning to sexual maturity (Strier, 2000).

Table 2 Life history variables for relevant primate species (yr: years; mo: months)

Species Life history variable	<i>Callithrix jacchus</i>	<i>Callithrix pygmaea</i>	<i>Callithrix argentata</i>	<i>Macaca arctoides</i>	<i>Macaca fascicularis</i>	<i>Macaca mulatta</i>	<i>Pan troglodytes</i>	<i>Aotus trivirgatus</i>	<i>Aotus nigriceps</i>	<i>Saimiri sciureus</i>	<i>Saimiri boliviensis</i>	<i>Saimiri oerstedii</i>
Gestation length (d)	148 ^a	137 ^a 119- 142 ^b	14 4 ^f	178 ^{ab}	160 ^a	164 ^b - 165 ^a	235 ^a - 240 ^b	120 ^b	120- 133 ^b	170 ^b - 171 ^a 152- 168 ^d	155-170 d ^b	161 ^f
Age at weaning (mo)	2 ^{b-} 3 ^a	3 ^{ab}	6 ^f	13.1 ^a 9-18 ^b	14 ^{ab}	12 ^a	56.4 ^a 48 ^b	2.5 ^e	8 ^b	14 ^{a*} 11 ^b	4-6 ^{f*}	12 [*]
Length of juvenile period (yr)	0.9 ^a 0.4- 0.8 ^b	1.3 ^a	-	1-4 ^b	2.3 ^a 1- 3.5 ^b	3.1 ^a 1-3 ^b	8.4 ^a 5-8 ^b	-	0.7-2 ^b	1.6 ^a 0.9- 2.5 ^b	-	-
Subadult phase (yr)	0.8- 1.3 ^b	1- 1.3 ^b	-	4-8 ^b	3.5- 4.5 ^b	4-6 ^b	8- 11 ^b	-	2-3 ^b	2.5-5 ^b	-	-
AAP's updated	1.8\$	1.8\$	1.8\$	4	3.5-4.5	4	8-10	2#	2-3	2.5	2.5#	2.5#

Species	<i>Callithrix jacchus</i>	<i>Callithrix pygmaea</i>	<i>Callithrix argentata</i>	<i>Macaca arctoides</i>	<i>Macaca fascicularis</i>	<i>Macaca mulatta</i>	<i>Pan troglodytes</i>	<i>Aotus trivirgatus</i>	<i>Aotus nigriceps</i>	<i>Saimiri sciureus</i>	<i>Saimiri boliviensis</i>	<i>Saimiri oerstedii</i>
Life history variable												
separation ages (yr)												
Age sexual maturity females (yr)	1 ^b	2 ^b	0.8 ^f	4 ^f	4.3 ^b	3.5-4 ^b	11.3 ^b	2.2 ^e	3-4 ^f	2.5 ^d	2.5-3 ^f	1 ^f 2.5 ^g
Age sexual maturity males (yr)	1.4 ^b	2 ^b	0.9 ^f	4.5-5 ^f	4.2 ^b	3.5-4 ^b	13 ^b	2 ^e	2 ^f	2.5-4 ^d	5 ^f	4-6 ^f 3.5 ^g
Female first reproduction age (yr)	1.5 ^a 1.7-2 ^b	1.9 ^a _b	1.7 ^a _b	3.8 ^a 3.8-4.7 ^b	3.9 ^a 3.8 ^b	4.5 ^a _b	13 ^a 14-15 ^b	2.4 ^a	2.5 ^b	2.5 ^{ab}	-	-
Life span (yr)	11.7 ^b	11.7 _b	16.5 ^e	30 ^b	37.1 _b	29 ^b	53 ^b	20 ^b	20 ^b	21 ^b	15-20 (up to 30) ^f	Unknown ^{***e}
Dispersal age (yr)	-	-	-	-	5 ^c 4-7 ^b	3.5-5 ^c	11 ^c	-	3 ^b	SA or A age ^d	-	2.5 ⁱ
Dispersal gender (Male or Female)	M+F ^h	-	-	-	M ^b	-	F ^b	-	M+F ^b	M ^{bd}	M ^{b**}	F ^b

§ In marmosets, it is important to learn parental care from its own parents. Thus, it may be important to not separate offspring from its parents until these latter had a second litter, in which the juveniles of the first litter could help (NRC, 1998). When animals are separated from their parents and not meant to breed, assisting their parents in raising a litter is not relevant and subadult ages could be used for separating these animals from their parents.

Based on age of sexual maturity.

* Squirrel monkeys nurse their offspring until they are four to twelve months old, depending on which taxa is considered, but also whether the monkeys are captive animals; monkeys in captivity were weaned at a later age than wild conspecifics (Boinski and Fragaszy, 1989).

** In *Saimiri boliviensis*, males only disperse from their natal group when forced by the more dominant males (Rowe, 1996).

*** One specimen was about 18 years old when it died in captivity.

References used in the table: ^a Ross (2003), ^b Rowe (1996). (note: Much information from this reference is originally from Ross (1991; 1992)). ^c Pusey and Packer (1986), ^d Robinson and Janson (1986).^e

^f www.genomics.senescence.info/; ^g Animal Diversity Web (several references given); ^h Primate Info Net (<http://pin.primat.wisc.edu/>); ⁱ de Sousa et al. (2009); ^j Jack (2007).

It is the opinion of AAP's staff that, according to Dunbar's statement (1988), young animals are not only dependent on their mother (or parents) for nutrition, but also for the development of social and behavioural skills. Separating primates from their mothers has been shown to be stressful for the young animals and can ultimately lead to the development of abnormal behaviour. Therefore, AAP is a strong advocate of not separating primates from their mother until they would or could normally do so in the wild. In general, individuals of primate species leave their natal group at a subadult age. This subadult age is therefore considered to be a suitable age to separate young primates from their mother. An exception could be possible for marmosets. In marmosets it has been shown that when youngsters do not have the chance to help raise their own brothers and sisters, they are less capable

of siring their own litter later in life (Pryce, 1993). Marmosets, intended for breeding should therefore, should be left with their parents until the younger siblings are about 5-6 months old.

Annex 4: Species involved

Classification of species involved in the Dutch Legislation (LNV, 1996; EZ, 2012) (source: Wikipedia, accessed 17-02-2013).

Term used in Dutch legislation	Number of species (& genera)	Genus	English name	Latin name
Chimpansee	1	Pan	Chimpanzee	<i>P troglodytes</i>
Rhesus makaak	1	Macaca	Rhesus macaque	<i>M mulatta</i>
Beermakaak	1	Macaca	Bear macaque, stump-tailed macaque	<i>M arctoides</i>
Java-aap	1	Macaca	Crab-eating macaque, long-tailed macaque, cynomolgus monkey	<i>M fascicularis</i>
Marmoset	22 (4)	Callithrix	Marmoset Atlantic marmosets Common marmoset Black-tufted marmoset Wied's marmoset White-headed marmoset Buffy-headed marmoset Buffy-tufted marmoset	<i>C jacchus</i> <i>C penicillata</i> <i>C kuhlii</i> <i>C geoffroyi</i> <i>C flaviceps</i> <i>C aurita</i>
		Mico	Amazonian marmosets Rio Acari marmoset Manicore marmoset Silvery marmoset White marmoset Emilia's marmoset Black-headed marmoset Marca's marmoset Black-tailed marmoset Santarem marmoset Maués marmoset Gold-and-white marmoset Hershkovitz's marmoset Satéré marmoset Rondon's marmoset	<i>M acariensis</i> <i>M manicorensis</i> <i>M argentata</i> <i>M leucippe</i> <i>M emiliae</i> <i>M nigriceps</i> <i>M marcai</i> <i>M melanura</i> <i>M humeralifera</i> <i>M mauesi</i> <i>M chrysoleuca</i> <i>M intermedia</i> <i>M saterei</i> <i>M rondoni</i>
		Callibella	Roosmalens' dwarf marmoset Roosmalens' dwarf marmoset	<i>C humilis</i>
		Cebuella	Pygmy Marmoset Pygmy marmoset	<i>C pygmaea</i>
Doeroecoeli	11 (1)	Aotus	Douroucouli, night monkey, owl monkey Gray-bellied night monkey Panamanian night monkey Gray-handed night monkey Hernández-Camacho's night monkey	<i>A lemurinus</i> <i>A zonalis</i> <i>A griseimembra</i> <i>A jorgehernandezi</i>

Term used in Dutch legislation	Number of species (& genera)	Genus	English name	Latin name
			Brumback's night monkey	<i>A brumbacki</i>
			Three-striped night monkey	<i>A trivirgatus</i>
			Spix's night monkey	<i>A vociferans</i>
			Azara's night monkey	<i>A azarae</i>
			Peruvian night monkey	<i>A miconax</i>
			Nancy Ma's night monkey	<i>A nancymaae</i>
			Black-headed night monkey	<i>A nigriceps</i>
Doodshoofdaap	5 (1)	Saimiri	Squirrel monkey	
			Central American squirrel monkey	<i>S oerstedii</i>
			Common squirrel monkey	<i>S sciureus</i>
			Bare-eared squirrel monkey, <i>Saimiri ustus</i>	
			Black-capped squirrel monkey	<i>S boliviensis</i>
			Black squirrel monkey	<i>S vanzolinii</i>

Annex 5: General mails sent to (potential) participants

a) Invitation

The invitation was sent to potential participating experts on Februari 15, 2013.

From: Bracke, Marc

Subject: Separation ages for captive primates - Delphi expert elicitation to support political decision making in the Netherlands

Dear Dr. ...,

The Dutch government is presently revising existing welfare regulations. One of the issues concerns separation ages for primates kept in captivity. In order to avoid unacceptable welfare problems to the young or its mother young animals should not be separated from their mothers before they have reached a specified age. We are seeking input from world-wide experts to determine whether specified ages need to be modified.

Existing legislation contains the following list of species and ages. The list applies to separation into group housing (between bracket are ages when weaning occurs into individual rather than group housing. However, we now intend to propose removing the separation ages for individual/solitary housing in the new legislation as this is no longer considered acceptable (as indicated e.g. by recent EU regulations for primates used in research.)

Chimpanzee (<i>Pan troglodytes</i>)	3 years (4 yr)
Rhesus monkey (<i>Macaca mulatta</i>)	1 year (2 yr)
Bear macaque (<i>Macaca arctoides</i>)	1 year (2 yr)
Long-tailed macaque (<i>Macaca fascicularis</i>)	1 year (2 yr)
Douroucouli, Night monkeys (<i>Aotus</i>)	1 year (1.5 yr)
Squirrel monkeys	7 months (9 mo)
Marmosets	6 months (1 yr)

What we ask is the following:

- Are you willing to provide (further) input before March 14? Based on the input received and literature quick-scans we will be compiling tables summarising (referenced) research and personal communications of experts as to what has been observed concerning animal welfare at the various weaning and separation ages. We will be asking what age you consider acceptable and what are your main reasons for that opinion (if possible backed up by references). You may already send us your first thoughts and/or references on this, if you like, but we will be sending out a more proper questionnaire later (in about 1-3 weeks time).
- At present however we would very much like to receive a list of up to 10 [later 5; later 3] international experts whom you consider to be most knowledgeable on this subject. We would like to receive a list of names and, if possible, email addresses, such that we can send out invitations to experts we may have missed.

Our inventory will be following the Delphi procedures, implying that experts will be consulted anonymously and that the main focus is on the arguments (observations and references), rather than on opinions (although we plan to report those too; anonymously of course).

b) Questionnaire and reminder to responders

The following questionnaire was sent to 16 experts on 250213.

Dear ...,

Many thanks for your positive response to my precious invitation to participate in the expert consultation.

This message comprises the questionnaire on separation ages for primates (in 8 questions). It explains how you can provide input. What we need is your opinion on suitable separation ages for the listed primate species/groups, and, more importantly, your main reasons (stated as much as possible as 'facts', i.e. cited with references and personal observations).

A most convenient way to select and present that information is to first specify what you consider to be required separation ages for selected species and then present 'facts' and other considerations as arguments to support your decision/opinion.

The separation ages and other personal opinions you provide will remain anonymous, unless you explicitly confirm that they can be cited with your name as official 'personal communication'. Furthermore, we acknowledge that your answers may have to be tentative and that it may be difficult/impossible to specify all relevant considerations. I hope you won't be afraid of providing tentative/preliminary opinions and arguments. These can be modified throughout the Delphi procedure, i.e. until March 14, and they will be revised and supplemented by other participants as well.

As indicated earlier, the Delphi procedure entails anonymous participation as well as a focus on arguments/content/observations/facts (including stated opinions). It also entails that there is room for discussion and revisions. A main issue is the early deadline (March 14). As a consequence, discussion arising late is likely to be cut-off by the deadline. Therefore, **it is much appreciated if you can contribute in an immediate reply mail**, if only by sharing your first, preliminary thoughts. If you, nevertheless, have to delay your response, you are kindly requested to inform me about the expected response date. I may then send you an **updated version at the appropriate time**.

The report containing received input will be revised periodically (i.e. every week). You will get a copy as soon as you have provided your (initial) answers to the questions below. The report already contains inputs received thus far (Section 3.5).

In order to guide your thoughts I have prepared (and will be updating) tables of increasing complexity, based primarily on received input from participating experts. The table below is a first example, which you have seen previously in the invitation mail. Subsequent tables derive from this, but have species as column headings.

Table 1 Minimally required separation ages for primates in existing Dutch animal welfare legislation for moving into group housing (LNV, 1996). Between brackets ages when moved to individual housing

Primate species/group	Separation age
Chimpanzee (<i>Pan troglodytes</i>)	3 years (4 yr)
Rhesus monkey (<i>M mulatta</i>)	1 year (2 yr)
Bear macaque (<i>M arctoides</i>)	1 year (2 yr)
Long-tailed macaque (<i>fascicularis</i>)	1 year (2 yr)
Douroucouli, Night monkeys (<i>Aotus</i>)	1 year (1.5 yr)
Squirrel monkeys (<i>Saimiri</i>)	7 months (9 mo)
Marmosets	6 months (1 yr)

The draft report has sections describing further details on the position of Foundation AAP who suggested substantially older separation ages (Section 3.1). And it contains sections giving more details about the interpretation of the legislation (Sections 3.2 and 3.3). You are (later) kindly requested to read selected sections and suggest improvements of the text and comments where relevant (in track changes). Participants who actively participate in co-writing sections in the report are also invited to become co-authors of these sections.

A second document contains a compilation of collected references (307 at present) and abstracts. The references are sorted by species and subject. Again, you are (later) invited to have a look so as to perhaps refresh your memory as to what may be relevant findings that need to be considered. If you encounter errors (e.g. when references are lacking, irrelevant or classified wrongly), you may point this out, again preferably in track changes. Using the navigation pane will allow you to quickly identify relevant sections to provide input, e.g. '3.5 Expert opinion in chronological order' and the subsequent sections on the different species/groups of primates.

The third document is an excel file containing the extended table with frozen panes (i.e. first rows and columns are fixed on the screen). This makes it easier to scroll through the table as it becomes bigger and bigger in the process. At present the worksheet has 47 rows and 12 columns (A-L) containing relevant information about suggested and natural weaning and separation ages.

Finally, you are kindly requested to provide some personal information in a separate table. This information will be used to anonymously describe the 'population' of participating experts.

Right now I ask you to state your responses in a reply email as answers to the questionnaire below. I hope you enjoy contributing to this Delphi exercise. If you have any questions or hesitations please don't hesitate to contact me (by email or mobile: +31-320238205).

Sincerely yours,

Marc Bracke

Questionnaire

Q1: In the table below please specify your preferred separation ages, i.e. those ages you believe would be best prescribed as minimally required separation ages in the Dutch (and European) welfare regulations for application to research institutes, breeding facilities, zoos and shelters, so as to avoid unacceptable suffering resulting from early separation. You may supplement the specified ages with a range (certainly not below and not above the given range). The best way to answer this question is to provide preliminary answers first, then have a look at the table below the questionnaire and then perhaps revise your input, where relevant. Until March 14 you are free to recall and modify previously provided answers. Alternatively (if you feel uncomfortable filling out the table), you can provide your answers (to all questions) in text directly below the table.

Table: specifying separation ages in months (mo) or years (yr)

Source / Expert	Conditions	Welfare impact	Chimpanzee (<i>P troglodytes</i>)	Rhesus monkey (<i>M mulatta</i>)	Bear macaque (<i>M arctoides</i>)	Crab-eating macaque (<i>M fascicularis</i>)	Douroucouli (<i>Aotus</i>)	Squirrel monkeys (<i>Saimiri</i>)	Marmosets	General	Other
E...	Separation ages										

- Q1:
- Q2:
- Q3:
- Q4:
- Q5:
- Q6:
- Q7:

Q2: Give your main arguments for these ages, i.e. fill out the table (in separate rows) or write down as text (below the table), where possible including sources (i.e. references, personal observations, pers. comm.). You can insert rows in the table by putting the cursor behind a row followed by pressing 'enter'.

Q3: Supply other considerations (e.g. conditions under which the specified ages apply or don't apply; and potential impact you think this may have on existing breeding practices).

Q4: If you have strong objections to specifying an age, please indicate your main considerations.

Q5: Foundation AAP has argued for substantially older separation ages for chimpanzees and macaques (but not for the other species, see table below, last row; chimpanzees: 9 yr; macaques: 4 yr). AAP, a European rescue centre for exotic animals including primates in the Netherlands, refers to own daily experiences and a number of references, esp. Rowe (1996; The pictorial guide to the living primates). Other references include (listing first authors only): Latham, 2008 ;Capitanio, 2005; Harlow, 1965; Lewis, 1990; Lyons, 2000; Nash, 1999; Novak, 2008; Dienske, 1978; Suomi, 1974a; Lutz, 2005; Dettling, 2002a; Clarke, 1993; Fone, 2008; Hol, 1999. What do you think about the separation ages suggested by AAP?

Q6: AAP also strongly objects against (separation into) individual housing (other than for quarantine or other medical reasons). AAP states that individual housing (>30 days) creates most serious welfare problems and should be considered to be cruel. Do you agree?

Q7: Other relevant remarks/comments

Q8: Finally, we kindly ask to supply some personal information in the table below. You are allowed to leave incidental cells blank (e.g. if you feel stating your age is inappropriate)

Surname	First name	Expert No.	Species	Position(s)	Years of experience	Gender (M/F)	Age (Yr)	Nationality	Subject area (e.g. cognition; abnormal behav.; social behav.; etc)	Primary affiliation (select one or more of: field work, lab work, business, breeding, zoo, animal protection, nature conservation, other namely...)	Are you interested in becoming a co-author of one or more sections (no/ specify section numbers)	Can we list your name in the acknowledgements of the report? (Y/No)	Other personal information

PS My overview of presently participating experts indicates we may have insufficient input on Aotus and squirrel monkeys in particular. Therefore, it would be appreciated if you could list one or two relevant experts and their email addresses.

Summary table of separation ages (in months unless specified otherwise; yr: years).

Source	Conditions	Chimpanzee (Pan troglodytes)	Rhesus monkey (Macaca mulatta)	Bear macaque (Macaca arctoides)	Crab-eating macaque (Macaca fascicularis)	Douroucoulis (Aotus)	Squirrel monkeys (Saimiri)	Marmosets	General
LNV, 1996; EZ, 2012	Solitary housing	48 (4 yr)	24 (2 yr)	24 (2 yr)	24 (2 yr)	18	9	12 (1 yr)	
^a EZ, 2012; ^b LNV, 1996	Group housing	36 (3 yr)	12 (1 yr)	12 (1 yr)	12 (1 yr)	12 (1 yr)	7	8 ^a 6 ^b	
Van Dixhoorn et al., 2011	Group housing	36 (3 yr)	-	10-12	-	-	6	8-13	
EU, 2010	Laboratory	-	8	8	8	-	6	-	6-12 (primates)
Prescott et al., 2012	Minimum weaning age in laboratory	-	8-14?	8-14?	8-14?	-	-	-	8-14 (macaques)
AAP	Group housing	108 (9 yr)	48	48	48	12	7	8	

Errata: the questionnaire and table contained several errors: a. the minimum separation age in Prescott et al. (2012) is 10 months, not 8; b. EU (2010) lists 8 months for marmosets; c.. The ages for Douroucoulis, squirrel monkeys and marmosets suggested here (in Question 5 and in the table) for AAP should have been missing values.

030313 sent to 11 participants (who had previously, more or less, agreed to contribute).

Dear all,

This message serves two purposes. It is a, rather early, reminder to my previous mail sent last Monday (Feb 25). I have now prepared a hopefully somewhat more convenient alternative questionnaire (attached below; however, the previous version can still be used too). I most appreciate receiving some suggestions and motivations for separation ages. That should not take too much of your time (perhaps as little as 15 min to start with).

For participants who already provided some input, this message also supplies the indicated background documents which you may want to browse through. It is probably too much to read it all; so please be selective (e.g. section 3.5 of the report contains input received from other participants). Note: the attachments are extra: it is perfectly OK to ignore them and have a look later (or not). In any case, I much prefer receiving some preliminary answers to the questions below without much delay. I realise this reminder is sent early, but we have a rather fixed deadline (March 14) and I will be doing lab work most of next week (implying also that I will have only limited opportunities to respond until next weekend).

Looking forward to receiving your input.

Most kind regards,

Marc

Shortened questionnaire

Q1: Please specify your preferred separation ages, i.e. those ages you believe would be best prescribed as minimally required separation ages in the Dutch (and European) welfare regulations for application to research institutes, breeding facilities, zoos and shelters, so as to avoid unacceptable suffering resulting from early separation.

Q1: My suggested separation ages are:

Chimpanzee (P troglodytes)

Rhesus monkey (M mulatta)

Bear macaque (M arctoides)

Crab-eating macaque (M fascicularis)

Douroucouli (Aotus)

Squirrel monkeys (Saimiri)

Marmosets

Q2: Give your main arguments for these ages (you may supply the answer as keywords behind the specified ages), where possible including sources (i.e. references, personal observations, pers. comm.).

Q3: Supply other considerations (e.g. conditions under which the specified ages apply or don't apply; and potential impact you think this may have on existing breeding practices).

Q4: If you have strong objections to specifying an age, please indicate your main considerations.

Q5: Foundation AAP has argued for substantially older separation ages for chimpanzees and macaques (but not for the other species, see table below, last row; chimpanzees: 9 yr; macaques: 4 yr). AAP, a European rescue centre for exotic animals including primates in the Netherlands, refers to own daily experiences and a number of references, esp. Rowe (1996; The pictorial guide to the living primates). What do you think about the separation ages suggested by AAP?

Q6: AAP also strongly objects against (separation into) individual housing (other than for quarantine or other medical reasons). AAP states that individual housing (>30 days) creates most serious welfare problems and should be considered to be cruel. Do you agree?

Q7: Other relevant remarks/comments

Q8: Finally, we kindly ask to supply some personal information in the table below. You are allowed to leave cells blank (e.g. if you feel stating your age is inappropriate)

Surname	First name	Expert No.	Species	Position(s)	Years of experience	Gender (M/F)	Age (Yr)	Nationality	Subject area (e.g. cognition; abnormal behav.; social behav.; etc)	Primary affiliation (select one or more of: field work, lab work, business, breeding, zoo, animal protection, nature conservation, other namely...)	Are you interested in becoming a co-author of one or more sections (no/ specify section numbers)	Can we list your name in the acknowledgements of the report? (Y/No)	Other personal information

Summary table of separation ages (in months unless specified otherwise; yr: years).

Source	Conditions	Chimpanzee (Pan troglodytes)	Rhesus monkey (Macaca mulatta)	Bear macaque (Macaca arctoides)	Crab-eating macaque (Macaca fascicularis)	Douroucoulis (Aotus)	Squirrel monkeys (Saimiri)	Marmosets	General
LNV, 1996; EZ, 2012	Solitary housing	48 (4 yr)	24 (2 yr)	24 (2 yr)	24 (2 yr)	18	9	12 (1 yr)	
^a EZ, 2012; ^b LNV, 1996	Group housing	36 (3 yr)	12 (1 yr)	12 (1 yr)	12 (1 yr)	12 (1 yr)	7	8 ^a 6 ^b	
Van Dixhoorn et al., 2011	Group housing	36 (3 yr)	-	10-12	-	-	6	8-13	
EU, 2010	Laboratory	-	8	8	8	-	6	-	6-12 (primates)
Prescott et al., 2012	Minimum weaning age in laboratory	-	8-14?	8-14?	8-14?	-	-	-	8-14 (macaques)
AAP	Group housing	108 (9 yr)	48	48	48	12	7	8	

Note on attachments:

The draft report contains inputs received thus far (Section 3.5).

The draft report has sections describing further details on the position of Foundation AAP who suggested substantially older separation ages (Section 3.1). And it contains sections giving more details about the interpretation of the legislation (Sections 3.2 and 3.3). You are kindly requested to read selected sections and suggest improvements of the text and comments where relevant (in track changes). Using the navigation pane will allow you to quickly identify relevant sections to provide input, e.g. '3.5 Expert opinion in chronological order' and the subsequent sections on the different species/groups of primates.

A second document contains a compilation of collected references and abstracts. The references are sorted by species and subject. Again, you are invited to have a look so as to perhaps refresh your memory as to what may be relevant findings that need to be considered. If you encounter errors (e.g. when references are lacking, irrelevant or classified wrongly), you may point this out, again preferably in track changes. Note: the abstract document is not fully up to date and abstracts of many references are missing. This is the least relevant document for you to have a look at.

The third document is an excel file containing the extended table with frozen panes (i.e. first rows and columns are fixed on the screen). This makes it easier to scroll through the table as it becomes bigger and bigger in the process. At present the worksheet has 47 rows and 12 columns (A-L) containing relevant information about suggested and natural weaning and separation ages.

Many thanks for your contribution, Marc

-

Errata: the questionnaire and table contain several errors: a. the minimum separation age in Prescott et al. (2012) is 10 months, not 8; b. EU (2010) lists 8 months for marmosets; c. The ages for Douroucoulis, squirrel monkeys and marmosets suggested here (in Question 5 and in the table) for AAP should have been missing values.

-

By 0803113: none had responded, so sent reminder:

030313 sent to 11 participants (who had previously, more or less, agreed to contribute).

From: Bracke, Marc

Sent: vrijdag 8 maart 2013 11:26

Subject: FW: RE: Separation ages for captive primates - Delphi expert elicitation to support political decision making in the Netherlands

Dear all,

Following my previous message I'm starting to get a bit worried. I haven't been receiving as much input as I had expected (and hoped for).

Your contribution is highly valued, even if only preliminary/tentative. If the previous attachments were a problem, please ignore them. What I really need asap is your views on suitable separation ages for the species you are familiar with, supplemented with your main reasons for those ages (questions 1 and 2). I was hoping that would not take more than 15-30 min of your time. If there is any other problem, I need to deal with, please let me know.

Kind regards, and sorry about this,
 Marc
 PS I need to emphasise that March 14 (next Thursday) is really a hard deadline.
 -

c) Questionnaire to non-responders regarding the invitation mail

Sent dd 010313 to 22 invited but not responded experts:

Dear ...,

This message is a reminder following my previous invitation to participate in the expert consultation on separation ages for primates. In case you are interested, you are still most welcome to participate. If you have very little time, a minimal participation should not take more than 15 minutes of your time.

Below this message you find the questionnaire. What we want is your opinion on suitable separation ages for the listed primate species/groups, and, if possible, your main reasons (stated as much as possible as 'facts', e.g. with some cited references or personal observations).

Your input will be anonymous, unless you explicitly indicate otherwise. Furthermore, we recognise that your answers may be tentative. In that respect please keep in mind that we are interested in reporting group averages, not individual responses (i.e. uncertainty will show up as deviations around a mean separation age). Also, until the deadline for providing input (March 14) you can, if you want, revise and supplement your previous suggestions.

We follow a Delphi procedure entailing anonymous participation as well as a focus on arguments/content/observations/facts (including stated opinions). It also entails that there is room for discussion, revisions and reflections on input from other participants.

What we want is your advice/comments on the separation ages presented in the table below.

Table 1 Minimally required separation ages for primates in existing Dutch animal welfare legislation for moving into group housing (LNV, 1996). Between brackets ages when moved to individual housing

Primate species/group	Separation age
Chimpanzee (<i>Pan troglodytes</i>)	3 years (4 yr)
Rhesus monkey (<i>M mulatta</i>)	1 year (2 yr)
Bear macaque (<i>M arctoides</i>)	1 year (2 yr)
Long-tailed macaque (<i>fascicularis</i>)	1 year (2 yr)
Douroucouli, Night monkeys (<i>Aotus</i>)	1 year (1.5 yr)
Squirrel monkeys (<i>Saimiri</i>)	7 months (9 mo)
Marmosets	6 months (1 yr)

Below you find the questionnaire. I hope you enjoy contributing to this Delphi exercise. If you have any questions or hesitations please don't hesitate to contact me (by email or mobile: +31-320238205).

Sincerely yours,

Marc Bracke

Questionnaire

Q1: Please specify your preferred separation ages, i.e. those ages you believe would be best prescribed as minimally required separation ages in the Dutch (and European) welfare regulations for application to research institutes, breeding facilities, zoos and shelters, so as to avoid unacceptable suffering resulting from early separation.

Q1: My suggested separation ages are:
 Chimpanzee (*P troglodytes*)

Rhesus monkey (M mulatta)
 Bear macaque (M arctoides)
 Crab-eating macaque (M fascicularis)
 Douroucouli (Aotus)
 Squirrel monkeys (Saimiri)
 Marmosets

Q2: Give your main arguments for these ages (you may supply the answer as keywords behind the specified ages), where possible including sources (i.e. references, personal observations, pers. comm.).

Q3: Supply other considerations (e.g. conditions under which the specified ages apply or don't apply; and potential impact you think this may have on existing breeding practices).

Q4: If you have strong objections to specifying an age, please indicate your main considerations.

Q5: Foundation AAP has argued for substantially older separation ages for chimpanzees and macaques (but not for the other species, see table below, last row; chimpanzees: 9 yr; macaques: 4 yr). AAP, a European rescue centre for exotic animals including primates in the Netherlands, refers to own daily experiences and a number of references, esp. Rowe (1996; The pictorial guide to the living primates). What do you think about the separation ages suggested by AAP?

Q6: AAP also strongly objects against (separation into) individual housing (other than for quarantine or other medical reasons). AAP states that individual housing (>30 days) creates most serious welfare problems and should be considered to be cruel. Do you agree?

Q7: Other relevant remarks/comments

Q8: Finally, we kindly ask to supply some personal information in the table below. You are allowed to leave cells blank (e.g. if you feel stating your age is inappropriate)

Surname	First name	Expert No.	Species	Position(s)	Years of experience	Gender (M/F)	Age (Yr)	Nationality	Subject area (e.g. cognition; abnormal behav.; social behav.; etc)	Primary affiliation (select one or more of: field work, lab work, business, breeding, zoo, animal protection, nature conservation, other namely...)	Are you interested in becoming a co-author of one or more sections (no/ specify section numbers)	Can we list your name in the acknowledgements of the report? (Y/No)	Other personal information

Summary table of separation ages (in months unless specified otherwise; yr: years).

Source	Conditions	Chimpanzee (Pan troglodytes)	Rhesus monkey (Macaca mulatta)	Bear macaque (Macaca arctoides)	Crab-eating macaque (Macaca fascicularis)	Douroucouli (Aotus)	Squirrel monkeys (Saimiri)	Marmosets	General
LNV, 1996; EZ, 2012	Solitary housing	48 (4 yr)	24 (2 yr)	24 (2 yr)	24 (2 yr)	18	9	12 (1 yr)	
^a EZ, 2012; ^b LNV, 1996	Group housing	36 (3 yr)	12 (1 yr)	12 (1 yr)	12 (1 yr)	12 (1 yr)	7	8 ^a 6 ^b	
Van Dixhoorn et al., 2011	Group housing	36 (3 yr)	-	10-12	-	-	6	8-13	
EU, 2010	Laboratory	-	8	8	8	-	6	-	6-12 (primates)
Prescott et al., 2012	Minimum weaning age in laboratory	-	8-14?	8-14?	8-14?	-	-	-	8-14 (macaques)
AAP	Group housing	108 (9 yr)	48	48	48	12	7	8	

Many thanks for your contribution, Marc

d) *Requesting last-minute comments on the draft summary/recommendations and report*

From: Bracke, Marc

Sent: vrijdag 15 maart 2013 17:09

Subject: Separation ages for captive primates - Delphi expert elicitation to support political decision making in the Netherlands

Dear all,

This is to thank you all once more for your kind responses.

If you are interested in the follow-up of the expert elicitation process, you may **read this message asap** (else delete it asap, :-).

The deadline for answering the questionnaire has finished and I have now started the writing process. Next Tuesday the report must be finalised for the Ministry, as it is to be discussed in parliament the following Monday.

Below you find a preliminary summary of the results.

I'm afraid the time schedule has become too tight to allow for further section co-authorship (unless you can offer immediate assistance).

In addition, I have to mention two errata concerning information presented earlier:

a. the minimum separation age for macaques mentioned in Prescott et al. (2012) is 10 months, not 8 months;

b. The ages for douroucoulis, squirrel monkeys and marmosets suggested previously by AAP should have been represented as missing values. AAP now suggests 2-3 years for douroucoulis, 2.5 years for squirrel monkeys and 1.8 years for marmosets (and provided referenced support for this).

If you are eager to have a look at the draft report you can do so upon request (the deadline for submitting comments is Tuesday noon, March 19th).

Many thanks again for your consideration.

It has been my pleasure,

Sincerely yours,

Marc

PS Below a summary of the Delphi so far:

Involved expertise

Table 1b. Overview of the number of expert which participated, their species-expertise, years of experience, age, nationality (AT: Austria; ES: Spain, IT: Italy, etc.), interest in being a section co-author and whether the expert agreed to have his/her name listed in the acknowledgements. Avg: average; M: male; F: female; Y: yes; N: no; (

Number of experts	Species	Years of experience (avg)	Gender (M/F)	Avg age (yr)	Nationality (number)	Co-author?	Acknowledgement?
25	All except Aotus*	24	M: 19; F: 11	52	UK:7; USA:7; NL:6; AT:1; IT:1; ES:1; FR:1	Y:9; N: 6	Y:14; N: 2; Conditional: 2

* Number of experts stating expertise was 12 for chimpanzees; 10 macaques generally; 6 rhesus, 1 arctoides, 4 fascicularis, 9 marmosets, 0 douroucoulis; 3 squirrel monkeys.

In addition to the information presented in the table, experts were also asked to specify their subject areas and primary affiliations. Main subject areas were: abnormal behaviour (n=4), social behaviour (9), welfare (5), behavioural management (6), behaviour (6) and cognition (3). Main affiliations were breeding (8), lab work (13) and field work (3).

Answers to the questions

Q1: Specified minimally required separation ages

The experts (indicated by E-numbers) suggested the following separation ages (sorted on age and showing median ages in bold):

Chimpanzee (*Pan troglodytes*): E29: 3yr; E8: 4yr; E25:4yr; E4:4-5yr; E24: 5-6yr; **E2: 6 yr**; E1: 7-9yr; E15: 8 yr (4-5 yr with mother and/or peers); E17ab: 8-10yr; E20: never; E26: never;
 Rhesus monkey (*Macaca mulatta*): E29:6-8mo; E10: 6-12 mo; E4:1yr; E28: 1 yr (practice: 4 yr); E13: 12-15 mo; **E1: 12-20mo; E12: 12 mo (research), 4 yr (breeding, zoos & shelters)**; E25:18 mo; E2: 3 yr; E17ab: 4 yr; E27: never or >8mo in familiar group; E26: never;
 Bear macaque (*Macaca arctoides*): E29:6-8mo; E1: 12-20mo; E25:18 mo; **E12: 12 mo (research), 4 yr (breeding, zoos & shelters); E2: 3 yr**; E17ab: 4 yr; E27:never or >8mo in familiar group; E26: never;
 Crab-eating macaque (*M fascicularis*): E29:6-8mo; E18b: 1 yr; E4:1yr; E28: 1 yr (practice: 4 yr); E1: 12-20mo; **E12: 12 mo (research), 4 yr (breeding, zoos & shelters)**; E25:18 mo; E2: 3 yr; E17ab: 3.5-4.5 yr; E27:never or >8mo in familiar group; E26: never;
 Douroucouli, Night monkeys (*Aotus*): E1: 10-18 mo; E25:18 mo; **E2: 24mo[?]**;E17ab: 2-3yr; E26: never;
 Squirrel monkeys (*Saimiri*): E29:6-8mo; E25: 9 mo; **E1: 10-18 mo; E2: 12mo[?]**; E17ab: 2.5yr; E26: never;
 Marmosets: E29:6-8mo; E1: 8-14 mo; E25: 9 mo; E7: 9 mo; **E23: 12-14 mo**; E2: 16 mo[?];E28: 1.5 yr (1.5-2yr practice); E17ab: 1.8 yr; E26: never.

Q2: Main arguments for these ages

Main arguments related to **natural** conditions (e.g. at what ages the animals can do without milk, can survive or migrate to other groups), **health** (e.g. iron deficiency due to prolonged nursing and vertical transmission of viruses) and **economy** (e.g. that raising separation ages would or would not reduce reproductive output of a breeding facility; young females may get pregnant).

Q3: Other considerations

Here points were raised on social conditions (peers; degree of contact with conspecifics; contact to younger and/or older animals), enrichment (e.g. hiding places), conditions for early separation (e.g. for specific research; animal welfare; medical reasons; SPF breeding), and specific breeding requirements (e.g. that young marmosets need to be able to learn parenting skills) and the selection of species (e.g. whether bonobos were included; they were not).
 Enrichment and (ideal) social conditions may be able to compensate for welfare risks imposed by early weaning.

Q4: Considerations for objecting to specifying separation ages

This question elicited some objections of a more ethical nature. Some took a most natural stance (e.g. pointing out that when individuals of a given sex (e.g. male chimps; female macaques) normally stay in their natal group, they should do so in captivity as well. Others pointed towards a cost-benefit evaluation and the need for tailor-made decisions in individual cases (esp. E13-090313)

Q5: Do you agree with the ages suggested by AAP: chimpanzees (9 yr) and macaques (4yr), douroucoulis (1yr), squirrel monkeys (7 months), marmosets (8 months)?

See above.

Q6: Do you agree with AAP that individual housing (>30 days) creates most serious welfare problems and should be considered to be cruel?

Though experts point out that there may be exceptions (requiring individual housing) and incidentally object to the word 'cruel', experts generally agreed that individual housing imposes serious welfare compromises to primates and should not be done routinely.

Note: The meaning of 'individual housing' may differ between experts. Some experts (in the US) would consider singly penned individuals with olfactory, visual and auditory contact to conspecifics to be housed socially.

Q7: Other relevant remarks/comments

Here experts listed point also mentioned under Q3 (e.g. about vertical transmission of viruses; non-natural conditions existing in some regions for perceived welfare reasons). On particular point raised

here was some details on political decision making regarding Directive 2010/63/EU (EU, 2010) (see E12-140313). This point also qualifies the present expert elicitation (e.g. that suggesting the median of a group of experts doesn't necessarily imply that this must be the best separation age).

Q8: Personal information

Nice group of international (7 different nationalities), senior experts (=25) with substantial experience (24 years on average).

Tentative recommendations

Below some tentative recommendations have been formulated:

- Given general consensus among experts, the revised legislation should not allow for routine separation into individual housing. This in accordance with EU legislation for animals used in research, where individual housing of primates is considered to be a serious welfare infringement.
- Given the general consensus that the natural conditions and adaptations provide important guiding principles, a modification of existing separation ages seems justified.
- Given the ambition of the Dutch government to promote animal welfare, including the need for animals to perform natural behaviour, and given the fact that enhancing the Dutch welfare regulations do not appear to have major economic consequences, the expert elicitation indicates that separation ages for chimpanzees could be raised from 3 to 6 years. However, especially re-grouping of males is to be avoided as much as possible.
- The separation ages for macaques used for research may stay at 12 months, but when used for breeding, this age may be raised up to 4 years.
- Rather than formulating separation ages for the three main species of macaque used in research, suggested separation ages may be formulated for macaques generally (as is already done for douroucoulis, marmosets and squirrel monkeys in the existing legislation). This means that other species of macaques, such as Barbary macaques, would be included as well.
- When separation ages are formulated for species groups (macaques generally, douroucoulis, marmosets and squirrel monkeys) an exception clause may be formulated that younger separation ages may incidentally be allowed in less prevalent species provided this is indicated from their documented natural behaviour.
- For douroucoulis, squirrel monkeys and marmosets, the presently listed separation ages for individual housing may be used (18, 9 and 12 months respectively), provided, of course, that they will apply to weaning into social groups only.
- While it is recommended that exceptional weaning at younger ages remains possible (e.g. for welfare or medical reasons, e.g. to block vertical transmission of pathogens and produce a high-health breeding colony), it is also recommended to specify under which conditions this may take place, e.g. that it requires documented authorisation of a specialised veterinarian or similar.

Annex 6: Expert opinions received in chronological order

This section presents expert opinions received in chronological order. Input was edited and questions were formulated by the moderator (Mod), which were returned to the submitting experts together with his/her edited input (including bold sections indicating emphasis of contents).

The following codes were used to guide the discussion:

Dash (-) separates input provided by different authors.

E(number): expert number (to secure anonymity in the Delphi procedure). Two groups of experts who were providing input together (i.e. not anonymously to each other). These are indicated a 'a' and 'b', e.g. E17a and E17b were 2 employees of AAP.

Mod: moderator (i.e. the first author of this report).

Q(number): question number (questions listed in the questionnaire (see below and Annex 2).

Dates are indicated by 6 digits (day-month-year), e.g. 150213 is 15th of Feb 2013.

Expert replies have been (moderately) edited.

Specified weaning and separation ages and very important statements (as judged by Mod) are shown in **bold**.

Reply to Mod by E[number]-[date]: This indicates that the expert has responded to comments formulated based on previously received input. These comments by Mod are formulated immediately below received input separated from that input by a dash (-) and preceded by '**Mod:**'.

Ad Q[number]: Is used for responses (mostly made by Mod) to an expert's response to a certain question (Q).

Some insertions are made in square brackets [Mod: ...] to clarify the text.

Note that statements made by experts on particular dates may be regarded as equivalent to personal communications.

Note also that the reader can track discussions involving statements in the document using 'find'-S(number).

The main **questionnaire** comprised the following questions (for more details see Annex 2):

Q1: *Specify your minimally required separation ages.*

Q2: *Give your main arguments for these ages.*

Q3: *Other considerations (e.g. conditions under which the specified ages apply and potential impact on breeding practices).*

Q4: *Indicate considerations for objecting to specifying separation ages.*

Q5: *Do you agree with the ages suggested by AAP: chimpanzees (9 yr) and macaques (4yr), douroucoullis (1yr), squirrel monkeys (7 months), marmosets (8 months)?*

Q6: *Do you agree with AAP that individual housing (>30 days) creates most serious welfare problems and should be considered to be cruel?*

Q7: *Other relevant remarks/comments*

Q8: *Personal information*

Mod sent the following **invitation** email message to selected experts as invitation to participate:

[Responses to **invitation** mail]

-

E2-150213:

The **ages between brackets** are definitely better, still **rather young**.

-

Mod: the ages between brackets are ages in existing legislation (LNV, 1996), as specified for moving young into individual housing. The respondent (E2) here presumably takes these ages to be rather young, even if the young were moved into group housing. Is that correct? [see further E2-250213]

-

E9-170213

I would say that for chimpanzees it is best they stay with their mother until they **choose to leave** their mother. There is tremendous variation in the wild with some infants spending less time with their mothers at **4 years** and others that rely on their mothers and stay with them / close proximity until puberty. Conservatively chimpanzees are weaned **about 4 or 4.5 years** of age but many stay socially dependent on their mothers **until puberty and often beyond**.

Females on average tend to immigrate into neighbouring groups after puberty - this would be the ideal time to move females into new chimpanzee groups.

However it also depends on the type of enclosure. In the wild chimpanzee migrants can choose to avoid others who might harass them. Often in captivity in small enclosures (less than one hectare) this is not possible.

I have seen many integrations of chimpanzees in African sanctuaries (www.pasaprimates.org) where the enclosures are 25 or 100 hectares of tropical forest. There integrating new females is very easy relative to European / US / AustroAsian zoo settings. Lots of places to hide and choose who to avoid.

Male chimpanzees in the wild typically never migrate and **often are killed in captivity when they are placed in new groups regardless of age**. Moving male chimpanzees is fraught with difficulty. ... But again in Africa have seen integration done with ease in these large forested enclosures where lots of escape routes, places to hide and avoid others.

So in summary taking chimpanzees from their mothers at 3 seems very early to me.

Definitely would never do this before **5 years** in my opinion. ... but also may largely depend on the individual and level of social dependence on the mother.

One size will not fit all in case of chimpanzees. They are individuals.

[For a literature review] on the impact of separation for mothers in a sanctuary setting, see Wobber and Hare (2011)

-

Mod: The law allows for earlier separation in individual cases on health or welfare grounds, so specifying an age of minimally 5 years of age should be fine.

I understand you suggest that earlier separation may be ok under ideal circumstances. However, please realise that the specified ages must concern chimpanzees kept in (Dutch/European/'Western') zoo's, (research) breeding institutes, primate shelters and (perhaps) private owners.

Based on your response, I'm now wondering what would best be specified for the separation of young male chimpanzees, both as regards their weaning age and as regards individual/group housing (into which they should be moved).

Does the age of 5 apply to males too? Or should different ages be specified for males and females? Is it a bad thing to require all primates to be weaned only into group housing, i.e. is it better for young males to be housed individually for some time, e.g. until they are strong enough to deal with integration?

Basically what you seem to be saying is that breeding with chimpanzees is inevitably leading to substantial welfare problems for the young males (perhaps unless the breeding colony has sufficient capacity to keep male infants in the group or wean several infants at once, such that the male young can be kept in (small) groups). Is that correct?

-

E7-180213

I assume that you are going to define the term "acceptable"? How does that relate, if at all, to what would be preferred or most desirable?

-

Mod: see Section 'Further details'.

-

E11-200213

Q1: I would recommend that **marmosets** are kept until **at least 18 months** in their natal group (unless there are welfare reasons for not doing so) This gives them experience of infant care, they are then more fully grown, and I believe earlier separation from the natal group is likely to be uncommon in nature. I have not however reviewed the recent field literature.

-

E14-210213

In a nutshell - I would orient the values towards natural weaning ages.

However, we need to bear in mind that weaning from nursing is quite different from maternal separation - it is the start of a process of increasing independence, not the achievement of independence. As a consequence, my question is about the rearing and keeping conditions and how they match. E.g. are the mother and the child separated from a social group with the date indicating when the child will be placed in a peer group and permanently separated from the mother? This is important contextual information that will influence my statement.

-

E12-240213

There have been few controlled studies comparing ages of weaning/separation from the mother. For practical, first-hand observations you might like to try [E13]...

Much of the literature on the effects of early mother separation (temporary or permanent) and on peer-rearing is from the United States, where these practices are more prevalent.

You ... would need to bear in mind transatlantic differences in colony management:

Prescott et al. (2012) provides new evidence from a colony of rhesus macaques and a very large colony of long-tailed macaques/cynomolgus monkeys that early weaning (before the biologically normal age) does not increase colony productivity.

The review (Prescott et al., 2012) also adds to the growing evidence base for behavioural and physical disturbances following early weaning, which can compromise animal welfare in the short and long terms.

The conclusion [of Prescott et al. (2012)] is that for animal welfare reasons and quality science, minimum weaning age should not normally be less than **10-14 months**, but weight, health and behavioural criteria should be used to determine the most appropriate weaning age for the welfare of each individual monkey [i.e. macaque].

-

E19-250213

Optimal welfare means, in my view, that the young leave the mother at an age at which they also do that in the wild, but in that case too so as to continue living in another social environment in their species-specific social way.

Q6: Separating the young from the mother and subsequently keeping them isolated for research is not good for their welfare, regardless of my personal ethical views.

When young have to be separated from their mother for research, there are two options:

1. After separation the young are kept in normal social groups. In that case I would postpone separation as long as possible (until early adulthood). When daughters in the wild never leave their mother, I would here again try to make this possible, or at least keep sisters of different ages together.
2. When the young will be isolated or kept in peer groups, then the best thing is to get them habituated to it as soon as possible, providing as little opportunity as possible for the young to bind/attach itself socially. As of the toddler age the animal can physically move reasonably autonomously and is starting to separating itself somewhat from the mother. That would then be the best age. The ages in the revised legislation appear to be based on this last option.

-

[Responses to the **questionnaire**, see Annex 4].

Main questions:

Q1: *Specify your minimally required separation ages.*

Q2: *Give your main arguments for these ages.*

Q3: *Other considerations (e.g. conditions under which the specified ages apply and potential impact on breeding practices).*

Q4: *Indicate considerations for objecting to specifying separation ages.*

Q5: *Do you agree with the ages suggested by AAP: chimpanzees (9 yr) and macaques (4yr), douroucoulis (1yr), squirrel monkeys (7 months), marmosets (8 months)?*

Q6: *Do you agree with AAP that individual housing (>30 days) creates most serious welfare problems and should be considered to be cruel?*

Q7: *Other relevant remarks/comments*

Q8: *Personal information*

Summary table of separation ages (in months unless specified otherwise; yr: years).

Source	Conditions	Chimpansees (Pan troglodytes)	Rhesus monkey (Macaca mulatta)	Bear macaque (Macaca arctoides)	Crab-eating macaque (Macaca fascicularis)	Douroucoulis (Aotus)	Squirrel monkeys (Saimiri)	Marmosets	General
LNV, 1996; EZ, 2012	Solitary housing	48 (4 yr)	24 (2 yr)	24 (2 yr)	24 (2 yr)	18	9	12 (1 yr)	
EZ, 2012; LNV, 1996	Group housing	36 (3 yr)	12 (1 yr)	12 (1 yr)	12 (1 yr)	12 (1 yr)	7	6 ^a	
VanDixhoorn et al., 2011	Group housing	36 (3 yr)	-	10-12	-	-	6	8-13	
EU, 2010	Laboratory	-	8	8	8	-	6	-	6-12 (primates)
Prescott et al., 2012	Minimum weaning age in laboratory	-	8-14?	8-14?	8-14?	-	-	-	8-14 (macaques)
AAP	Group housing	108 (9 yr)	48	48	48	12	7	8	

-

E2-250213a [is only available for specific questions.]

-

Mod:

Previously you indicated that the ages in the invitation mail between brackets are definitely better, still rather young. Would that imply that you consider suitable separation ages for listed species to be e.g.

1/3 higher than those listed for separation into individual housing, but applied to group housing?
For chimpanzees that would imply 5.3 years (=4+ 4/3), for marmosets 16 months (12+12/3).

AAP suggested 9 years for chimpanzees and 4 years for macaques (and other species following the legislation initiative). Agreed?

-

E2-250213b

Q1: That is rather old, but for **chimps 6 years** seems to be a minimum and **3 years for macaques**.

-

E8-250213

Q1: **Chimpanzee** (P troglodytes) Separation ages: **4 yrs**; ... necessary caveat that this is a minimum requirement (all chimpanzees must have the opportunity to spend at least 4 years with the mother, but no separation from the mother is necessary or required). [Mod: I presume this ('but ...') means something like 'provided no separation from the mother is necessary or required for other reasons such as medical, welfare and safety issues. This is accommodated for in the legislation, see Section 3.3.]

Q2: From the AZA Chimpanzee Care Manual (AZA, 2010): "Youngsters should stay in their natal group for at least 4 years, or as long as is necessary. There appears to be no evidence of negative effects of staying too long in the natal group other than the difficulty of integration at a later age ..., and the necessity to avoid inbreeding. Chimpanzee communities in the wild are frequently multi-generational. In zoos and aquariums, multi-generational groups have been formed over years usually by the introduction of new breeding males to a group, to avoid daughters breeding with fathers, or the use of reliable birth control. It has been documented that mother-raised infants show greater adult social and sexual competence when reared in the presence of cycling females in a group."

Q3: From the AZA Chimpanzee Care Manual (AZA, 2010): "In the wild, offspring may typically stay with their mothers for at least **six years**, sometimes longer. At the age of adolescence, females may transfer from one community to another. In zoos and aquariums, it may be easier to introduce a young female developing her first sexual swellings to a new group before she is at the age where established females may consider her "competition" for the males' attention. It is also important to remember the potential threat from the resident adults if the young female is carrying an infant when she is introduced (there is a risk of infanticide). In addition, an adolescent male may be considered a threat to an adult male as well. This is considered an extremely difficult age to introduce a male. If breeding recommendations call for the emigration of a young chimpanzee from one group to another, it is recommended that young chimpanzees, in particular males, be transferred and introduced in a new group by the **age of 5**, when they are still considered juveniles, and their presence may not seem so threatening (McNary, 1992). In all cases, the relative risks of the social introduction should be weighed against the relative benefits for both the immigrant and resident individuals."

Q5: The recommendations from AAP may be overly-conservative in terms of likely impact on the development, behaviour and welfare of captive chimpanzees. While there is no evidence of negative effects of staying too long in the natal group, having a minimum requirement of 9 years may handcuff managers when attempting to make inter-group transfers that will ultimately benefit the individual and group dynamics. Ensuring that chimpanzee infants get at least 4-5 years of time in their natal group should be sufficient to ensure development trajectories, but still allow some of the management flexibility necessary to facilitate cooperative population management.

Q6: I am in agreement that individual housing should NOT be used with chimpanzees unless under serious health concerns warrant short-term solitary housing. Management conveniences do not constitute an adequate justification for solitary housing ever. If a particular facility cannot house a chimpanzee socially, that chimpanzee should be moved to another qualified facility that can.

-

E15-260213

Q1 **Chimpanzee** separation age: **8 yr (as individual [Mod: to new group]), 4-5 yr with mother and/or peers**.

Generally, no separation should occur before weaning.

In the wild chimpanzees are **weaned at around 5 years**. At this age transfer should only occur with familiar peers and/or the mother.

If chimpanzees are transferred individually, I would suggest not separating them before they are in their adolescence, i.e. at least **8 years** old.

Q2: For the development of the primate infant's arousal-modulation abilities it is necessary not to disrupt the infant's attachment-exploration balance which is facilitated by the mother ((Ainsworth et al., 1971), for humans) and which in turn is vital for the development of socio-emotional and cognitive skills (Bowlby, 1969/1982). Negative outcomes of social separation in primate infants caused by

disturbances in attachment such as impaired affective development and behavioural coping were reported by e.g. Kraemer (1992), and Reite and Capitanio (1985). For chimpanzees, in particular, reports on negative outcomes of maternal loss are provided by Goodall (1986) (p.101 ff) and Boesch et al. (2010).

Early stages of the life cycle of chimpanzees according to Goodall (1986) (p.81):

Infancy: 0-5 years

Childhood: 5-7 years

Early Adolescence: Males: 8-12 years; Females: 8-10 years

Late Adolescence: Males: 13-15 years; Females: 11-14 years

Q3: Beside separation ages, the group composition and the housing conditions (e.g. enrichment, places to hide, etc.) are crucial factors for the individuals to be transferred.

Q5: I would agree with the separation ages of chimpanzees as suggested by AAP.

Q6: I also agree with AAP with respect to single housing. For more information please see studies on re-socialization of former lab chimpanzees ((Kalcher et al., 2008; Kalcher-Sommersguter et al., 2011; Kalcher-Sommersguter et al., 2013).

-

E8-270213

[S23] ...regarding one AAP comment....I would heartily dispute that Rowe (1996) is widely considered the "bible" for primatologists...it is primarily a photographic guidebook though it is very complete. I would submit the rough equivalent be "Primate Societies" (Smuts et al., 1986) which is more of a scientific reference. ... There is also an updated version entitled "The Evolution of Primate Societies" (Mitani et al., 2012).

-

E20-010313

[Q4] I am a field primatologist who has spent 40+ years studying wild chimpanzees. I am opposed to keeping chimpanzees in captivity, except when refuges are needed to care for them after release from labs or zoos. I am opposed to breeding chimpanzees in captivity for any reason. Therefore, why should I cooperate with any organisation that seeks to do such immoral things as separate offspring from parents?

-

E17-010313

We would like to have some kind of general approach that would also fit primates that are currently not on the list (e.g. Barbary macaques). I will try to make a general graph, to see whether we can estimate separation age based on e.g. maximum age (life span), neonatal weight, brain weight, etc. There might be a relation between those factors and the onset of adulthood/end of the subadult period.

-

Mod: I'm afraid finding such a relationship may be difficult. A primary list of subadult ages supplemented with other relevant ages for whatever species would be most valuable. From there we can then see if and to what extent we can extrapolate ([e.g.] to propose a general age for a group, e.g. for macaques generally).

These other relevant ages include 'true' weaning ages (i.e. at which they stop drinking milk), ages at which orphans can (/have been observed to) survive (i.e. without mother in the natal group), and ages at which certain individuals may leave the group/move to other groups, esp. also if they can be observed to live solitary lives (e.g. older males) (or perhaps whether or not they tend to live on their own for some times of their life/under certain conditions).

This is more or less in line what other experts have suggested thus far.

-

E21-010313

Q1: To clarify the term, I assume that 'separation age' means the age at which an animal can be taken from its mother ('weaning age'). This generally implies that the animal is also removed from its natal group.

Based on my experience with wild primates, I propose that the management in captivity should try to mimic the demographic dynamics of the animals in the wild. In the wild two moments exist where an animal is separated from its mother/group: when it becomes an orphan; and at migration. It seems to me that the minimal age to separate an animal from its mother should be the age at which an orphan can survive in the wild. Besides that animals migrate (depending on the species males, females or both sexes), at which they separate from the group or have a period of solitary living. This is the moment at which generally new groups are formed. This would be the preferred age at which animals change social groups. However, also in the wild groups may split up or fuse at any age. Therefore, all kinds of social conditions in the group of birth may interfere with this preferred situation.

Given the objectives, including an advice to zoos, I do not understand the limited list of primate species.

Q2: A literature search would deliver the indicated ages for all kinds of primate species.

Research of **Thomas langurs (*Presbytis thomasi*)**, for example, showed that an individual of **11 months** survived after her mother died, while mothers move to another group and leave offspring as young as **15 months** (Sterck, 1997).

Q3: It is important to take into account the social situation before and after an animal changes social conditions (see also Q1).

Q4: These should be based on the literature (as indicated at Q1)

Q5: These match the migration ages, which are for me preferred ages of changing groups based on natural demographic processes (see Q1).

Q6: Most primates live in groups. Therefore, social housing is very important. However, not all species (e.g. nocturnal prosimians) and all animals live in a group (e.g. males having a period of solitary living). For these species/animals a solitary period will be much less of a welfare problem compared to species/animals which normally live socially (see Q2).

Q7: None.

-

Mod: When orphans (without mother) can survive without their mother, they remain in their natal group. That may not imply that they can be safely separated at that age in captivity as they may remain dependent on familiar conspecifics (and the concomitant ability to learn social and other survival skills). Furthermore, ages at which primates are able to move to other groups in the wild may be too early in captivity as well in some cases (cf response E9-170213, who indicated that chimpanzees can integrate in other groups much better under very extensive conditions). Alternatively, however, when animals are older they may show reduced flexibility/adaptability to settle into a new group (as when older males may sometimes prefer (or be forced) to live solitary lives).

-

E22-010313

[Q4] I'm sorry, I'm too much of a scientist to guess, and this is too important a question.

-

E24-020313

Are you referring to permanent or temporary (visual, auditory, or tactile contact allowed) separation?

Mod: Separation should be taken to be permanent. If it makes a lot of difference to you when there is some maintenance of e.g. auditory/visual contact (e.g. if separation has been to the next cage so to speak), then you may indicate this (e.g. by specifying different ages depending on main variables). Generally separation also means loss of perceptual contact.

-

E23-010313&020313

Q1: My personal experience is with common marmoset only, therefore I feel more confident in giving my advice on this species, rather than the others.

Marmosets: no less than one year: 12-14 months

Q2: Extended parental care (Abbott et al., 2003).

Q3: As a member of a social group of common marmosets, a young individual can be a valuable helper to raise and play with younger brothers and sisters. Furthermore, this experience is crucial for the learning process related to parenting in the future. Then, in the case the individual belongs to a family where new babies are expected and possible, I would delay the moment of separation for not less than the age of one year. At the age of 12-14 months common marmosets (*C. jacchus*) are reproductive and can start a new family. If there have been babies in the family they should have also been able to acquire the proper experience to be good parents.

[Mod: and if there have been no young conspecifics in the group, they need to stay with the group for longer to become good parents?]

Q5: For **marmosets** I would delay separation to at least **12 months**.

Q6: I agree very much. No solitary housing should be allowed for non-human primates, unless clear and sound justification is provided. In the literature many example can be found of behavioural abnormalities due to solitary housing (Laudenslager et al., 1990; Gust et al., 1992; Reinhardt, 2002b-b; a; 2004; Honess and Marin, 2006a; 2006b; Olsson and Westlund, 2007).

Q7: Separation age should be not only species-specific, but **individual-specific** as well. Non-human primates show distinct personalities. Therefore each case should be analysed taking into account the character of that particular individual in the group, as well as his/her personality traits.

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E25-020313

Q1:

Chimpanzee (P troglodytes)	4 yr
Rhesus monkey (M mulatta)	18 mo
Bear macaque (M arctoides)	18 mo
Crab-eating macaque (M fascicularis)	18 mo
Douroucoulis (Aotus)	18 mo
Squirrel monkeys (Saimiri)	9 mo;
Marmosets	9 mo

Q3: A precondition is that they must be moved into a social group (preferably a group with members of a similar age). A sharp cut-off point is, of course, at odds with the fact that a gradual maturation towards independence takes place. Such prescriptions cannot be applied without understanding/knowledge. For example, it is important to determine or monitor whether the placement group has individuals that could take the mother role (and will do so).

Q5: The ages AAP suggested are rather high and mark about the start of adolescence. Before that time animals can already function reasonably independently, namely as of the moment of weaning. The mother is not needed for that (although it is nice if she is still around). Her role can be taken by peers, esp. individuals of similar age.

Q6: Yes (see above).

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E26-020313

Q2: My position is that group-living primates, such as those in your table, should live with conspecifics in groups resembling the composition of wild groups for their entire life and young should NOT be separated from their mothers until the **age they will normally emigrate from their natal group**. The practice of **separating young from the mothers for breeding purposes is unethical**. I could support temporary separation from group members only in a few special cases.

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E27-050213

Q1: I cannot answer this question. I don't understand, as monkeys are housed in groups, why juveniles have to be separated from whom, why they should be single housed or introduced into "other" social groups. All these events are sources of problems, stress and worse.

[Mod: Separation may be needed if an owner wants to sell, rehome or conduct an experiment.]

Q2: A young **macaque** whatever its species (long-tailed or rhesus) is no longer dependent on its mother at **8 months**. However he should be kept in social contexts, and as a matter of fact with **known partners of the same age or much older**.

Q3: Any disruption of social networks has consequences on the subjects' well-being.

Q4: See Q1.

Q5: Rowe 1996 is not a suitable reference. It contains at best second-hand information. It is advised to deal with original papers (e.g. for mangabeys and macaques see (Deputte, 2000)).

Q6: I agree on well-being problems and I also strongly object to individual housing. This is not now an acceptable practice (other than.... [in a few very exceptional cases]).

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Mod: Ad Q1: Based on your statement to Q1 I had the impression your separation ages would be '**never**'. However, in your response to Q2 you mention that age of 8 months for macaques and you state that young should be kept with **familiar conspecifics of the same age or much older**. What about familiar conspecifics that are younger and those that are only a bit older? And how do the two statements relate to each other? E.g. Is separation allowed as of 8 months if they are moved (taken away from the mother/own group) in peer groups (e.g. with at least 2 or more youngsters)?

Reply to Mod by E27-060313: I am quite aware that young monkeys may be bred to serve as subjects for different kinds of scientific experiments. Monkey breeders generally regroup just weaned monkeys too soon. Many monkeys may become very susceptible to diseases due to immunological consequences of the stress induced by a too early separation. However weaned monkeys at a suitable age may live well in juvenile groups.

The apparent contradiction between my responses to Q1 and Q2 arises from what is the best for monkeys - response to Q1 - and what is needed to use monkeys for scientific experimental purposes. My answer to Q2 comes from my own studies on monkeys' development and more precisely primate socialization. My own results show that an **8 months** old monkey has already built its own social network.

E7-080313

Q1: **Marmosets – 9 months**Q2: **By 9 months marmosets are completely weaned from nursing and have begun puberty.**

Based upon my **experience of over 30 years** working with marmosets, I believe at this age marmosets could be separated from their natal groups with minimal negative welfare effects.

Q3: If marmosets in question are to be used in breeding, they should remain in their natal groups for as long as possible. Ideally, until they are removed for mating. Marmosets and tamarins are more likely to show adequate parenting behaviour if they have remained in their natal groups long enough to participate in cooperative rearing of younger siblings.

The continued presence of youngsters in a marmoset group does not negatively affect reproduction of the breeding pair – i.e. you do not speed up breeding by removing youngsters in this species. Therefore, that is not a consideration in making decision regarding separation ages in this species, as it might be in **macaques**.

Q6: **There is little or no evidence that individual housing of marmosets causes ‘most serious welfare problems’.** In over 30 years of working with marmosets and tamarins, including hundreds of animals that were housed singly (with visual, auditory and olfactory contact with other marmosets), I have witnessed only one incident of self-injurious behaviour and extremely limited signs of any other ‘serious welfare problems’. While social housing is clearly preferred and best for the animals, I could not agree with the statement that individual housing of marmosets creates most serious welfare problems and should be considered to be cruel – **as long as the singly housed animals have auditory, visual and olfactory contact with other marmosets**. For example, Tardif et al. (1994) illustrated ovulatory suppression effects in singly housed females within a room similar to that seen in marmoset social groups – i.e. that the singly housed animals within a room communicate in a fashion similar to a social group.

Q7: The best way to house marmosets that are removed from natal groups prior to breeding age is unclear. **In the EU, marmosets are sometimes housed in same-sexed peer groups of youngsters.** However, **this is a totally artificial arrangement.** Marmosets in the wild would never be found in such peer groups (while they are a normal part of social life in wild **macaques**). There are significant risks associated with same-sex housing of socially unfamiliar marmosets – particularly females, who can be extremely aggressive toward each other.

References: (Tardif et al., 1984; Tardif et al., 1992; Tardif et al., 1994; Tardif, 1996; Bales et al., 2000; Tardif et al., 2003)

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Mod: What are the welfare consequences of individual housing that involves loss of visual, auditory and/or olfactory contact with conspecifics (in marmosets and/or other species)?

As to the artificial conditions of same-sexed peer groups, I was wondering whether such conditions generally are to be considered worse for welfare than individual housing (with or without auditory/visual/olfactory contact).

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E17ab-090313-Updated position of AAP

Q1: See Table below.

Q3: If new separation ages would be implemented, we expect laboratories to be influenced in their management of breeding groups. They may separate animals from their mothers at younger ages.

Q5: “Foundation AAP has argued for substantially older separation ages for chimpanzees and macaques (but not for the other species)” - As mentioned, I think something went wrong: we did not thoroughly look into those ages at the moment this was first discussed at AAP.

Q7: AAP is in favour of looking at **subadult ages** to determine when animals can leave their mothers. In many species, offspring that disperse from their natal group, do so at subadult age. At this stage, it is also relatively easy to introduce animals into new social groups (AAP experience). Once adult, that may be more difficult (AAP experience).

The reason for AAP’s opinion in this matter is very accurately phrased by Dunbar (1988) “*There are two important stages of development of an infant primate. The first is the period during which it is totally dependent on its parent(s) for nourishment, care and transport. The second period begins at the point where the infant is no longer dependent on its parents for food and transport, and ends when it can effectively fend for itself in adult society. In Old World monkeys, this lasts from about the end of the first year up to the age of four years. During this period, the animal is largely dependent on its mother and close relatives for social support against other group members, as well as for protection against predators.*”

In addition, compared to other mammals, primates have the longest juvenile periods for their body size (Pereira and Fairbanks, 1993; in: Strier, 2000). The juvenile phase spans from the period of weaning to sexual maturity (Strier, 2000).

Table. Life history variables for relevant primate species (yr: years; mo: months)

Species Life history variable	<i>Callithrix jacchus</i>	<i>Callithrix pygmaea</i>	<i>Callithrix argentata</i>	<i>Macaca arctoides</i>	<i>Macaca fascicularis</i>	<i>Macaca mulatta</i>	<i>Pan troglodytes</i>	<i>Aotus trivirgatus</i>	<i>Aotus nigriceps</i>	<i>Saimiri sciureus</i>	<i>Saimiri boliviensis</i>	<i>Saimiri oerstedii</i>
Gestation length (d)	148 ^a	137 ^a 119-142 ^b	14 4 ^f	178 ^{ab}	160 ^a	164 ^b - 165 ^a	235 ^a - 240 ^b	120 ^b	120-133 ^b	170 ^b - 171 ^a 152- 168 ^d	155-170 d ^b	161 ^f
Age at weaning (mo)	2 ^{b--} 3 ^a	3 ^{ab}	6 ^f	13.1 ^a 9-18 ^b	14 ^{ab}	12 ^a	56.4 ^a 48 ^b	2.5 ^e	8 ^b	14 ^{a*} 11 ^b	4-6 ^{f*}	12 ^{f*}
Length of juvenile period (yr)	0.9 ^a 0.4- 0.8 ^b	1.3 ^a	-	1-4 ^b	2.3 ^a 1- 3.5 ^b	3.1 ^a 1-3 ^b	8.4 ^a 5-8 ^b	-	0.7-2 ^b	1.6 ^a 0.9- 2.5 ^b	-	-
Subadult phase (yr)	0.8- 1.3 ^b	1- 1.3 ^b	-	4-8 ^b	3.5- 4.5 ^b	4-6 ^b	8- 11 ^b	-	2-3 ^b	2.5-5 ^b	-	-
Suggested separation age (yr) by AAP	1.8\$	1.8\$	1.8\$	4	3.5-4.5	4	8-10	2#	2-3	2.5	2.5#	2.5#
Age sexual maturity females (yr)	1 ^b	2 ^b	0.8 ^f	4 ^f Several refs. given	4.3 ^b	3.5-4 ^b	11.3 ^b	2.2 ^e	3-4 ^f	2.5 ^d	2.5-3 ^f	1 ^f 2.5 ^g
Age sexual maturity males (yr)	1.4 ^b	2 ^b	0.9 ^f	4.5-5 ^f	4.2 ^b	3.5-4 ^b	13 ^b	2 ^e	2 ^f	2.5-4 ^d	5 ^f	4-6 ^f 3.5 ^g
Female age at first reproduction (yr)	1.5 ^a 1.7- 2 ^b	1.9 ^{a,} b	1.7 ^{a,} b	3.8 ^a 3.8- 4.7 ^b	3.9 ^a 3.8 ^b	4.5 ^{a,} b	13 ^a 14- 15 ^b	2.4 ^a	2.5 ^b	2.5 ^{ab}	-	-
Life span (yr)	11.7 ^b	11.7 ^b	16.5 ^e	30 ^b	37.1 ^b	29 ^b	53 ^b	20 ^b	20 ^b	21 ^b	15-20 (have lived to 30) ^f	Not yet established****e
Dispersal age (yr)	-	-	-	-	5 ^c 4-7 ^b	3.5-5 ^c	11 ^c	-	3 ^b	SA or A age ^d	-	2.5 ^f
Dispersal gender (Male or Female)	M+F ^h	-	-	-	M ^b	-	F ^b	-	M+F ^b	M ^{bd}	M ^{b**}	F ^b

§ In marmosets, it is important to learn parental care from its own parents. Thus, it may be important to not separate offspring from its parents until these latter had a second litter, in which the juveniles of the first litter could help NRC (1998). When animals are separated from their parents and not meant to breed, assisting their parents in raising a litter is not relevant and subadult ages could be used for separating these animals from their parents.

Based on age of sexual maturity.

* Squirrel monkeys nurse their offspring until they are four to twelve months old, depending on which taxa is considered, but also whether the monkeys are captive animals; monkeys in captivity were weaned at a later age than wild conspecifics Boinski and Fragaszy (1989).

** In *Saimiri boliviensis*, males only disperse from their natal group when forced by the more dominant males (Rowe, 1996).

*** One specimen was about 18 years old when it died in captivity.

References used in the table: ^a Ross (2003), ^b Rowe (1996). (note: Much information from this reference is originally from Ross (1991, 1992)). ^c Pusey and Packer (1986), ^d Robinson and Janson (1986).^e www.genomics.senescense.info; ^f Animal Diversity Web; ^g Primate Info Net (<http://pin.primat.wisc.edu/>); ^h de Sousa et al. (2009); ⁱ Jack (2007).

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E18b-090313

Q1: **Cynomolgus monkey (*Macaca fascicularis*): 1 year**

Q2: From experience we have observed that **most infant cynos at 1 year of age are free ranging in the colony and feeding themselves**. The **females** will often be **heavily pregnant** so will have been weaning the infant off already. That said whilst 1 year is an acceptable minimum, **we prefer** to wean at about **18 months as the infant is a little more robust** and able to cope better with a new peer group.

Q3: Infants may need to be removed earlier if a) they are not thriving b) the mother or infant is sick/injured (the infant could be returned when the mother/infant is well again). The infant may be left in for **up to 2.5 years if the infant is going to be used for breeding** outside the colony of its birth or not removed at all if kept within the colony as a future breeder.

Q4: No objections.

Q5: **4 years is way too old** for separation from the colony. **Females can become pregnant from 2.5 years onwards. Males** can remain longer but again can mature sufficiently to be **sexually active from 3.5 years on** so could come into **conflict** with the dominant male.

Q6: I would tend to agree that separation into **single housing is far from ideal** aside from the reasons stated.

Q7: There is nothing stated about the **sort of groups that infants should be weaned into**.

Preferably these should be animals of **similar age** and if they are going to be held together for a long time, **same sex**. It is also preferable where possible to wean more than a single infant from each breeding colony so that there will be **familiar** animals in the newly formed group. **Single animals going to a newly formed group should be a little older than the mean**.

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Mod: Ad Q3 "The infant may be left in for **up to 2.5 years if the infant is going to be used for breeding** outside the colony of its birth" – Is there a difference in minimum separation age in cynomolgus monkeys depending on whether they will be used breeding or for research and/or is later separation for breeding beneficial for reproductive success in any way?

Reply E18-120313: **There is a great deal of difference between weaning for research and for retention as future breeders. We are moving to the matriarchal system** whereby we retain animals for future breeding in their colony of birth and move the males around every three to four years to reduce chances of inbreeding. It is early days yet so I cannot back this up with figures but **it is becoming generally accepted that keeping a young female with its mother and possibly older siblings will help her learn mothering skills and increase her chances of breeding success in later life**. With animals that we are using for future breeding (including males) that need to be used away from the natal group i.e. new colonies, we still feel that there is benefit to leaving the animal for as long as possible in the natal group such that they have the opportunity to learn parenting skills over the longer period.

Ad Q5: "**Females can become pregnant from 2.5 years onwards**" - How difficult is birth control?

Reply E18-120313: With reference to birth control we have **no experience** of methods other than male vasectomy which is not what you are after. It may be that there are appropriate implants that provide hormone control you could use for such females but it is not something we would contemplate.

Ad Q7: "**Groups that infants should be weaned into**. Preferably ... **similar age** and if they are going to be held together for a long time, **same sex**" – Note that this may be species specific, e.g. same-sex housing so socially unfamiliar marmosets is advised against (E7-080313).

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E13-090313

Q4: Whatever the **natural separation age** for the species; which in the case of **female macaques** is often **never** - since they stay in the maternal group, it is the males that move on; the critical issue to remember is why we are breeding these animals in the first place. I am assuming that you are collecting the data primarily to establish guidelines for use in the primate centres where primates are **bred for use in research**. Of course I wholeheartedly support guidelines that improve animals' welfare and for animals that are only there for breeding, establishing systems that maximise welfare and maintain adequate productivity is essential. The main criterion is the monkey's well-being and it is important that young monkeys are reared with an appropriate social background (Wolfensohn and Honess, 2005). However, to produce an animal for use in research, it may be unrealistic to expect to leave that animal in the natal group for a "natural" period of time and any earlier separation has then to be balanced against the need for that research and taken into account in the **harm:benefit balance** to justify the use of that animal at all. Any early separation, changes in social grouping, movements and relocation have to be accounted for when estimating the lifetime experience of the animal and the total level and duration of suffering it may endure by being an experimental animal, in addition to the actual scientific procedures carried out on it (Honess and Wolfensohn, 2010). It is important to monitor **each animal individually** and continuous assessment of behaviour and welfare is more important than sticking to rigid temporal criteria (Wolfensohn, 2010).

In some circumstances use of the animal **experimentally within its natal group** may avoid the need for separation, but this is not always feasible although it may be a situation that we should be considering working towards on a more frequent basis. The net effect of this, however, may be an increase in general stress levels of all the animals in the natal group, due to the interference necessary to work in the experimental animals. The overall strategy should be to work for the **greatest good of the greatest number** (and therefore be consistent with Bentham's utilitarian philosophy on which the principle of the use of animals in science is based).

The conclusion, therefore, has to be to leave the animals in natal groups as long as is feasible but to recognise that there will be a net cost to the animal of separation and to account for this in the harm:benefit justification and to consider long term management strategies of breeding/research facilities and refinement of procedures that enable animals to remain in natal groups whenever possible. **The age of separation will, therefore, not be consistent between zoos, research facilities and shelters** since the use of the animal is entirely different and it has to be fit for purpose.

Q6: I agree that **individual housing causes serious welfare problems but so does pair housing** in many circumstances (the norm in many US facilities). A stable social group should be the aim.

Quote: "The question is not can they reason, nor can they talk, but can they suffer?" (Bentham, 1789).

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Mod: I'm a bit concerned that the suggestion (a harm:benefit evaluation) in practice would boil down to complete removal of separation ages for primates from existing legislation. Is that correct? And if so, I would be interested to hear more about how that could lead to enhanced overall utility/good, esp. when the world is not made up of benevolent and knowledgeable actors.

Minimum ages could be specified for different classes (e.g. separate minimum separation ages for zoos and research facilities; bearing in mind also that the law allows for individual cases that can deviate from the general rule).

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E13-110313

Of course you are right! I wasn't anticipating a complete removal of minimum ages from the legislation just on the basis of doing a harm:benefit evaluation. That would be a disaster –especially given the lack of benevolence shown by a recalcitrant few in the research sector!

But looking quickly through what you had sent I got the impression that there were many arguments in favour of much later separation ages than are used currently. While this is great for some animals and should be encouraged there will be some cases where a **later separation age** will impact on the science and **may increase the negative welfare aspects** of that science thus reducing the quality of the science even more, then more animals will be used. If we want the science to be done and can argue that it is important enough to justify using primates at all, then the required separation age needs to be factored in.

But, that said, in my experience the minimum age for separation for **rhesus macaques destined for research projects should be 12 – 15 months**. Ideally the management of the breeding facility will be such that **siblings/half siblings** from a group can be **kept together** and separated at around **18 months** of age but inevitably in that group there will be some a bit older and some a bit younger. Better to keep them in the group assuming they are healthy and well grown even if they are only 12 months than leave them behind. We did a project some years ago **monitoring** the juveniles to see which animals spent time with which others so they could be kept with their **chosen "friends"** when

put into groups for research projects – selection of these groups is **vitaly important if we are to stop ending up with them singly housed with the excuse that they keep fighting.**

I can think of some people I'd fight with if I had to spend 24 hours a day with them – but others I would get along fine with! **Individual monitoring is the key** – but that takes time and money....

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E10-100313

Q1: Minimum age for **rhesus monkeys (and probably the other macaque species)** should be **six months** of age. However, animals should be kept with their mothers/groups as long as is feasible given the reasons for keeping the animals in captivity in the first place.

Q2: The principal argument is that this has been the policy at at least one facility that I am aware of for many years, and it appears to be successful.

Q3: **An important caveat is the environment in which the animals are a) currently living, and b) will be separated into.** The vast majority of animals at my facility are kept with their mother/group **very long-term** (e.g. for breeding purposes, or until required for experimental protocol, which is usually not until the animals are **a couple of years old**). However, for animals that are born **to mothers that are living indoors in small cages** (that is, two adult females are living in adjacent cages and are given daily access to each other for socialization), weaning tends to occur around **six months** of age. Weanlings then are put in a large gang cage that includes peers and adults. I believe there is a sense that keeping a developing animal in a relatively small cage under relatively limited social conditions with the mother will lead to poorer welfare than removing the animal and putting it in a larger social group. Thus, the context, regarding current and future housing, is extremely important.

Q5: These ages (as suggested by AAP for macaques) are unrealistic for a research facility. You state that the **regulations** will apply to research institutes, breeding facilities, zoos, and shelters. These institutions have **very different purposes**; for example, zoos are attempting to provide a relatively naturalistic setting, in order to educate the customer. A research facility, however, has a completely different purpose. One might argue that "good welfare should apply to all," and there is some merit to this statement, but the statement can presuppose that welfare is a binary outcome, and that all members of a species will respond in the same way to a specific set of circumstances. Both of these are unreasonable assumptions. **I have seen animals remain with their social groups for years, and still show disturbed behaviour, and I have seen animals that were reared in a nursery show normal behaviour.** I think everyone agrees that there is a certain minimum of welfare that should apply to all; but above that minimum, there are issues of incremental benefits versus greater costs, and considerations such as these will differ substantially among the different types of institutions mentioned above.

Q6: I agree that separation into **individual housing should be avoided at all costs. However**, there are reasons other than quarantine or medical reasons why this may be necessary. One concerns implementation of a **research** protocol. In some infectious disease research, for example, it may be necessary to keep animals housed individually. Another situation might be where an animal, after multiple pairing attempts, is found to be incompatible with other animals. For such animals, **there are alternatives** to provide social enrichment, including housing to **see other animals, use of video, etc.**

Q7: Welfare is a critical issue for all captive animals. But even in the richest of circumstances, some animals will show poor welfare, and in the most impoverished environments, some animals will do just fine. **Attempts to replicate all features of an animal's natural environment are unnecessary for good welfare**, as anyone who runs a zoo can attest - many (though not all) animals do just fine, although their range size, dietary choices, social choices, etc. are considerably restricted from those of their wild counterparts. The approach that has been taken by zoos regarding the limitations of captivity (which might be summarized as "finding some minimum approximation to features of the wild that will lead to good welfare in the majority of captive animals") can apply as well to the social attributes. **In my opinion and experience, the benefit of remaining with mother for four years is unlikely to provide any increment in well-being for the vast majority of animals over separation at three years, at two years, or at one year. And separation at ages as young as six months have been successful for the majority of animals in that situation as well, so long as the animals are put into a rich social and physical environment.**

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Mod: Welfare in my view is not a binary variable. It is continuous and may range from very good to very poor. I'm struggling also a bit with the 6 months cut-off point. The normal practice at this facility is 'a couple of years old'. That would seem to be a more 'safe' age for general application (given that exceptions for specific research/medical requirements are allowed by law), e.g. because remaining in the natal group is one of the most secure ways to provide for a 'rich social (and physical) environment'. That would not conflict with allowing earlier separation (at 6 months) for 'humanitarian' reasons (e.g. to

allow for better social conditions in larger cages). At present 12 months are presently specified in EU legislation on using Rhesus macaques for scientific purposes. The last sentences also seem to point in that direction, i.e. a cut-off age between 1 and 2 years. Is that correct?

Reply E10-110313: As for the **6-month cut-off**, this is the case for a small proportion of animals bred for specific research requirements. The rest are in outdoor enclosures, and as I said, they are kept with their mothers/families/groups as long as possible.

Ad Q4: One of my concerns about providing input to the Dutch government on this is that I don't want to see regulations promoted that my own facility could be considered in violation of. As I said, **6 months works, for the vast majority of animals**. If the regulations are written so that they allow for some exceptions, then that would be fine with me. Ignoring, for the moment, the situation at my facility, however, **I really do not think extending the weaning age beyond one year is going to have any measurable effect on well-being**. "More" is not the same as "better." In this regard, I think the Prescott et al. (2012) paper summarizes the thinking (at least for macaques) on this best.

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E24-110313

Q1: I would put the **chimpanzee** separation age at a minimum of **5-6 years**. This is based on infants' behaviour in the group as well as their response to separation from their mothers during testing. We have been unable to separate a **3 year-old** from her mother for an extended period without **much distress** from both mother and infant. Please understand what I am saying. One can separate them at earlier ages but they do not do so voluntarily. Only older infants are comfortable doing this, which is when we start testing them individually.

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E18c-120313

Weaning age is a huge topic of debate starting with **defining weaning**. Does it mean the age at which **milk is no longer necessary for adequate nutrition** in which case **about 8 months** would be right **for macaques** or is there an **emotional development** component in which case older may be better - **a year** is often quoted but I'm not sure of any great evidence for this and **18 months may be better**. If it refers simply to **maternal separation** then the **optimum age will vary between animals - small infants** are often left with their mother for **longer** than may be usual in the belief that this will be better for them but often **earlier** than usual separation will be physically if not emotionally better for the infant if **good nutrition** is provided.

I could go on but a full discussion of this would take hours!!

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Mod: **'Weaning age'**, I consistently try to use the term 'separation age', is to indicate the moment when the young animal(s) can be taken from their mother(s)/natal group. It explicitly includes taking the emotional component into account, in that the minimal separation age for legislation is intended to prevent (serious) welfare problems as a result of separation (esp. to the young but also to the mother/other group mates).

What I'm looking for is minimum ages applying (as much as possible) generally (but depending on species and other restrictions deemed necessary). Exceptions (e.g. earlier weaning in individual cases for medical reasons) are allowed for in the legislation. So the focus should not be on optimum ages but on minimum ages and what is known about the (welfare) consequences of setting these ages (a bit higher/lower than those suggested (i.e. formulated as main arguments for suggested ages).

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E24-110313

Q5: AAP's ages are not unreasonable. It's an age when most chimpanzees become completely independent from their mothers.

Q6: Isolation for an extended period of time should be avoided whenever possible.

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E29-110313

Q8: I direct a large primate breeding facility and thus am in a position to comment on successful and humane husbandry strategies. This breeding colony is comprised entirely of rhesus monkeys and we produce up to 100 infants each year.

In the past, I have also directed a chimpanzee facility and spent over 10 years studying and breeding squirrel monkeys. However, I am not an expert on **Aotus**, which **is unique because of the pair bonding and also the paternal care**.

Q3/Q7 (other considerations/comments): I see that there is no room to comment on several aspects of animal **husbandry** that your survey appears to overlook. It seems you are focusing on behavioural issues to the exclusion of health. For example, one reason to wean certain monkeys at **6 months** rather than **12 months** is that it is actually **healthier** for them **to be eating solid foods** rather than to

persist in nursing. Like human infants if they persist in largely subsisting on breast milk, they will be more prone to **iron deficiency** anaemia, which is corrected by eating fortified commercial diets. Similarly, there are some **viruses** that are more likely to be transmitted from mother to infant if you keep the infant with the mother for a year. In the case of the **rhesus monkey**, it is extremely rare for **Herpes B** to be transferred from mother to infant in the first **6 months** of life. Hence if you wean at 6 months, you **prevent the vertical transmission** of the Herpes virus that is a serious concern for human handlers. Conversely, if you let the infant stay with the mother for a full year, the odds are much greater that it will have been infected with Herpes B as the mother sheds the virus.

Q3/Q6: Finally, it seems that the plans ignore the long-standing evidence that the peer group and play becomes at least as important as the initial maternal care over time. Weaning infants, even at a younger age, into **juvenile peer groups**, is at least as important. In fact, **I would be disinclined to individual house monkeys even at 2 years of age, but rather would keep them in larger peer groups.**

The strategy at my facility is to wean at a younger age than in your plan (e.g. 6-8 months for macaques), but then to have them in peer groups all the way to adulthood, which occurs between 3-6 years of age in the rhesus monkey. I hope this information is of some help in your planning and regulations. Below I have completed the form and questions, but there may not be room to explain the rationales as completely.

Q1:

Chimpanzee (P troglodytes): 3 years (although I would transfer to peer housing);

Rhesus monkey (M mulatta): 6-8 months providing that the weanlings are housed socially together;

Bear macaque (M arctoides): same as rhesus (i.e. 6-8 months providing that the weanlings are housed socially together);

Crab-eating macaque (M fascicularis): same as rhesus (i.e. 6-8 months providing that the weanlings are housed socially together);

Squirrel monkeys (Saimiri): 6-8 months, provided that the weanlings are transferred into small social groups comprised of peers of the same age;

Marmosets: 6-8 months, although given their family social structure, there may be socialization benefits of continuing with the family housing through **2 years** of age.

Q2: **Macaques and squirrel monkeys can be entirely self-sufficient from the food/nutrition perspective by 6 months** of age. In fact, there are some benefits of shifting onto solid foods entirely at this age because of the greater **iron** fortification of commercial diets. The important social transition is to **peer housing**, which **ideally includes 3 or more weanlings**. They can then live in the juvenile peer group **through puberty**, especially if comprised of **mixed sex** animals. If the goal is ultimately to create the next generation of **breeders**, then it is important to **move the monkeys into mixed aged housing by 2-3 years of age**. I do not recommend housing **macaques or squirrel monkeys alone**, but, if possible, to pair or group house them. In addition, individual housing of these species should certainly not take place before **adulthood, which is >3-4 years** of age.

Q3: Although it may seem benevolent to house infant monkeys with their mothers through **1 year** of age, it increases the likelihood that some **pathogens will be transmitted** from mother to infant, including one virus of particular concern, **Herpes B**. If weaned by **6 months** of age, most **macaques** will be free of Herpes B. Similarly for **squirrel monkeys**, if infants are weaned by **6 months** of age, they will not be likely to be infected with **Herpes saimiri**. The same concerns apply to other viral pathogens that are transmitted vertically.

Q4: I think **it is a serious mistake to house monkeys with just their mother for one year of age, and then to shift the weaned juvenile into individual housing**. Especially, if you are trying to create the next generation of **breeders**, this is an ill-conceived husbandry practice. In addition, once you have required this long mother-infant housing phase [of **1 year**], you have **compelled the females to be bred at 2 year intervals**. At our facility that would have **negative economic and practical consequences, reducing our fecundity and infant output by nearly 50%**. Many seasonally breeding monkeys can have infants at annual intervals rather than every 2 years.

Q5: In general, **I don't think primates should be individually housed unless it is essential for the research. But there is no reason why the infant must remain with the mother. Many studies have documented the added value of a transition into peer groups** comprised of other weanlings. In addition, **even if an adult should be present, it does not have to be the biological mother. The overseer of the peer group can even be an aged animal. In fact, from a practical husbandry perspective, it is a good use of the aging adults who are now past breeding age.**

Q7: Please be sure to consider nutritional and pathogen factors, not only behavioural ones.

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Mod:

Ad Q3/Q7 (Other considerations/comments): Questionnaire seems to be overlooking aspects of husbandry and health (e.g. iron deficiency, vertical transmission). – Mod reply: The focus on behaviour and welfare is correct, but husbandry and health are not to be overlooked. These areas can certainly provide valid arguments to wean earlier/later. As to the health examples: Is there is no (easy) way to **provide for additional iron** to young monkeys during (prolonged) nursing (as there is in the case of humans and other animals such as pigs)?

Reply to Mod by E29-130313: Yes you can supplement infant monkeys with iron while they are with the mother, but isn't it easier and more practical to ensure that they eat fortified commercial diets by 6 months of age? In addition, when you wean an infant monkey from the mother, she begins to cycle again. After a few cycles, she can be re-bred if one purpose of your colony is the generation of new infants.

Reply to Mod by E29-140313: You can appreciate my comments about **iron** and growth. It's similar to what is seen with rapidly growing piglets. By 6 months of age, a portion of infant monkeys need more iron than they can get from breast milk and need to move onto solid foods. Alternatively, a preventive strategy is to **feed the pregnant female a highly fortified diet**. Then, she prenatally passes enough iron to the fetus before birth to sustain its postnatal growth. About 1/2 of the iron needed for infant growth comes transplacentally, the other half through milk. But by 6 months of ages, it is time for solids (in fact, similar to human infants). **Sadly, few of the ethologists and regulators who are thinking about animal welfare take a fully integrated view of animal husbandry when it comes to primates.**

Mod: Similarly, is it not possible to use Herpes-B-free breeding colonies for rhesus monkeys (yet) (and mutatis mutandis for other viruses and primate species)?

Reply to Mod by E29-130313: Many adult monkeys are carriers of Herpes viruses and other viruses. Even the squirrel monkey has its own variant - Herpes saimiri. If you want to **minimize vertical transmission** then separation from the mother at 6 months is a good strategy. There are **many other types of viruses** as well, such as retroviruses, which I imagine that most facilities do not test for, such as **SRV or CMV**. Again, in my facility **we try to minimize contact with adults when the juveniles are between 7-24 months of age**. In that way we minimize the vertical transmission of viruses from the adult colony to the juveniles.

Q5: **"The overseer of the peer group can even be an aged animal. In fact, from a practical husbandry perspective, it is a good use of the aging adults who are now past breeding age."**

Mod: I like that point! What is the benefit of an 'overseer'?

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E29-120313

Ad Q2: I would assume that **most New World monkey** infants can be weaned from the mother by **6 months of age** (from the sustenance point of view). [New World monkeys include **marmosets, squirrel monkeys and douroucoulis.**] **But the species that use a family breeding strategy would likely benefit from a longer period of socialization with the parent pair (that assumes of course that the facility is housing the male and female together as a monogamous pair).**

As I said, **most macaques can thrive with a different rearing strategy, which involves a period of maternal care followed by living in social groups with same age peers**. I saw in your plan that the option would go from the mother-infant phase into **individual housing**. So while I shortened the time with the mother, I would **recommend that you continue with at least pair housing of the weanlings**. In my facility we should form peer groups of 4-8 weanlings, comprised of both male and female offspring. But one of our goals is to produce successful, normal breeders for the next generation.

I believe this **peer housing phase does comply with all humane and animal welfare concerns**, providing a type of social stimulation that is enriching and comfortable for animals of this age.

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Mod: What is meant by "In my facility we should form peer groups of 4-8 weanlings, comprised of both male and female offspring. But one of our goals is to produce successful, normal breeders for the next generation." . At which age are the peer groups formed?

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Reply to Mod by E29-130313: **I would not house monkeys alone or just in pairs at the period when we keep them separate from the adults to avoid vertical disease transmission (i.e. between 7-24 months). Later as adults they can be pair-housed, but when young it is more ideal to permit social play in larger groupings, including both male and female juveniles together. Otherwise they don't learn about sex through play.**

Reply to Mod by E29-120313: Primate husbandry is a very specialized area of knowledge, just as the care of any other type of animal requires special insights into its behaviour, nutrition and diseases.

Even two experts on primates would likely disagree on the optimal age for weaning an infant monkey. My own husbandry perspectives **take into account not only behavioural needs, but also disease transmission, nutritional needs, and the economics of running a large breeding program.** If in our desire to promote animal welfare, we create **restrictions** that make the husbandry cumbersome and excessively costly, then it **will be counter-productive.** For a breeding program, it is not a minor consideration to **reduce** a breeding female's **reproductive success by nearly 50% (if one requires that the infant stay with her past one year).**

I don't know if the others who have responded to your request were considering all of these issues together. **Often many think that just extending the mother-infant phase is good without even knowing why.**

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E4-110313

I consider the Dutch animal welfare legislation appropriate.

Q1:

Chimpanzee (P troglodytes): 4-5 years. Personal view: **in captivity chimps wean at an earlier age than in the wild** but I think that that is simply due to the **ease of having food around and the relative lack of stimulation** in the environment which makes food receive more attention. **This should not suggest that the developmental/emotional trajectory is different.** (No additional literature to suggest; No relevant personal observations.)

Rhesus monkey (M mulatta): 1 year (based upon management experience, observed development of independence, no additional literature to offer).

Crab-eating macaque (M fascicularis): 1 year (just based upon my experience with rhesus macaques and I don't know of any literature to suggest that the developmental trajectory of fascicularis is significantly slower. No additional literature to offer.)

Q5: I have **no objection to the longer times recommended by AAP.** In general though, I have not worked with captive individuals weaned and then placed in a different social group at an age greater than above, so I don't have personal observation of the value of the older ages. I have no reason to suggest that ages SHOULD be lower than cited below [i.e. in the summary table including the ages from current national and EU legislation].

Q6: I too **object strongly to single housing** and think that it should be avoided whenever possible. But if nonhuman primates are used in biomedical research, there are legitimate scientific needs for single housing and in captivity legitimate clinical needs for single housing may occur as well. Since I am not prepared to assert that nonhuman primates should not be used in research, I cannot consider the word '**cruel**' to be appropriate unless it is done for no compelling reason and no attempt is made to reduce the impact of single housing on the wellbeing of the animal.

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E28-120313

My first comment concerns the species list. What is it based on? When I look at the groups it appears to include everything (e.g. zoos, shelters) and then more species are concerned (even if limited to non-human primates). This lists suggests it concerns species which the primate centre has or has had.

Q1-Q3: I assume separation ages refer to weaning ages (which differs from separation age in my view).

This is a tough one. Recently NC3R (UK) investigated this (Prescott et al., 2012). I understand in the **UK** a separation age of **8 months** applies legally. Weaning (and separation to other groups or peer groups) can be done from an age that the youngsters can survive in nature without their mother. For many macaques this is as of about **1 year** (as for the other species in the list, except for chimpanzees).

Our breeding and research facility has the policy to keep **macaques** together until they are **4 years** of age. This is the age at which the animals (**males**) **start to migrate** to other groups in nature. Note, in nature the males migrate, but the females don't. In this respect, separation age is a difficult concept and I would prefer to select the age at which the animals can manage in the group when considering weaning or separation (separation seems to give the false impression that they animals are to be housed individually; that is never the case).

Q4: There must certainly be a minimum age at which the animals can be taken from their natal group. I would argue to use the age at which they can manage on their own, i.e. about **12 months** for macaques (usually by that time there is a next baby which requires the mother's attention). I would recommend **1.5 years for marmosets.** In practice we use this as a minimum unless there are other reasons to separate them; as there are more young that are old enough to help the father in carrying the newborns.

Q5. See above. As far as I know AAP has a non-breeding policy and I wonder whether their views are based on their daily practice. In Europe 1 year is used for macaques and I don't know why AAP suggests 4 years, other than that at that age males in nature start to migrate (see above). Also before that time conflicts can arise, making it more sensible to move animals into other groups. My plea is to use the criterion of the animals' ability to be self-supporting.

Q6: In principle these animals should not be housed individually, except for very good reasons and for a temporary period of time. For non-human primates used in research this has been regulated in the new Directive (EU, 2010). The natural living conditions of the animals should be the leading principle and (re-)groupings should be in accordance with that as much as possible.

Q8: We have breeding colonies of rhesus and long-tailed macaques (*M. mulatta* and *fascicularis*), and common marmosets (*C. jacchus*). Previously we had bear macaques (*M. arctoides*), and owl and squirrel monkeys (*Aotus trivirgatus* and *S. sciureus*) as well.

Q2: We separate our macaques at **4 years** of age because that is the most **natural breeding** configuration and because we use in principle all infants for breeding as well. Since **restlessness** (social conflict) starts at 4 years, that is the time we separate the animals. In addition, the **immune system** of the young animals is more mature at that age (young animals are more susceptible to disease).

At our facility we don't see female **macaques get pregnant** at 2.5 years of age. At 3 years there starts to be a risk. **We use subcutaneous anti-conception implants** (Implanon^(r)). That works fine, e.g. when we don't want to breed with individual females for genetic reasons.

We wean **marmosets** at a somewhat earlier age [than macaques] and the youngsters must have the opportunity to help raise other young. We keep marmosets in the natal group until **1.5-2 years** of age. After that time (1.5-2 years) they are placed in same-sex groups. When they are not in breeding configuration we usually place them in female or male groups (usually after **2 years**, sometimes earlier depending on the stability of the natal group (i.e. family group)). **Marmosets** live in **family groups** and young animals literally help carry younger animals. By contrast **macaques** live in larger **gangs** (made up of smaller sub-groups). This difference in social structure has consequences for the animals' ability to deal with separation.

We have some experience with breeding with animals that had been separated from the mother/natal group early (at **1 year**). In our experience this increases the risk of problems. We need to put much more effort into these animals, keep an eye on them; they are at an increased risk of not accepting their first babies and they need to be placed in groups with older animals to give them an opportunity to learn. These problems arise in a breeding configuration, not when the animals are kept in groups and not used for breeding.

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E1-120313

This is a very complicated area of opinion and it is important to be aware of some of the key factors that are likely to influence opinion: culture, jurisdiction, purpose of animal keeping, scientific justification and intrinsic sources of variation. I will deal with these briefly first (may need more detailed examination of this in due course):

Culture and jurisdiction

By this I mean both the national culture from which the expert originates, and where they work as well as the organisational culture. There is a considerable difference of opinion across cultures that needs to be borne in mind when considering expert opinion in this area. Much of this difference is based in national attitudes to animals, existing guidelines/baselines, focus on financial aspects, misunderstanding of the costs/benefits of early weaning/separation, etc. For example I visited a mixed **macaque breeding facility in China** and was told, with some pride, that they **had just changed their weaning age from 6 months down to 3 months for productivity** reasons and they cohoused weanlings of different species! This despite the fact that the **literature establishes sufficient basis to believe that early weaning elevates maternal, and not just infant, stress that impacts body condition and therefore reproductive condition. In the USA**, the scale of operation is often so large that **mass production mentality and fear of disease can easily predominate** to impact on optimal management of the maternal-infant relationship. I think that given these sources of variation it would be vital to not only bear this in mind when collating opinions but also noting that **ethical consistency needs to be maintained** and the same restrictions should be applied to the authorisation of **importation of animals bred outside the Netherlands** as is applied to breeders within the Netherlands. Of course, there also needs to be awareness that an eye should be kept on the **EU Directive 2010/63** and the fact that this Directive seeks to harmonise practice and regulation across the EU. **'Gold plating'** is not permitted that would place higher restrictions on a member state's sector (unless these restrictions already existed). This would open the authorities to **legal challenge** both

from interested parties and the EU itself. I am assuming that sufficient legal advice is in place for this exercise.

Another important variable is that of **existing baselines**. If an expert works in an environment where, for example, the permitted separation age is low (e.g. 6 months), it would be considered radical to propose an elevation of >50% (to 9 months) and potentially outlandish to suggest a level 100% (to 12 months) higher than in their regulated environment, unless working in an animal protection/welfare organisation. Indeed the reality is that even some of the animal protection organisations, in somewhere like the USA, are so focused on the battle to ban the use of chimpanzees in research that issues such as the use of wild-caught monkeys or the merits of weaning ages over 3-6 months may not be a priority.

Purpose of animal keeping and scientific justification

The goal of any breeding programme, whether it is zoo- or lab-based **must be to produce animals that are as normal/natural as possible**. In a zoo abnormal (including species-atypical) behaviour is undesirable as the animal loses an element of its **educational** value for the visiting public and it becomes an unsuitable candidate for **reintroduction to the wild** as part of conservation efforts. In a breeder producing **research** models, even if the animal is destined to become part of the breeding population, it needs to exhibit normal/natural behaviour to be **socially acceptable and to be a viable breeder**. **We know that early weaning affects a range of behavioural and physiological baselines and responses that would impact on the animal's 'normality'**. Vitality, an animal destined for a research environment, must be the **best quality model** possible for the planned programme of research both for the successful **management** of the animal in a restricted, captive, social environment **and** for the **quality and reproducibility of the data** produced in the research (upholding the principles of the 3Rs). While this perhaps would lead to calls for a **harmonised separation age** across contexts there may be instances where deviations from this would be considered by the authorities to be acceptable. For example, the **precautionary principle** may suggest that an extended age of separation in a breeding (zoo or lab) context should be consistent and set for (e.g. a macaque) at 18 months, but given that some studies (e.g. in regulatory toxicology) are as short as 3 months it may be considered acceptable to include some animals separated at less than that age in order to keep them with simultaneously weaned half-siblings provided their body weights meet study parameters. On top of this, of course, are developmental studies that require animals that may be less than the prescribed separation age. Where such studies cannot be conducted *in situ* with the juvenile still in its natal group/with its mother (or are terminal) then this will of course be subject to separate and specific justification made to the regulating authorities and where relevant permissions/licences/permits are only granted on threshold balance of scientific/societal benefits outweighing the objectively considered costs to the animal of not only the programme of research but also the 'early' separation. This is explicit in **Directive 63/2010/EU** as it **requires justification based on the lifetime experience** of the animal.

Intrinsic sources of variation

It is vital that this area of regulation is examined with due consideration given to intrinsic sources of variation. Here I specifically refer to not only **species-specific life history factors** but also **sex** differences, **individual temperament** differences, and **institutional** conditions differences (management and facilities). You correctly identify an important variable in the process – that of whether the animal is removed to solitary or other social conditions. Of course for the former, where solitary conditions are planned this would, in lab conditions where **63/2010/EU** applies, require specific justification as the regulations **require animals to be kept in social settings** (note of warning here – **some USA-based literature defines social housing as having sensory contact (smell, sight, vision, touch) with conspecifics, not the more widely accepted cohoused definition**). In **zoos** or other settings there may not be regulations governing these processes. Of course separating an animal for **therapeutic reasons** (primarily veterinary or behavioural management) should not be barred but under these conditions **it is vital that a plan is in place for the re-integration** of the individual into a compatible social group at the earliest appropriate time. For infants options for **cross-fostering** with conspecifics **or supplementary care** should be considered before any option to hand-rear is taken where there has been maternal rejection or other rearing difficulties. **There is considerable evidence of deleterious effects of hand-rearing on a range of animal species**. In terms of **sex differences** – it is important to consider the **social organisation** of the species in question, specifically **which sex is philopatric**. Primates exhibit a range of social organisations: they may live in dispersed societies where animals spend most of their time foraging alone and where maturing offspring disperse differentially (daughters may remain closest to their mother's territory/range), family groups where both sexes of offspring migrate at sexual maturity, or in mixed-sex groups where one or the other sex emigrates at sexual maturity. In my feedback I am

predominantly concerned with the **macaques** which **live in mixed sex groups where peer groups of maturing young males leave their natal group to seek inclusion in another group**. This acts well, together with limited adult male tenure of the group, to reduce inbreeding. It is also a possible reason for some important behavioural differences between **juvenile males** and females – the former being **more aggressive in play** in order to determine dominance in their peer group as once they leave the natal group they can no longer count on support derived from the dominance status of their mother. **Daughters however, to a differing extent in different macaque species, derive their social status from that of their mothers in a matrilineal bonded society**. How is this relevant to the current review? Well, one might make a case (as I have done in my paper you cite on Selective breeding; (Honest et al., 2010)) that efforts should be made **not to separate daughters from their natal group at all and that only sons should be removed, in order to mimic the wild state**. While it is undoubtedly true that there are **considerable benefits in terms of behavioural management and reproductive learning and alloparenting** of such a strategy, it is also true that **few facilities have the capacity** to allow groups to grow in this way to the point where they would naturally split, and **therefore some selective removal of females may also be necessary** to stay within acceptable/regulated stocking density. If we are to be guided by what happens in the wild then we would have to consider a **natural separation age for juvenile macaque males of around 2.4-3 years of age** – the point at which they may leave their natal group in the wild. Indeed, this appears to be the approach of AAP and I have some sympathy with this as an ideal. While this may be ideal, it is **rarely practical** in reality, partly for stocking density reasons and for behavioural management reasons. In the lab sector **economics** also come into play – unless a customer wants older animals and is prepared to pay for their keep until >3 years old plus quarantine/health screening periods, the breeder needs to maintain a turnover by supplying the animals at the earliest safe, ethical and practical time point in order to minimise costs and maximise turnover. A good breeder will be able to achieve this while still maximising primate welfare. Such a strategy with animals (**macaques**) separated from their natal group into peer groups at **12 months** of age **would not necessarily indicate a departure from best practice**. Of course, the impact on an animal of a **well-managed separation** from its natal group is less than if it is managed poorly, even at the same age. The manner of the separation (quick, efficient, low impact vs. drawn out, inefficient, high impact [e.g. excessive pursuit and excessive restraint]), the composition of peer groups, the nature of destination housing (including levels and appropriateness of enrichment), and the level of supportive and interventive surveillance make all the difference for the experience of the animal. Older separation with poor practice is not necessarily better than younger (within reason) separation with good practice. Finally, serious consideration needs to be given not only to individual temperament but also to variation introduced by **epigenetic effects**. The latter is typified by some of Steve Suomi's work, e.g. Suomi (2006) but the literature is full of work pointing to differences in individual temperament and reactivity. By natural and logical extension **permanent separation from the mother will have a more significant impact on individuals that are more reactive or that have a more fragile temperament or are more closely bonded / behaviourally dependent on their mother**. There is therefore no substitute for **informed observation and knowledge** of the animals as part of the process of planning the appropriate time to separate juveniles from their mothers. Greater **independence and confident interaction with conspecific peers** is likely to predict a smoother, less stressful separation process and long-term adaptation. Determining behavioural suitability for timing of separation is something that is **impossible to regulate** – not every facility has suitably qualified, trained or **capable staff** to perform this accurately and objectively. Of course it is also vital to have **clear definitions** that identify what the opinion is being expressed on. Here the main terms are “*separation*” and “*weaning*”. It is important to be aware that some literature focuses on the age and process of establishing **nutritional** independence of the infant from the mother (as in field studies) and other (captive studies and management literature) uses weaning to describe the **forced** separation of the infant from the mother. It is also worth noting that many authorities believe that the **weight** at which the juvenile is separated from its mother is at least as important as its age. As Phyllis Lee points out (Lee, 1999) weaning weight is strongly predicted by birth mass: **lower birth weight predicts lower weaning weight**. This of course relates specifically to the establishment of **nutritional independence** from the mother rather than relating to any physical separation. However, it does indicate that **there should be some consideration of body mass (specifically birth mass) in the decision of when to separate**. A useful table of natural weaning ages that is more recent than the information supplied in Rowe (1996) is included in Ross and Jones (1999).

Q1:

Chimpanzee (*Pan troglodytes*): 7-9 years, based on weaning age in Ross and Jones (1999) plus allowance for socio-behavioural development;

Rhesus monkey (*Macaca mulatta*): 12-20 months, based on Wolfensohn and Honess (2005) and pers. obs.;

Bear macaque (*M. arctoides*): 12-20 months. This is a guess (no experience) but based on being a congener of *M. mulatta/fascicularis* with similar life history and social organisation;

Crab-eating macaque (*M. fascicularis*): 12-20 months (pers. obs. And unpublished data in preparation for publication);

Douroucouli (*Aotus spp*): 10-18 months, based on weaning age in Ross and Jones (1999) plus allowance for socio-behavioural development;

Squirrel monkeys (*Saimiri spp*): 10-18 months, based on weaning age in Ross and Jones (1999) plus allowance for socio-behavioural development;

Marmosets (*Callithrix spp*): 8-14 months, based on weaning age in Ross and Jones (1999) plus allowance for socio-behavioural development;

Q1/Q6: **I do not believe that any primate should be routinely removed to solitary conditions unless with specific veterinary or well-justified scientific reasons and so all figures above are for separation to social conditions (one conspecific partner is insufficient for all except *Aotus* and *Callithrix*).**

Q3: Are you also considering *Sanguinus* to be the same as *Callithrix* and *P. paniscus* to be the same as *P. troglodytes*?

Q5: As I said above – I have some sympathy with AAP's position. They have clearly taken the normal **wild dispersal age** as a suitable separation age. Certainly, this applies a **precautionary principle** to minimise the impact on the animal. My ages are typically lower and this is for a number of reasons. The **dispersal age** is determined by a **balance** of threats/risks to the individual including **aggression** in its natal group and the risk of aggression and even predation outside the **protection** of the group. Certainly, the latter does not exist in captivity. The other important factor absent in captivity is the level of competition between groups for food and safe resting places. An animal may try to extend its life within a group as the **group may offer competitive advantages** in foraging against other groups. A lone individual or a smaller peer group is likely to always lose out in competition for food and safety to a larger group. With secure sources of food and safety from predators etc. an earlier age of dispersal may be safe and possible.

Q7: See above and Honess and Marin (2006b).

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Mod: there is quite some **variation in the separation ages** you suggested. This is most understandable, but it also implies (almost 'automatically') that your **lower border would tend to 'count'** for political decision making (unless you specify otherwise, e.g. for macaques that 12-20 mo is a range (e.g. indicating uncertainty and variability) and that your best guess for a specific age (if you have to specify it) would be e.g. 16 months (if that is what 12-20 means).

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E12-140313

Please find my answers to your questions below. These supplement my initial email reply of 24/02/13. I have chosen to restrict my input to **macaque species only**, since these are the species about which I have the greatest knowledge in terms of weaning and rearing.

I note that the Excel spreadsheet attached to your email, and the table below [supplied with the questionnaire], list '8-14 months' as the recommended minimum weaning age in Prescott et al. (2012) – it actually specified 10-14 months (for reasons given in the paper), so the spreadsheet and table need to be corrected.

Q1: It would be helpful for you to **separate a) non-human primates (NHPs) bred for research from b) those destined for future breeding stock and those housed in zoos or sanctuaries** – the two have different demands and hence the minimum separation ages can justifiably be different. In a commercial breeding situation, NHPs destined for **research** will have to be separated from their natal group at some point ready for supply to the user laboratory; although this need not (and in my expert view, **should not**) be before the **biologically normal/natural weaning age (10-14 months for macaques** – see Prescott et al. (2012)).

In contrast, NHPs destined as **future breeders** can remain in the natal group well beyond the natural weaning age (sometimes even **permanently** for **female** macaques - in order to create stable matrilineal breeding groups [although there needs to be a strategy to avoid inbreeding]; and for young **male** macaques, until the age at which they would **naturally disperse** in the wild – **4-5 years** old [most captive breeding groups are comprised of 1-2 breeding males only, for ease of management]). This is likely to be **beneficial for their behavioural development and lifetime welfare**.

This would also apply to breeding groups in **zoos and sanctuaries** (although responsible sanctuaries should not breed, as this decreases the capacity for further rescues and drains resources). However, note that male macaques may **fight** as they approach maturity and seek to establish their position in the hierarchy, so there would need to be sufficient **space, environmental enrichment and management** systems to ensure good welfare.

Q1:

Rhesus monkey (M mulatta) 12 months for animals destined for **research** use; **4 years** for animals destined as **breeding stock** and those in **zoos and sanctuaries**

Bear macaque (M arctoides) 12 months for animals destined for **research** use; **4 years** for animals destined as **breeding stock** and those in **zoos and sanctuaries**

Crab-eating macaque (M fascicularis) 12 months for animals destined for **research** use; **4 years** for animals destined as **breeding stock** and those in **zoos and sanctuaries**

Q2: The Prescott et al. (2012) paper provides new data from a colony of **M. mulatta** and a very large colony of **M. fascicularis** which demonstrate that **early separation** from the mother (i.e. before the biologically normal weaning age of **10-14 months** old) **does not increase colony productivity**. The review also adds to the **growing evidence base for behavioural, physical and immunological disturbances following early separation**, which can compromise animal welfare in the short and long terms – see Section 3.

Ideally, **body weight, health and behavioural criteria** would be used to determine the most appropriate age of separation for individual animals, but this **may not be feasible for very large colonies; 12 months is a reasonable minimum** to adopt to support the welfare of macaques destined for use in research and the provision of high quality animal models, without compromising colony productivity.

Q3: For **laboratory breeding** colonies, mother-infant **separation before the biologically normal weaning age** may be necessary in some specific but **rare circumstances** – 1) for the **welfare of the individual infant** e.g. where the infant is neglected or abused by the mother, or is ill; 2) for **specific experimental protocols**, such as those which seek to create NHP models of stress depression and immune deficiency; or 3) to create **specific pathogen free colonies** – obviously 2) and 3) need to be justified to the regulatory authorities on a case-by-case basis. See Section 2 in Prescott et al. (2012). I have commented above on colony productivity.

I have explained above that **future breeders and those housed in zoos and sanctuaries need not be separated from the mother around 12 months and could remain in the natal group for many years**.

Q4: Not relevant.

Q5: The Rowe (1996) reference is not a primary reference – it is a pictorial encyclopaedia of extant NHP species.

AAP have probably suggested **4 years** for macaques as this is about the age at which young **male macaques disperse** from their natal group in the wild; **young females remain in the natal group for life**.

Q6: **Single housing** should never be the default housing configuration for NHPs because it is **detrimental for the welfare** of these highly social animals – there is a **large evidence base** for this in the literature. NHPs should not be housed singly unless there is very strong scientific or veterinary justification for this.

Q7: Please note that the requirement under **Directive** to wean macaques at no less than **8 months** comes from the earlier Appendix A to the Council of Europe Convention ETS 123, revised in 2006 (p.51): <http://conventions.coe.int/Treaty/EN/Treaties/PDF/123-Arev.pdf>. The enclosure dimensions and space allocations, plus a few other provisions (such as the 8 months lower limit), were subsequently incorporated into Annex III of Directive 2010/63/EU (p.63): <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:276:0033:0079:en:PDF>

I was a member of the Primate Expert Group (then employed by the Royal Society for the Prevention of Cruelty to Animals) that drafted the cage dimensions, space allocations and provisions for primates in the revised Appendix A. I was also Observer to the Multilateral Consultation of the Parties to the Convention (representing the World Society for the Protection of Animals). The animal welfare representatives in the Expert Group and Multilateral Consultation argued for weaning at the biologically normal weaning age of **10-14 months**; representatives of industry and commercial breeders argued to maintain the status quo at **6 months** (the reasons why some suppliers prefer 6 months are given in the Prescott et al. (2012) paper – basically the **infants can survive away from the mother's milk** at this time, and it was thought that this early separation from the mother will increase colony productivity). **Negotiation led to the compromise position of 8 months - this process was not scientific and 8 months is not supported by strong scientific evidence**.

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Responses to mail 'Requesting last-minute input' (Section 17.4)

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E1-150313

I would be a little more cautious about the separation age for **macaques in breeding**. At **4 years** many males will already be **sexually mature** and females definitely. Four-year olds would carry a considerable risk of reproduction and in some cases, particularly young females, **incest**. **Few facilities move breeding males between groups** and so fertile daughters left in their natal group risk incestuous pregnancy. Retaining sons also risks incest, but even if the young male impregnates a non related female there may be **issues about tracing parentage**. This may be critical if **selective breeding or mhc typing** is being done. **This is a very real risk and I have experience of this in both rhesus and fascicularis**.

-
Mod: I was told birth control is relatively easy. If not, I guess **2.5 years** should be the alternative age for breeding macaques.

-
Reply to Mod by E1-150313: **Birth control is not an easy** issue in a breeding facility. Ask Monkey World [a UK-based ape rescue centre] how effective **implants** have been for them, certainly not 100%. Such practices can involve more interventions, complications and welfare costs for animals compared to separation at a slightly earlier age. Again the issue needs a **specification of whom/what you are separating the animal from**. **Daughters from male relatives and sons from female relatives are vital elements**.

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E13-150313

Well done Marc. Good piece of work.

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E8-150313

It looks very thorough...I am interested in receiving the final product of these deliberations if possible

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E17ab-190313: Several suggestions for clarification (e.g. what recommendations are based on).

Annex 7: Responses to Question 6: individual housing

The list below contains the responses received from the experts, sorted as much as possible on the degree to which they allow for exceptions, c.q. agree with the position formulated by AAP.

E7: There is little or no evidence that individual housing of marmosets causes ‘most serious welfare problems’. In over 30 years of working with marmosets and tamarins, including hundreds of animals that were housed singly (with visual, auditory and olfactory contact with other marmosets), I have witnessed only one incident of self-injurious behaviour and extremely limited signs of any other ‘serious welfare problems’. While social housing is clearly preferred and best for the animals, I could not agree with the statement that individual housing of marmosets creates most serious welfare problems and should be considered to be cruel – **as long as the singly housed animals have auditory, visual and olfactory contact with other marmosets.** For example, Tardif et al. (1994) illustrated ovulatory suppression effects in singly housed females within a room similar to that seen in marmoset social groups – i.e. that the singly housed animals within a room communicate in a fashion similar to a social group (E7-080313).

E28: In principle these animals should not be housed individually, except for very good reasons and for a temporary period of time. For non-human primates used in research this has been regulated in the new Directive (EU, 2010). The natural living conditions of the animals should be the leading principle and (re-)groupings should be in accordance with that as much as possible (E28-120313).

E4: I too **object strongly to single housing** and think that it should be avoided whenever possible. But if nonhuman primates are used in biomedical research, there are legitimate scientific needs for single housing and in captivity legitimate clinical needs for single housing may occur as well. Since I am not prepared to assert that nonhuman primates should not be used in research, I cannot consider the word ‘cruel’ to be appropriate unless it is done for no compelling reason and no attempt is made to reduce the impact of single housing on the wellbeing of the animal (E4-110313).

E10: I agree that separation into **individual housing should be avoided at all costs. However,** there are reasons other than quarantine or medical reasons why this may be necessary. One concerns implementation of a **research** protocol. In some infectious disease research, for example, it may be necessary to keep animals housed individually. Another situation might be where an animal, after multiple pairing attempts, is found to be incompatible with other animals. For such animals, **there are alternatives** to provide social enrichment, including housing to **see other animals, use of video, etc.** (E10-100313).

E29: **I would be disinclined to individual house monkeys even at 2 years of age, but rather would keep them in larger peer groups. ... Later as adults they can be pair-housed, but when young (7-24 months) it is more ideal to permit social play in larger groupings, including both male and female juveniles together. Otherwise they don’t learn about sex through play** (E29-110313).

E13: I agree that **individual housing causes serious welfare problems but so does pair housing** in many circumstances (the norm in many US facilities). A stable social group should be the aim ...We did a project some years ago **monitoring** the juveniles to see which animals spent time with which others so they could be kept with their **chosen “friends”** when put into groups for research projects – selection of these groups is **vitaly important if we are to stop ending up with them singly housed with the excuse that they keep fighting.**

I can think of some people I’d fight with if I had to spend 24 hours a day with them – but others I would get along fine with! **Individual monitoring is the key** – but that takes time and money (E13-090313).

E21: Most primates live in groups. Therefore, social housing is very important. However, not all species (e.g. nocturnal prosimians) and all animals live in a group (e.g. males having a period of solitary living). For these species/animals a solitary period will be much less of a welfare problem compared to species/animals which normally live socially (E21-010313) .

E19: Separating the young from the mother and subsequently keeping them isolated is not good for their welfare (E19-250213).

E18: I would tend to agree that separation into **single housing is far from ideal** aside from the reasons stated (E18b-090313)

E27: I agree on well-being problems and I also strongly object to individual housing. This is not now an acceptable practice (other than.... in a few very exceptional cases).

E.g. A young **macaque** whatever its species (long-tailed or rhesus) is no longer dependent on its mother at **8 months**. However he should be kept in social contexts, and as a matter of fact with **known partners of the same age or much older** (E27-050213).

E24: Isolation for an extended period of time should be avoided whenever possible (E24-110313).

E1:...You correctly identify an important variable in the process – that of whether the animal is removed to solitary or other social conditions. Of course for the former, where solitary conditions are planned this would, in lab conditions where Directive **63/2010/EU** applies, require specific justification as the regulations **require animals to be kept in social settings** (note of warning here – **some USA-based literature defines social housing as having sensory contact (smell, sight, vision, touch) with conspecifics, not the more widely accepted cohoused definition**). In **zoos** or other settings there may not be regulations governing these processes. Of course separating an animal for **therapeutic reasons** (primarily veterinary or behavioural management) should not be barred but under these conditions **it is vital that a plan is in place for the re-integration** of the individual into a compatible social group at the earliest appropriate time. For infants options for **cross-fostering** with conspecifics **or supplementary care** should be considered before any option to hand-rear is taken where there has been maternal rejection or other rearing difficulties. **There is considerable evidence of deleterious effects of hand-rearing on a range of animal species. ...I do not believe that any primate should be routinely removed to solitary conditions unless with specific veterinary or well-justified scientific reasons and so all my suggested ages are for separation to social conditions (one conspecific partner is insufficient for all except Aotus and Callithrix)** (E1-120313).

E12: **Single housing** should never be the default housing configuration for NHPs (nonhuman primates) because it **is detrimental for the welfare** of these highly social animals – there is a **large evidence base** for this in the literature. NHPs should not be housed singly unless there is very strong scientific or veterinary justification for this (E12-140313).

E25: Yes (E25-020313).

E15: I agree with AAP with respect to single housing. For more information see studies on re-socialization former lab chimpanzees (Kalcher et al., 2008; Kalcher-Sommersguter et al., 2011; Kalcher-Sommersguter et al., 2013)(E15-260213).

E23: I agree very much. No solitary housing should be allowed for non-human primates, unless clear and sound justification is provided. In the literature many example can be found of behavioural abnormalities due to solitary housing (Laudenslager et al., 1990; Gust et al., 1992; Reinhardt, 2002b-b; a; 2004; Honess and Marin, 2006a; 2006b; Olsson and Westlund, 2007) (E23-010313&020313).

E26: My position is that group-living primates should live with conspecifics in groups resembling the composition of wild groups for their entire life and young should NOT be separated from their mothers until the **age they will normally emigrate from their natal group**. The practice of **separating young from the mothers for breeding purposes is unethical**. I could support temporary separation from group members only in a few special cases (E26-020313).

E8: Individual housing should NOT be used with chimpanzees unless under serious health concerns warrant short-term solitary housing. Management conveniences do not constitute an adequate justification for solitary housing ever. If a particular facility cannot house a chimpanzee socially, that chimpanzee should be moved to another qualified facility that can (E8-250213).

E20: I am a field primatologist who has spent 40+ years studying wild chimpanzees. I am opposed to keeping chimpanzees in captivity, except when refuges are needed to care for them after release from labs or zoos. I am opposed to breeding chimpanzees in captivity for any reason. Therefore, why should I cooperate with any organisation that seeks to do such immoral things as separate offspring from parents? (E20-010313).

Annex 8: Species-specific inputs

This Annex presents the answers received from the experts by species, and sorted as much as possible on suggested separation age.

a) Chimpanzee (*Pan troglodytes*)

E29-110313

Q8: I direct a large primate breeding facility and thus am in a position to comment on successful and humane husbandry strategies.In the past, I have also directed a chimpanzee facility

Q1: **Chimpanzee (P troglodytes): 3 years** (although I would transfer to peer housing); ...

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E8-250213

Chimpanzee (P troglodytes) Separation ages: **4 yrs**. A necessary caveat is that this is a minimum requirement....

From the AZA Chimpanzee Care Manual (AZA, 2010): “Youngsters should stay in their natal group for at least 4 years, or as long as is necessary. There appears to be no evidence of negative effects of staying too long in the natal group other than the difficulty of integration at a later age ..., and the necessity to avoid inbreeding. Chimpanzee communities in the wild are frequently multi-generational. In zoos and aquariums, multi-generational groups have been formed over years usually by the introduction of new breeding males to a group, to avoid daughters breeding with fathers, or the use of reliable birth control. It has been documented that mother-raised infants show greater adult social and sexual competence when reared in the presence of cycling females in a group.”

From the AZA Chimpanzee Care Manual (AZA, 2010): “In the wild, offspring may typically stay with their mothers for at least **six years**, sometimes longer. At the age of adolescence, females may transfer from one community to another. In zoos and aquariums, it may be easier to introduce a young female developing her first sexual swellings to a new group before she is at the age where established females may consider her “competition” for the males’ attention. It is also important to remember the potential threat from the resident adults if the young female is carrying an infant when she is introduced (there is a risk of infanticide). In addition, an adolescent male may be considered a threat to an adult male as well. This is considered an extremely difficult age to introduce a male. If breeding recommendations call for the emigration of a young chimpanzee from one group to another, it is recommended that young chimpanzees, in particular males, be transferred and introduced in a new group by the **age of 5**, when they are still considered juveniles, and their presence may not seem so threatening (McNary, 1992). In all cases, the relative risks of the social introduction should be weighed against the relative benefits for both the immigrant and resident individuals.”

Q5: The recommendations from AAP may be overly-conservative in terms of likely impact on the development, behaviour and welfare of captive chimpanzees. While there is no evidence of negative effects of staying too long in the natal group, having a minimum requirement of 9 years may handcuff managers when attempting to make inter-group transfers that will ultimately benefit the individual and group dynamics. Ensuring that chimpanzee infants get at least 4-5 years of time in their natal group should be sufficient to ensure development trajectories, but still allow some of the management flexibility necessary to facilitate cooperative population management.

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E25-020313

Q1: **Chimpanzee (P troglodytes) 4 yr**

Q3: A precondition is that they must be moved into a social group (preferably a group with members of a similar age). A sharp cut-off point is, of course, at odds with the fact that a gradual maturation towards independence takes place. Such prescriptions cannot be applied without understanding/knowledge. For example, it is important to determine or monitor whether the placement group has individuals that could take the mother role (and will do so).

Q5: The ages AAP suggested are rather high and mark about the start of adolescence. Before that time animals can already function reasonably independently, namely as of the moment of weaning. The mother is not needed for that (although it is nice if she is still around). Her role can be taken by peers, esp. individuals of similar age.

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E4-110313

I consider the Dutch animal welfare legislation appropriate.

Q1: **Chimpanzee (P troglodytes): 4-5 years.** Personal view: **in captivity chimps wean at an earlier age than in the wild** but I think that that is simply due to the **ease of having food around and the relative lack of stimulation** in the environment which makes food receive more attention. **This should not suggest that the developmental/emotional trajectory is different.** (No additional literature to suggest; No relevant personal observations.) ...Q5: I have **no objection to the longer times recommended by AAP.** In general though, I have not worked with captive individuals weaned and then placed in a different social group at an age greater than above, so I don't have personal observation of the value of the older ages. I have no reason to suggest that ages SHOULD be lower than cited below [i.e. in the summary table including the ages from current national and EU legislation].

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E9-170213

I would say that for chimpanzees it is best they stay with their mother until they **choose to leave** their mother. There is tremendous variation in the wild with some infants spending less time with their mothers at **4 years** and others that rely on their mothers and stay with them / close proximity until puberty. Conservatively chimpanzees are weaned **about 4 or 4.5 years** of age but many stay socially dependent on their mothers **until puberty and often beyond.**

Females on average tend to immigrate into neighbouring groups after puberty - this would be the ideal time to move females into new chimpanzee groups.

However it also depends on the type of enclosure. In the wild chimpanzee migrants can choose to avoid others who might harass them. Often in captivity in small enclosures (less than one hectare) this is not possible.

I have seen many integrations of chimpanzees in African sanctuaries (www.pasaprimates.org) where the enclosures are 25 or 100 hectares of tropical forest. There integrating new females is very easy relative to European / US / AustroAsian zoo settings. Lots of places to hide and choose who to avoid.

Male chimpanzees in the wild typically never migrate and **often are killed in captivity when they are placed in new groups regardless of age.** Moving male chimpanzees is fraught with difficulty. ... But again in Africa have seen integration done with ease in these large forested enclosures where lots of escape routes, places to hide and avoid others.

So in summary, taking chimpanzees from their mothers at 3 seems very early to me.

Definitely would never do this before **5 years** in my opinion. ... but also may largely depend on the individual and level of social dependence on the mother.

One size will not fit all in case of chimpanzees. They are individuals.

For a literature review on the impact of separation for mothers in a sanctuary setting, see Wobber and Hare (2011)

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E2-250213b

For **chimps 6 years** seems to be a minimum.

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E15-260213

Q1 **Chimpanzee** separation age: **8 yr (as individual [Mod: to new group]), 4-5 yr with mother and/or peers.**

Generally, no separation should occur before weaning.

In the wild chimpanzees are **weaned at around 5 years.** At this age transfer should only occur with familiar peers and/or the mother.

If chimpanzees are transferred individually, I would suggest not separating them before they are in their adolescence, i.e. at least **8 years** old.

Q2: For the development of the primate infant's arousal-modulation abilities it is necessary not to disrupt the infant's attachment-exploration balance which is facilitated by the mother ((Ainsworth et al., 1971), for humans) and which in turn is vital for the development of socio-emotional and cognitive skills (Bowlby, 1969/1982). Negative outcomes of social separation in primate infants caused by disturbances in attachment such as impaired affective development and behavioural coping were reported by e.g. Kraemer (1992), and Reite and Capitanio (1985). For chimpanzees, in particular, reports on negative outcomes of maternal loss are provided by Goodall (1986) (p.101 ff) and Boesch et al. (2010).

Early stages of the life cycle of chimpanzees according to Goodall (1986) (p.81):

Infancy: 0-5 years

Childhood: 5-7 years

Early Adolescence: Males: 8-12 years; Females: 8-10 years

Late Adolescence: Males: 13-15 years; Females: 11-14 years

Q3: Beside separation ages, the group composition and the housing conditions (e.g. enrichment, places to hide, etc.) are crucial factors for the individuals to be transferred.

Q5: I would agree with the separation ages of chimpanzees as suggested by AAP.

Q6: I also agree with AAP with respect to single housing. For more information please see studies on re-socialization of former lab chimpanzees ((Kalcher et al., 2008; Kalcher-Sommersguter et al., 2011; Kalcher-Sommersguter et al., 2013).

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E24-110313

Q1: I would put the **chimpanzee** separation age at a minimum of **5-6 years**. This is based on infants' behaviour in the group as well as their response to separation from their mothers during testing. We have been unable to separate a **3 year-old** from her mother for an extended period without **much distress** from both mother and infant. Please understand what I am saying. One can separate them at earlier ages but they do not do so voluntarily. Only older infants are comfortable doing this, which is when we start testing them individually.

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E17ab-090313-See Annex 3 '**AAP's updated position**': **chimpanzees: 8-10 years**.

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E24-110313

Q5: AAP's ages are not unreasonable. It's an age when most chimpanzees become completely independent from their mothers.

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E1-120313

...Q1: **Chimpanzee (*Pan troglodytes*): 7-9 years**, based on weaning age in Ross and Jones (1999) plus allowance for socio-behavioural development;

...Q1/Q6: **I do not believe that any primate should be routinely removed to solitary conditions unless with specific veterinary or well-justified scientific reasons and so the figure above is for separation to social conditions (one conspecific partner is insufficient for chimpanzees).**

Q5: As I said above – I have some sympathy with AAP's position. They have clearly taken the normal **wild dispersal age** as a suitable separation age. Certainly, this applies a **precautionary principle** to minimise the impact on the animal. My ages are typically lower and this is for a number of reasons. The **dispersal age is** determined by a **balance** of threats/risks to the individual including **aggression** in its natal group and the risk of aggression and even predation outside the **protection** of the group. Certainly, the latter does not exist in captivity. The other important factor absent in captivity is the level of competition between groups for food and safe resting places. An animal may try to extend its life within a group as the **group may offer competitive advantages** in foraging against other groups. A lone individual or a smaller peer group is likely to always lose out in competition for food and safety to a larger group. With secure sources of food and safety from predators etc. an earlier age of dispersal may be safe and possible.

Q7: See above and Honess and Marin (2006b).

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E20-010313

Q4: I am a field primatologist who has spent 40+ years studying wild chimpanzees. I am opposed to keeping chimpanzees in captivity, except when refuges are needed to care for them after release from labs or zoos. I am opposed to breeding chimpanzees in captivity for any reason. Therefore, why should I cooperate with any organisation that seeks to do such immoral things as separate offspring from parents?

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b) Macaques

E10-100313

Q1: Minimum age for **rhesus monkeys (and probably the other macaque species)** should be **six months** of age. However, animals should be kept with their mothers/groups as long as is feasible given the reasons for keeping the animals in captivity in the first place.

Q2: The principal argument is that this has been the policy at at least one facility that I am aware of for many years, and it appears to be successful.

Q3: **An important caveat is the environment in which the animals are a) currently living, and b) will be separated into.** The vast majority of animals at my facility are kept with their mother/group **very long-term** (e.g. for breeding purposes, or until required for experimental protocol, which is

usually not until the animals are **a couple of years old**). However, for animals that are born **to mothers that are living indoors in small cages** (that is, two adult females are living in adjacent cages and are given daily access to each other for socialization), weaning tends to occur around **six months** of age. Weanlings then are put in a large gang cage that includes peers and adults. I believe there is a sense that keeping a developing animal in a relatively small cage under relatively limited social conditions with the mother will lead to poorer welfare than removing the animal and putting it in a larger social group. Thus, the context, regarding current and future housing, is extremely important. Q5: These ages (as suggested by AAP for macaques) are unrealistic for a research facility. You state that the **regulations** will apply to research institutes, breeding facilities, zoos, and shelters. These institutions have **very different purposes**; for example, zoos are attempting to provide a relatively naturalistic setting, in order to educate the customer. A research facility, however, has a completely different purpose. One might argue that "good welfare should apply to all," and there is some merit to this statement, but the statement can presuppose that welfare is a binary outcome, and that all members of a species will respond in the same way to a specific set of circumstances. Both of these are unreasonable assumptions. **I have seen animals remain with their social groups for years, and still show disturbed behaviour, and I have seen animals that were reared in a nursery show normal behaviour.** I think everyone agrees that there is a certain minimum of welfare that should apply to all; but above that minimum, there are issues of incremental benefits versus greater costs, and considerations such as these will differ substantially among the different types of institutions mentioned above.

In my opinion and experience, the benefit of remaining with mother for four years is unlikely to provide any increment in well-being for the vast majority of animals over separation at three years, at two years, or at one year. And separation at ages as young as six months have been successful for the majority of animals in that situation as well, so long as the animals are put into a rich social and physical environment.

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E10-110313: As for the **6-month cut-off**, this is the case for a small percentage of animals bred under specific research requirements. The rest are in our outdoor enclosures, and as I said, they are kept with their mothers/families/groups as long as possible.

Ad Q4: One of my concerns about providing input to the Dutch government on this is that I don't want to see regulations promoted that my own facility could be considered in violation of. As I said, **6 months works, for the vast majority of animals.** If the regulations are written so that they allow for some exceptions, then that would be fine with me. Ignoring, for the moment, the situation at my facility, however, **I really do not think extending the weaning age beyond one year is going to have any measurable effect on well-being.** "More" is not the same as "better." In this regard, I think the Prescott et al. (2012) paper summarizes the thinking (at least for macaques) on this best.

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E29-110313

Q8: I direct a large primate breeding facility and thus am in a position to comment on successful and humane husbandry strategies. This breeding colony is comprised entirely of rhesus monkeys and we produce up to 100 infants each year.

Q3/Q7 I see that there is no room to comment on several aspects of animal **husbandry** that your survey appears to overlook. It seems you are focusing on behavioural issues to the exclusion of health. For example, one reason to wean certain monkeys at **6 months** rather than **12 months** is that it is actually **healthier** for them **to be eating solid foods** rather than to persist in nursing. Like human infants if they persist in largely subsisting on breast milk, they will be more prone to **iron deficiency anaemia**, which is corrected by eating fortified commercial diets.

Similarly, there are some **viruses** that are more likely to be transmitted from mother to infant if you keep the infant with the mother for a year. In the case of the **rhesus monkey**, it is extremely rare for **Herpes B** to be transferred from mother to infant in the first **6 months** of life. Hence if you wean at 6 months, you **prevent the vertical transmission** of the Herpes virus that is a serious concern for human handlers. Conversely, if you let the infant stay with the mother for a full year, the odds are much greater that it will have been infected with Herpes B as the mother sheds the virus.

Q3/Q6: Finally, it seems that the plans ignore the long-standing evidence that the peer group and play becomes at least as important as the initial maternal care over time. Weaning infants, even at a younger age, into **juvenile peer groups**, is at least as important. In fact, **I would be disinclined to individual house monkeys even at 2 years of age, but rather would keep them in larger peer groups.**

The strategy at my facility is to wean at a younger age than in your plan (e.g. 6-8 months for macaques), but then to have them in peer groups all the way to adulthood, which occurs

between 3-6 years of age in the rhesus monkey. I hope this information is of some help in your planning and regulations. Below I have completed the form and questions, but there may not be room to explain the rationales as completely.

Q1: Rhesus monkey (M mulatta): 6-8 months providing that the weanlings are housed socially together;

Bear macaque (M arctoides): same as rhesus (i.e. 6-8 months providing that the weanlings are housed socially together);

Crab-eating macaque (M fascicularis): same as rhesus (i.e. 6-8 months providing that the weanlings are housed socially together);

...**Q2: Macaques and squirrel monkeys can be entirely self-sufficient from the food/nutrition perspective by 6 months** of age. In fact, there are some benefits of shifting onto solid foods entirely at this age because of the greater **iron** fortification of commercial diets. The important social transition is to **peer housing**, which **ideally includes 3 or more weanlings**. They can then live in the juvenile peer group **through puberty**, especially if comprised of **mixed sex** animals. If the goal is ultimately to create the next generation of **breeders**, then it is important to **move the monkeys into mixed aged housing by 2-3 years of age**. I do not recommend housing **macaques or squirrel monkeys alone**, but, if possible, to pair or group house them. In addition, individual housing of these species should certainly not take place before **adulthood, which is >3-4 years** of age.

Q3: Although it may seem benevolent to house infant monkeys with their mothers through **1 year** of age, it increases the likelihood that some **pathogens will be transmitted** from mother to infant, including one virus of particular concern, **Herpes B**. If weaned by **6 months** of age, most **macaques** will be free of Herpes B. The same concerns apply to other viral pathogens that are transmitted vertically.

Q4: I think **it is a serious mistake to house monkeys with just their mother for one year of age, and then to shift the weaned juvenile into individual housing**. Especially, if you are trying to create the next generation of **breeders**, this is an ill-conceived husbandry practice. In addition, once you have required this long mother-infant housing phase [of **1 year**], you have **compelled the females to be bred at 2 year intervals**. At our facility that would have **negative economic and practical consequences, reducing our fecundity and infant output by nearly 50%**. Many seasonally breeding monkeys can have infants at annual intervals rather than every 2 years.

Q5: In general, **I don't think primates should be individually housed unless it is essential for the research. But there is no reason why the infant must remain with the mother. Many studies have documented the added value of a transition into peer groups** comprised of other weanlings. In addition, **even if an adult should be present, it does not have to be the biological mother. The overseer of the peer group can even be an aged animal. In fact, from a practical husbandry perspective, it is a good use of the aging adults who are now past breeding age.**

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E28-130313: Yes you can supplement infant monkeys with iron while they are with the mother, but isn't it easier and more practical to ensure that they eat fortified commercial diets by 6 months of age? In addition, when you wean an infant monkey from the mother, she begins to cycle again. After a few cycles, she can be re-bred if one purpose of your colony is the generation of new infants.

E29-140313: You can appreciate my comments about **iron** and growth. It's similar to what is seen with rapidly growing piglets. By 6 months of age, a portion of infant monkeys need more iron than they can get from breast milk and need to move onto solid foods. Alternatively, a preventive strategy is to **feed the pregnant female a highly fortified diet**. Then, she prenatally passes enough iron to the foetus before birth to sustain its postnatal growth. About 1/2 of the iron needed for infant growth comes transplacentally, the other half through milk. But by 6 months of ages, it is time for solids (in fact, similar to human infants). **Sadly, few of the ethologists and regulators who are thinking about animal welfare take a fully integrated view of animal husbandry when it comes to primates.**

Mod: Similarly, is it not possible to use Herpes-B-free breeding colonies for rhesus monkeys (yet) (and mutatis mutandis for other viruses and primate species)?

Reply to Mod by E28-130313: Many adult monkeys are carriers of Herpes viruses and other viruses. Even the squirrel monkey has its own variant - Herpes saimiri. If you want to **minimize vertical transmission** then separation from the mother at 6 months is a good strategy. There are **many other types of viruses** as well, such as retroviruses, which I imagine that most facilities do not test for, such as **SRV or CMV**. Again, in my facility **we try to minimize contact with adults when the juveniles are between 7-24 months of age**. In that way we minimize the vertical transmission of viruses from the adult colony to the juveniles.

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E28-130313: **I would not house monkeys alone or just in pairs at the period when we keep them separate from the adults to avoid vertical disease transmission (i.e. between 7-24 months). Later as adults they can be pair-housed, but when young it is more ideal to permit social play in larger groupings, including both male and female juveniles together. Otherwise they don't learn about sex through play.**

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E27-050213

Q2: A young **macaque** whatever its species (long-tailed or rhesus) is no longer dependent on its mother at **8 months**. However he should be kept in social contexts, and as a matter of fact with **known partners of the same age or much older**.

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E27-060313

Monkey breeders generally regroup just weaned monkeys too soon. Many monkeys may become very susceptible to diseases due to immunological consequences of the stress induced by a too early separation. However weaned monkeys at a suitable age may live well in juvenile groups.

The apparent contradiction between my responses to Q1 and Q2 arises from what is the best for monkeys - response to Q1 - and what is needed to use monkeys for scientific experimental purposes. My answer to Q2 comes from my own studies on monkeys' development and more precisely primate socialization. My own results show that an **8 months** old monkey has already built its own social network.

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E4-110313

Rhesus monkey (M mulatta): 1 year (based upon management experience, observed development of independence, no additional literature to offer).

Crab-eating macaque (M fascicularis): 1 year (just based upon my experience with rhesus macaques and I don't know of any literature to suggest that the developmental trajectory of fascicularis is significantly slower. No additional literature to offer.)

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E18b-090313

Q1: **Cynomolgus monkey (Macaca fascicularis): 1 year**

Q2: From experience we have observed that **most infant cynos at 1 year of age are free ranging in the colony and feeding themselves**. The **females** will often be **heavily pregnant** so will have been weaning the infant off already. That said whilst 1 year is an acceptable minimum, **we prefer** to wean at about **18 months as the infant is a little more robust** and able to cope better with a new peer group.

Q3: Infants may need to be removed earlier if a) they are not thriving b) the mother or infant is sick/injured (the infant could be returned when the mother/infant is well again). The infant may be left in for **up to 2.5 years if the infant is going to be used for breeding** outside the colony of its birth or not removed at all if kept within the colony as a future breeder.

Q5: **4 years is way too old** for separation from the colony. **Females can become pregnant from 2.5 years onwards. Males** can remain longer but again can mature sufficiently to be **sexually active from 3.5 years on** so could come into **conflict** with the dominant male.

Q7: There is nothing stated about the **sort of groups that infants should be weaned into**.

Preferably these should be animals of **similar age** and if they are going to be held together for a long time, **same sex**. It is also preferable where possible to wean more than a single infant from each breeding colony so that there will be **familiar** animals in the newly formed group. **Single animals going to a newly formed group should be a little older than the mean**.

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E18c-120313

Weaning age is a huge topic of debate starting with **defining weaning**. Does it mean the age at which **milk is no longer necessary for adequate nutrition** in which case **about 8 months** would be right **for macaques** or is there an **emotional development** component in which case older may be better - **a year** is often quoted but I'm not sure of any great evidence for this and **18 months may be better**. If it refers simply to **maternal separation** then the **optimum age will vary between animals - small infants** are often left with their mother for **longer** than may be usual in the belief that this will be better for them but often **earlier** than usual separation will be physically if not emotionally better for the infant if **good nutrition** is provided.

-

E28-120313: 12 months

Q1-Q3: I assume separation ages refer to weaning ages (which differs from separation age in my view).

Weaning (and separation to other groups or peer groups) can be done from an age that the youngsters can survive in nature without their mother. For many macaques this is as of about **1 year**. Our breeding and research facility has the policy to keep macaques together until they are **4 years** of age. This is the age at which the animals (**males**) **start to migrate** to other groups in nature. Note, in nature the males migrate, but the females don't. In this respect, separation age is a difficult concept and I would prefer to select the age at which the animals can manage in the group when considering weaning or separation (separation seems to give the false impression that they animals are to be housed individually; that is never the case).

Q4: There must certainly be a minimum age at which the animals can be taken from their natal group. I would argue to use the age at which they can manage on their own, i.e. about **12 months** for macaques (usually by that time there is a next baby which requires the mother's attention).

Q5: In Europe 1 year is used for macaques and I don't know why AAP suggests 4 years, other than that at that age males in nature start to migrate (see above). Also before that time conflicts can arise, making it more sensible to move animals into other groups. My plea is to use the criterion of the animals' ability to be self-supporting.

Q8: We have breeding colonies of rhesus and long-tailed macaques (*M. mulatta* and *fascicularis*). Previously we had bear macaques (*M. arctoides*) as well.

Q2: We separate our macaques at **4 years** of age because that is the most **natural breeding** configuration and because we use in principle all infants for breeding as well. Since **restlessness** (social conflict) starts at 4 years, that is the time we separate the animals. In addition, the **immune system** of the young animals is more mature at that age (young animals are more susceptible to disease).

At our facility we don't see female **macaques get pregnant** at 2.5 years of age. At 3 years there starts to be a risk. **We use subcutaneous anti-conception implants** (Implanon^(r)). That works fine, e.g. when we don't want to breed with individual females for genetic reasons.

Marmosets live in **family groups** and young animals literally help carry younger animals. By contrast **macaques** live in larger **gangs** (made up of smaller sub-groups). This difference in social structure has consequences for the animals' ability to deal with separation.

We have some experience with breeding with animals that had been separated from the mother/natal group early (at **1 year**). In our experience this increases the risk of problems. We need to put much more effort into these animals, keep an eye on them; they are at an increased risk of not accepting their first babies and they need to be placed in groups with older animals to give them an opportunity to learn. These problems arise in a breeding configuration, not when the animals are kept in groups and not used for breeding.

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E13-110313

In my experience the minimum age for separation for **rhesus macaques destined for research projects should be 12 – 15 months**. **Ideally** the management of the breeding facility will be such that **siblings/half siblings** from a group can be **kept together** and separated at around **18 months** of age but inevitably in that group there will be some a bit older and some a bit younger. Better to keep them in the group assuming they are healthy and well grown even if they are only 12 months than leave them behind. We did a project some years ago **monitoring** the juveniles to see which animals spent time with which others so they could be kept with their **chosen "friends"** when put into groups for research projects – selection of these groups is **vitaly important if we are to stop ending up with them singly housed with the excuse that they keep fighting**.

I can think of some people I'd fight with if I had to spend 24 hours a day with them – but others I would get along fine with! **Individual monitoring is the key** – but that takes time and money....

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E13-090313

Q4: Whatever the **natural separation age** for the species; which in the case of **female macaques** is often **never** - since they stay in the maternal group, it is the males that move on; the critical issue to remember is why we are breeding these animals in the first place. I am assuming that you are collecting the data primarily to establish guidelines for use in the primate centres where primates are **bred for use in research**. Of course I wholeheartedly support guidelines that improve animals' welfare and for animals that are only there for breeding, establishing systems that maximise welfare and maintain adequate productivity is essential. The main criterion is the monkey's well-being and it is important that young monkeys are reared with an appropriate social background (Wolfensohn and Honess, 2005). ... Any early separation, changes in social grouping, movements and relocation have to be accounted for when estimating the lifetime experience of the animal and the total level and duration of suffering it may endure by being an experimental animal, in addition to the actual scientific

procedures carried out on it (Honest and Wolfensohn, 2010). It is important to monitor **each animal individually** and continuous assessment of behaviour and welfare is more important than sticking to rigid temporal criteria (Wolfensohn, 2010).

The conclusion, therefore, has to be to leave the animals in natal groups as long as is feasible but to recognise that there will be a net cost to the animal of separation and to account for this in the harm:benefit justification and to consider long term management strategies of breeding/research facilities and refinement of procedures that enable animals to remain in natal groups whenever possible. **The age of separation will, therefore, not be consistent between zoos, research facilities and shelters** since the use of the animal is entirely different and it has to be fit for purpose.

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E1-120313

Rhesus monkey (*Macaca mulatta*): 12-20 months, based on Wolfensohn and Honest (2005) and pers. obs.;

Bear macaque (*M. arctoides*): 12-20 months. This is a guess (no experience) but based on being a congener of *M. mulatta/fascicularis* with similar life history and social organisation;

Crab-eating macaque (*M. fascicularis*): 12-20 months (pers. obs. And unpublished data in preparation for publication);

...Q1/Q6: **I do not believe that any primate should be routinely removed to solitary conditions unless with specific veterinary or well-justified scientific reasons and so all figures above are for separation to social conditions (one conspecific partner is insufficient).**

...Q5: As I said above – I have some sympathy with AAP's position. They have clearly taken the normal **wild dispersal age** as a suitable separation age. Certainly, this applies a **precautionary principle** to minimise the impact on the animal. My ages are typically lower and this is for a number of reasons. The **dispersal age** is determined by a **balance** of threats/risks to the individual including **aggression** in its natal group and the risk of aggression and even predation outside the **protection** of the group. Certainly, the latter does not exist in captivity. The other important factor absent in captivity is the level of competition between groups for food and safe resting places. An animal may try to extend its life within a group as the **group may offer competitive advantages** in foraging against other groups. A lone individual or a smaller peer group is likely to always lose out in competition for food and safety to a larger group. With secure sources of food and safety from predators etc. an earlier age of dispersal may be safe and possible.

Q7: See above and Honest and Marin (2006b).

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E1-150313

I would be a little more cautious about the separation age for **macaques in breeding**. At **4 years** many males will already be **sexually mature** and females definitely. Four-year olds would carry a considerable risk of reproduction and in some cases, particularly young females, **incest**. **Few facilities move breeding males between groups** and so fertile daughters left in their natal group risk incestuous pregnancy. Retaining sons also risks incest, but even if the young male impregnates a non related female there may be **issues about tracing parentage**. This may be critical if **selective breeding or mhc typing** is being done. **This is a very real risk and I have experience of this in both rhesus and fascicularis.**

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Reply to Mod by E1-150313: **Birth control is not an easy** issue in a breeding facility. Ask Monkey World [a UK-based ape rescue centre] how effective **implants** have been for them, certainly not 100%. Such practices can involve more interventions, complications and welfare costs for animals compared to separation at a slightly earlier age. Again the issue needs a **specification of whom/what you are separating the animal from. Daughters from male relatives and sons from female relatives are vital elements.**

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E12-140313

I have chosen to restrict my input to **macaque species only**, since these are the species about which I have the greatest knowledge in terms of weaning and rearing.

Q1: It would be helpful for you to **separate a) non-human primates (NHPs) bred for research from b) those destined for future breeding stock and those housed in zoos or sanctuaries** – the two have different demands and hence the minimum separation ages can justifiably be different.

In a commercial breeding situation, NHPs destined for **research** will have to be separated from their natal group at some point ready for supply to the user laboratory; although this need not (and in my expert view, **should not**) be before the **biologically normal/natural weaning age (10-14 months for macaques** – see Prescott et al. (2012)).

In contrast, NHPs destined as **future breeders** can remain in the natal group well beyond the natural weaning age (sometimes even **permanently** for **female** macaques - in order to create stable matrilineal breeding groups [although there needs to be a strategy to avoid inbreeding]; and for young **male** macaques, until the age at which they would **naturally disperse** in the wild – **4-5 years old** [most captive breeding groups are comprised of 1-2 breeding males only, for ease of management]). This is likely to be **beneficial for their behavioural development and lifetime welfare**.

This would also apply to breeding groups in **zoos and sanctuaries** (although responsible sanctuaries should not breed, as this decreases the capacity for further rescues and drains resources).

However, note that male macaques may **fight** as they approach maturity and seek to establish their position in the hierarchy, so there would need to be sufficient **space, environmental enrichment and management** systems to ensure good welfare.

Q1: Rhesus monkey (M mulatta) 12 months for animals destined for **research** use; **4 years** for animals destined as **breeding stock** and those in **zoos and sanctuaries**

Bear macaque (M arctoides) 12 months for animals destined for **research** use; **4 years** for animals destined as **breeding stock** and those in **zoos and sanctuaries**

Crab-eating macaque (M fascicularis) 12 months for animals destined for **research** use; **4 years** for animals destined as **breeding stock** and those in **zoos and sanctuaries**

Q2: The Prescott et al. (2012) paper provides new data from a colony of **M. mulatta** and a very large colony of **M. fascicularis** which demonstrate that **early separation** from the mother (i.e. before the biologically normal weaning age of **10-14 months** old) **does not increase colony productivity**. The review also adds to the **growing evidence base for behavioural, physical and immunological disturbances following early separation**, which can compromise animal welfare in the short and long terms – see Section 3.

Ideally, **body weight, health and behavioural criteria** would be used to determine the most appropriate age of separation for individual animals, but this **may not be feasible for very large colonies; 12 months is a reasonable minimum** to adopt to support the welfare of macaques destined for use in research and the provision of high quality animal models, without compromising colony productivity.

Q3: For **laboratory breeding** colonies, mother-infant **separation before the biologically normal weaning age** may be necessary in some specific but **rare circumstances** – 1) for the **welfare of the individual infant** e.g. where the infant is neglected or abused by the mother, or is ill; 2) for **specific experimental protocols**, such as those which seek to create NHP models of stress depression and immune deficiency; or 3) to create **specific pathogen free colonies** – obviously 2) and 3) need to be justified to the regulatory authorities on a case-by-case basis. See Section 2 in Prescott et al. (2012). I have commented above on colony productivity.

I have explained above that **future breeders and those housed in zoos and sanctuaries need not be separated from the mother around 12 months and could remain in the natal group for many years**.

Q7: Please note that the requirement under **Directive** to wean macaques at no less than **8 months** comes from the earlier Appendix A to the Council of Europe Convention ETS 123, revised in 2006 (p.51): <http://conventions.coe.int/Treaty/EN/Treaties/PDF/123-Arev.pdf>. The enclosure dimensions and space allocations, plus a few other provisions (such as the 8 months lower limit), were subsequently incorporated into Annex III of Directive 2010/63/EU (p.63): <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:276:0033:0079:en:PDF>

I was a member of the Primate Expert Group (then employed by the Royal Society for the Prevention of Cruelty to Animals) that drafted the cage dimensions, space allocations and provisions for primates in the revised Appendix A. I was also Observer to the Multilateral Consultation of the Parties to the Convention (representing the World Society for the Protection of Animals). The animal welfare representatives in the Expert Group and Multilateral Consultation argued for weaning at the biologically normal weaning age of **10-14 months**; representatives of industry and commercial breeders argued to maintain the status quo at **6 months** (the reasons why some suppliers prefer 6 months are given in the Prescott et al. (2012) paper – basically the **infants can survive away from the mother's milk** at this time, and it was thought that this early separation from the mother will increase colony productivity). **Negotiation led to the compromise position of 8 months - this process was not scientific and 8 months is not supported by strong scientific evidence.**

E25-020313

Rhesus monkey (M mulatta)	18 mo
Bear macaque (M arctoides)	18 mo
Crab-eating macaque (M fascicularis)	18 mo

Q3: A precondition is that they must be moved into a social group (preferably a group with members of a similar age). A sharp cut-off point is, of course, at odds with the fact that a gradual maturation towards independence takes place. Such prescriptions cannot be applied without understanding/knowledge. For example, it is important to determine or monitor whether the placement group has individuals that could take the mother role (and will do so).

Q5: The ages AAP suggested are rather high and mark about the start of adolescence. Before that time animals can already function reasonably independently, namely as of the moment of weaning. The mother is not needed for that (although it is nice if she is still around). Her role can be taken by peers, esp. individuals of similar age.

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E2-250213b: **3 years for macaques.**

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E17ab-090313-See Annex 3 'AAP's updated position': **M arctoides and M mulatta: 4 yr; Macaca fascicularis: 3.5-4.5 years**

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E26-020313

My position is that group-living primates, such as those in your table, should live with conspecifics in groups resembling the composition of wild groups for their entire life and young should NOT be separated from their mothers until the **age they will normally emigrate from their natal group**. The practice of **separating young from the mothers for breeding purposes is unethical**. I could support temporary separation from group members only in a few special cases.

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E7-080313

The continued presence of youngsters in a marmoset group does not negatively affect reproduction of the breeding pair – i.e. you do not speed up breeding by removing youngsters in this species. Therefore, that is not a consideration in making decision regarding separation ages in this species, as it might be in **macaques**.

In the EU, marmosets are sometimes housed in same-sexed peer groups of youngsters.

However, **this is a totally artificial arrangement**. Marmosets in the wild would never be found in such peer groups (while they are a normal part of social life in wild **macaques**).

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c) *Marmosets*

E29-110313

Marmosets: 6-8 months, although given their family social structure, there may be socialization benefits of continuing with the family housing through **2 years** of age.

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E29-120313

Ad Q2: I would assume that **most New World monkey** infants can be weaned from the mother by **6 months of age** (from the sustenance point of view). [New World monkeys include **marmosets, squirrel monkeys and douroucoulis.**] **But the species that use a family breeding strategy would likely benefit from a longer period of socialization with the parent pair (that assumes of course that the facility is housing the male and female together as a monogamous pair).**

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E1-120313

Marmosets (*Callithrix spp*): 8-14 months, based on weaning age in Ross and Jones (1999) plus allowance for socio-behavioural development;

Q1/Q6: **I do not believe that any primate should be routinely removed to solitary conditions unless with specific veterinary or well-justified scientific reasons and so the figure above are for separation to social conditions (one conspecific partner is sufficient for *Callithrix*).**

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E7-080313

Q1: **Marmosets – 9 months**

Q2: **By 9 months marmosets are completely weaned from nursing and have begun puberty.**

Based upon my **experience of over 30 years** working with marmosets, I believe at this age marmosets could be separated from their natal groups with minimal negative welfare effects.

Q3: If marmosets in question are to be used in breeding, they should remain in their natal groups for as long as possible. Ideally, until they are removed for mating. Marmosets and tamarins are more

likely to show adequate parenting behaviour if they have remained in their natal groups long enough to participate in cooperative rearing of younger siblings.

The continued presence of youngsters in a marmoset group does not negatively affect reproduction of the breeding pair – i.e. you do not speed up breeding by removing youngsters in this species. Therefore, that is not a consideration in making decision regarding separation ages in this species, as it might be in **macaques**.

Q6: **There is little or no evidence that individual housing of marmosets causes ‘most serious welfare problems’**. In over 30 years of working with marmosets and tamarins, including hundreds of animals that were housed singly (with visual, auditory and olfactory contact with other marmosets), I have witnessed only one incident of self-injurious behaviour and extremely limited signs of any other ‘serious welfare problems’. While social housing is clearly preferred and best for the animals, I could not agree with the statement that individual housing of marmosets creates most serious welfare problems and should be considered to be cruel – **as long as the singly housed animals have auditory, visual and olfactory contact with other marmosets**. For example, Tardif et al.(1994) illustrated ovulatory suppression effects in singly housed females within a room similar to that seen in marmoset social groups – i.e. that the singly housed animals within a room communicate in a fashion similar to a social group.

Q7: The best way to house marmosets that are removed from natal groups prior to breeding age is unclear. **In the EU, marmosets are sometimes housed in same-sexed peer groups of youngsters**. However, **this is a totally artificial arrangement**. Marmosets in the wild would never be found in such peer groups (while they are a normal part of social life in wild **macaques**). There are significant risks associated with same-sex housing of socially unfamiliar marmosets – particularly females, who can be extremely aggressive toward each other.

References: (Tardif et al., 1984; Tardif et al., 1992; Tardif et al., 1994; Tardif, 1996; Bales et al., 2000; Tardif et al., 2003)

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Mod: What are the welfare consequences of individual housing that involves loss of visual, auditory and/or olfactory contact with conspecifics (in marmosets and/or other species)?

As to the artificial conditions of same-sexed peer groups, I was wondering whether such conditions generally are to be considered worse for welfare than individual housing (with or without auditory/visual/olfactory contact).

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E25-020313

Marmosets: 9 months

Q3: A precondition is that they must be moved into a social group (preferably a group with members of a similar age). A sharp cut-off point is, of course, at odds with the fact that a gradual maturation towards independence takes place. Such prescriptions cannot be applied without understanding/knowledge. For example, it is important to determine or monitor whether the placement group has individuals that could take the mother role (and will do so).

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E23-010313&020313

Marmosets: no less than one year: 12-14 months

Q2: Extended parental care (Abbott et al., 2003).

Q3: As a member of a social group of common marmosets, a young individual can be a valuable helper to raise and play with younger brothers and sisters. Furthermore, this experience is crucial for the learning process related to parenting in the future. Then, in the case the individual belongs to a family where new babies are expected and possible, I would delay the moment of separation for not less than the age of one year. At the age of 12-14 months common marmosets (*C. jacchus*) are reproductive and can start a new family. If there have been babies in the family they should have also been able to acquire the proper experience to be good parents.

[Mod: and if there have been no young conspecifics in the group, they need to stay with the group for longer to become good parents?]

Q7: Separation age should be not only species-specific, but **individual-specific** as well. Non-human primates show distinct personalities. Therefore each case should be analysed taking into account the character of that particular individual in the group, as well as his/her personality traits.

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E11-200213

Q1: I would recommend that **marmosets** are kept until **at least 18 months** in their natal group (unless there are welfare reasons for not doing so) This gives them experience of infant care, they are then

more fully grown, and I believe earlier separation from the natal group is likely to be uncommon in nature. I have not however reviewed the recent field literature.

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E28-120313

Weaning (and separation to other groups or peer groups) can be done from an age that the youngsters can survive in nature without their mother.

Q4: There must certainly be a minimum age at which the animals can be taken from their natal group. I would argue to use the age at which they can manage on their own. ... I would recommend **1.5 years for marmosets**. In practice we use this as a minimum unless there are other reasons to separate them; as there are more young that are old enough to help the father in carrying the newborns.

Q8: We have breeding colonies of ... common marmosets (*C. jacchus*).

... We wean **marmosets** at a somewhat earlier age [than macaques] and the youngsters must have the opportunity to help raise other young. We keep marmosets in the natal group until **1.5-2 years** of age. After that time (1.5-2 years) they are placed in same-sex groups. When they are not in breeding configuration we usually place them in female or male groups (usually after **2 years**, sometimes earlier depending on the stability of the natal group (i.e. family group). **Marmosets** live in **family groups** and young animals literally help carry younger animals. By contrast **macaques** live in larger **gangs** (made up of smaller sub-groups). This difference in social structure has consequences for the animals' ability to deal with separation.

We have some experience with breeding with animals that had been separated from the mother/natal group early (at **1 year**). In our experience this increases the risk of problems. We need to put much more effort into these animals, keep an eye on them; they are at an increased risk of not accepting their first babies and they need to be placed in groups with older animals to give them an opportunity to learn. These problems arise in a breeding configuration, not when the animals are kept in groups and not used for breeding.

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E17ab-090313-See Annex 3 'AAP's updated position'; **Marmosets: *Callithrix jacchus*, *C. pygmaea* and *C. argentata*: all 1.8 years.**

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E26-020313

My position is that group-living primates, such as those in your table, should live with conspecifics in groups resembling the composition of wild groups for their entire life and young should NOT be separated from their mothers until the **age they will normally emigrate from their natal group**. The practice of **separating young from the mothers for breeding purposes is unethical**. I could support temporary separation from group members only in a few special cases.

d) *Douroucoulis*, night monkeys (*Aotus*)

E29-110313

I am not an expert on **Aotus**, which is **unique because of the pair bonding and also the paternal care**. ... I would assume that **most New World monkey infants** (i.e. **marmosets, squirrel monkeys and douroucoulis**) can be weaned from the mother by **6 months of age** (from the sustenance point of view). **But the species that use a family breeding strategy would likely benefit from a longer period of socialization with the parent pair (that assumes of course that the facility is housing the male and female together as a monogamous pair).**

-

E1-120313

Douroucouli (*Aotus spp*): 10-18 months, based on the weaning age in Ross and Jones (1999) plus allowance for socio-behavioural development;

...Q1/Q6: **I do not believe that any primate should be routinely removed to solitary conditions unless with specific veterinary or well-justified scientific reasons and so all figures above are for separation to social conditions (one conspecific partner is insufficient for all except *Aotus* and *Callithrix*).**

-

E25-020313: **Douroucouli (*Aotus*): 18 months**

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E2-150213:

The **ages between brackets** [i.e. existing legislation formulated for moving into single housing but applied to group housing; 1.5 years for douroucoulis] are definitely better, still **rather young**.

-
E17ab-090313-See Annex 3 'AAP's updated position' : **Aotus trivirgatus: 2 yr; Aotus nigriceps: 2-3 yr.**

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Mod: Natural weaning and independence ages differ considerably between species. For example, for *A. nancymae* (Ma's night monkey) these ages are 13 and 18 days respectively (Graf, 2006). By contrast, for *A. azarae* (Azara's night monkey) the mean weaning age is 231 days, and both males and females reach sexual maturity at 2 years of age (Smith, 1999).

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E26-020313

Q2: My position is that group-living primates, such as those in your table, should live with conspecifics in groups resembling the composition of wild groups for their entire life and young should NOT be separated from their mothers until the **age they will normally emigrate from their natal group**. The practice of **separating young from the mothers for breeding purposes is unethical**. I could support temporary separation from group members only in a few special cases.

-
e) *Squirrel monkeys (Saimiri)*

E29-110313

I spent over 10 years studying and breeding squirrel monkeys. ...

Q1: **Squirrel monkeys (Saimiri): 6-8 months**, provided that the weanlings are transferred into **small social groups** comprised of peers of the same age;

Q2: **Macaques and squirrel monkeys can be entirely self-sufficient from the food/nutrition perspective by 6 months** of age. In fact, there are some benefits of shifting onto solid foods entirely at this age because of the greater **iron** fortification of commercial diets. The important social transition is to **peer housing**, which **ideally includes 3 or more weanlings**. They can then live in the juvenile peer group **through puberty**, especially if comprised of **mixed sex** animals. If the goal is ultimately to create the next generation of **breeders**, then it is important to **move the monkeys into mixed aged housing by 2-3 years of age**. I do not recommend housing **macaques or squirrel monkeys alone**, but, if possible, to **pair or group house them**. In addition, individual housing of these species should certainly not take place before **adulthood, which is >3-4 years** of age.

Q3: Although it may seem benevolent to house infant monkeys with their mothers through **1 year** of age, it increases the likelihood that some **pathogens will be transmitted** from mother to infant, including one virus of particular concern, **Herpes B**. If weaned by **6 months** of age, most **macaques** will be free of Herpes B. Similarly for **squirrel monkeys**, if infants are weaned by **6 months** of age, they will not be likely to be infected with **Herpes saimiri**. The same concerns apply to other viral pathogens that are transmitted vertically.

Q4: I think **it is a serious mistake to house monkeys with just their mother for one year of age, and then to shift the weaned juvenile into individual housing**. Especially, if you are trying to create the next generation of **breeders**, this is an ill-conceived husbandry practice. In addition, once you have required this long mother-infant housing phase [of **1 year**], you have **compelled the females to be bred at 2 year intervals**. At our facility that would have **negative economic and practical consequences, reducing our fecundity and infant output by nearly 50%**. Many seasonally breeding monkeys can have infants at annual intervals rather than every 2 years.

Q5: In general, **I don't think primates should be individually housed unless it is essential for the research. But there is no reason why the infant must remain with the mother. Many studies have documented the added value of a transition into peer groups** comprised of other weanlings. In addition, **even if an adult should be present, it does not have to be the biological mother. The overseer of the peer group can even be an aged animal. In fact, from a practical husbandry perspective, it is a good use of the aging adults who are now past breeding age.**

-
Mod:

Ad Q3/Q7 (Other considerations/comments): Questionnaire seems to be overlooking aspects of husbandry and health (e.g. iron deficiency, vertical transmission). – Mod reply: The focus on behaviour and welfare is correct, but husbandry and health are not to be overlooked. These areas can certainly provide valid arguments to wean earlier/later. As to the health examples: Is there is no (easy) way to **provide for additional iron** to young monkeys during (prolonged) nursing (as there is in the case of humans and other animals such as pigs)?

Reply to Mod by E28-130313: Yes you can supplement infant monkeys with iron while they are with the mother, but isn't it easier and more practical to ensure that they eat fortified commercial diets by 6 months of age? In addition, when you wean an infant monkey from the mother, she begins to cycle again. After a few cycles, she can be re-bred if one purpose of your colony is the generation of new infants.

Reply to Mod by E29-140313: You can appreciate my comments about **iron** and growth. It's similar to what is seen with rapidly growing piglets. By 6 months of age, a portion of infant monkeys need more iron than they can get from breast milk and need to move onto solid foods. Alternatively, a preventive strategy is to **feed the pregnant female a highly fortified diet**. Then, she prenatally passes enough iron to the foetus before birth to sustain its postnatal growth. About 1/2 of the iron needed for infant growth comes transplacentally, the other half through milk. But by 6 months of ages, it is time for solids (in fact, similar to human infants). **Sadly, few of the ethologists and regulators who are thinking about animal welfare take a fully integrated view of animal husbandry when it comes to primates.**

Mod: Similarly, is it not possible to use Herpes-B-free breeding colonies for rhesus monkeys (yet) (and mutatis mutandis for other viruses and primate species)?

Reply to Mod by E28-130313: Many adult monkeys are carriers of Herpes viruses and other viruses. Even the squirrel monkey has its own variant - Herpes saimiri. If you want to **minimize vertical transmission** then separation from the mother at 6 months is a good strategy. There are **many other types of viruses** as well, such as retroviruses, which I imagine that most facilities do not test for, such as **SRV or CMV**. Again, in my facility **we try to minimize contact with adults when the juveniles are between 7-24 months of age**. In that way we minimize the vertical transmission of viruses from the adult colony to the juveniles.

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E29-120313

Ad Q2: I would assume that **most New World monkey** infants can be weaned from the mother by **6 months of age** (from the sustenance point of view). [New World monkeys include **marmosets, squirrel monkeys and douroucoulis.**] **But the species that use a family breeding strategy would likely benefit from a longer period of socialization with the parent pair (that assumes of course that the facility is housing the male and female together as a monogamous pair).**

As I said, **most macaques can thrive with a different rearing strategy, which involves a period of maternal care followed by living in social groups with same age peers**. I saw in your plan that the option would go from the mother-infant phase into **individual housing**. So while I shortened the time with the mother, I would **recommend that you continue with at least pair housing of the weanlings**. In my facility we should form peer groups of 4-8 weanlings, comprised of both male and female offspring. But one of our goals is to produce successful, normal breeders for the next generation.

I believe this **peer housing phase does comply with all humane and animal welfare concerns**, providing a type of social stimulation that is enriching and comfortable for animals of this age.

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Mod: What is meant by "In my facility we should form peer groups of 4-8 weanlings, comprised of both male and female offspring. But one of our goals is to produce successful, normal breeders for the next generation. ". At which age are the peer groups formed?

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Reply to Mod by E28-130313: **I would not house monkeys alone or just in pairs at the period when we keep them separate from the adults to avoid vertical disease transmission (i.e. between 7-24 months). Later as adults they can be pair-housed, but when young it is more ideal to permit social play in larger groupings, including both male and female juveniles together. Otherwise they don't learn about sex through play.**

Reply to Mod by E29-120313: Primate husbandry is a very specialized area of knowledge, just as the care of any other type of animal requires special insights into its behaviour, nutrition and diseases. Even 2 experts on primates would likely disagree on the optimal age for weaning an infant monkey. My own husbandry perspectives **take into account not only behavioural needs, but also disease transmission, nutritional needs, and the economics of running a large breeding program**. If in our desire to promote animal welfare, we create **restrictions** that make the husbandry cumbersome and excessively costly, then it **will be counter-productive**. For a breeding program, it is not a minor consideration to **reduce a breeding female's reproductive success by nearly 50% (if one requires that the infant stay with her past one year)**.

I don't know if the others who have responded to your request were considering all of these issues together. **Often many think that just extending the mother-infant phase is good without even knowing why.**

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E25-020313: **Squirrel monkeys (*Saimiri*): 9 months;**

Q5: The ages AAP suggested are rather high and mark about the start of adolescence. Before that time animals can already function reasonably independently, namely as of the moment of weaning. The mother is not needed for that (although it is nice if she is still around). Her role can be taken by peers, esp. individuals of similar age.

-

E1-120313:

Squirrel monkeys (*Saimiri spp*): 10-18 months, based on weaning age in Ross and Jones (1999) plus allowance for socio-behavioural development;

...Q1/Q6: **I do not believe that any primate should be routinely removed to solitary conditions unless with specific veterinary or well-justified scientific reasons and so all figures above are for separation to social conditions (one conspecific partner is insufficient for all except *Aotus* and *Callithrix*).**

...Q5: As I said above – I have some sympathy with AAP's position. They have clearly taken the normal **wild dispersal age** as a suitable separation age. Certainly, this applies a **precautionary principle** to minimise the impact on the animal. My ages are typically lower and this is for a number of reasons. The **dispersal age** is determined by a **balance** of threats/risks to the individual including **aggression** in its natal group and the risk of aggression and even predation outside the **protection** of the group. Certainly, the latter does not exist in captivity. The other important factor absent in captivity is the level of competition between groups for food and safe resting places. An animal may try to extend its life within a group as the **group may offer competitive advantages** in foraging against other groups. A lone individual or a smaller peer group is likely to always lose out in competition for food and safety to a larger group. With secure sources of food and safety from predators etc. an earlier age of dispersal may be safe and possible.

Q7: See above and Honess and Marin (2006b).

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E17ab-090313-See Annex 3 'AAP's updated position': *S sciureus*, *S boliviensis* and *S oerstedii*: 2.5 years (the two last species based on sexual maturity).

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E26-020313

Q2: My position is that group-living primates, such as those in your table, should live with conspecifics in groups resembling the composition of wild groups for their entire life and young should NOT be separated from their mothers until the **age they will normally emigrate from their natal group**. The practice of **separating young from the mothers for breeding purposes is unethical**. I could support temporary separation from group members only in a few special cases.

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Annex 9: Expert comments on the near-final report

On 23-03-2013 the following message was sent to the contributors:

Dear all,

Please find attached the near-final report on primate separation ages. Your valued contributions have been processed leading to more detailed recommendations (Section 12, also copied below). Comments are most welcome. I can only promise, however, to correct factual mistakes; and I will do my best to accommodate other suggestions, but the available time left is limited, I'm afraid. I intend to finalise the report 2 weeks from now (Monday **April 8**).

Kind regards, Marc

PS The report itself is 30 pages, but with Annexes 112 pp. Annex 6 lists all expert input. Summarising statements can be found in Section 11.

PPS I will be listing your name in the acknowledgements of the final report only if you indicated that I could do so. If you want to change your mind about that (either way), you can still do so. Thank you.

Recommendations

Based on this research the following recommendations were formulated:

- Given general consensus among experts, the revised legislation should not allow for routine separation into individual housing. This in accordance with EU legislation for animals used in research, where individual housing of primates is considered to be a serious welfare infringement. All suggested separation ages concern weaning into group housing, preferably with (at least some) familiar conspecifics.
- Natural behaviour, conditions and adaptations provide important guiding principles to determine suitable separation ages, but other aspects need to be taken into account as well.
- Given the ambition of the Dutch government to promote animal welfare, including the need for animals to perform natural behaviour, given the existing legislative framework (including Directive 2010/63/EU), and given the fact that enhancing the Dutch welfare regulations do not appear to have major economic or practical consequences for primate owners in the Netherlands, the expert consultation indicates that separation ages for the species examined should be raised in accordance with the 'species-specific' recommendations below.
- Rather than formulating separation ages for the three main species of macaque used in research, suggested separation ages can be formulated for macaques generally (as is already done for douroucoulis, marmosets and squirrel monkeys in the existing legislation). This means that other species of macaques, such as Barbary macaques, would be included as well.
- When separation ages are formulated for species groups (macaques generally, douroucoulis, marmosets and squirrel monkeys) an exception clause may be formulated that younger separation ages may incidentally be allowed in less prevalent species provided this is indicated from their documented natural behaviour. This, however, may also fall under the exception clause that under special circumstances earlier separation may be allowed.
- While it is recommended that exceptional weaning at younger ages remains possible (e.g. for welfare or medical reasons), it is also recommended to specify under which conditions this may take place, e.g. that it requires documented authorisation of a specialised veterinarian or similar.

'Species-specific' recommendations:

- *Based on the input received from the experts, the separation age for **chimpanzees** should be raised beyond weaning (4-5 years) when moved with the mother and/or with peers, and preferably be raised to 6 years of age in other cases. However, especially re-grouping of males is to be avoided as much as possible.*
- *For **macaques** used in research the minimum separation age should be 12 months provided the animals are kept together with at least one familiar peer, otherwise 15 or even 18 months is more suitable. When used for breeding, or are kept in zoos, sanctuaries or shelters, this age*

may be raised safely up to 2.5 years, but should ideally be around 3-4 years for males and 'never' for females (i.e. they should stay in their natal group). Raising the age for macaques generally to 2 years, as presently regulated for individual separation of macaques, but now applying to separation in groups, is a real option, also because this would be in line with recommendations for the other species and no important arguments to the contrary were found to apply to the Dutch situation.

- *For **douroucoulis** separation ages are recommended to be raised to 18 months, i.e. previous legislative ages for separation into individual housing, but now applied to group housing.*
- *For **squirrel monkeys** separation ages for weaning into group housing should be raised to at least 9 months (previously used for separation into individual housing) or to 12 months. However, further raising to 18 months appears to be more appropriate, esp. when animals are to be used for breeding or are kept in zoos, sanctuaries or shelters.*
- *For **marmosets** separation ages should be raised to 12 months. This age was previously specified in legislation for separation into individual housing, but should in the future apply to separation into group housing. However, raising to 18 months may be more appropriate, esp. when animals are used for breeding or are kept in zoos, sanctuaries or shelters.*

Responses received from the experts:

E29-230313a

Thank you for sharing your report. Obviously, I will have to respectfully disagree with your final conclusions and several recommendations of others.

I don't think you will accomplish much 'welfare' but pushing the age for weaning monkeys up to 12-18 months. Certainly not if your primary goals are the ones listed below.

On the other hand, I am as concerned, or more so, about the nature of the social groupings for the weanlings. At my facility I accomplish the same social and welfare goals by providing **complex social groups** for weanlings and juveniles, rather than relying on simple pairs.

Certainly, reasonable people will disagree on how best to achieve the optimal ends. Although your plan will probably work fine for zoos and exhibitions, I believe **the constraints will ensure that the Netherlands is not known for biomedical research with nonhuman primates in the future**, certainly not in the area of developmental biology. Perhaps that is OK and one of intended goals of these regulations.

I appreciate that you included some of my comments in the final report even when they are divergent from the consensus. You better propose **extensive screening of the adults to create SPF colonies**, or you will certainly ensure the vertical transmission of many viruses (of concern to some of us -- Herpes, retroviruses).

Not sure you want to make any modifications at this point, but you might also want to include some options and ground rules for **exceptions**. For example, if a young monkey has an infectious condition and needs treatment (e.g., Shigellosis), it would be unreasonable to say that it must stay with others and spread this serious enteric pathogen to all. If a wounded and debilitated animal (perhaps due to social aggression) needs fluids, supplementation, and antibiotics, it would be far easier for the veterinarian to treat it alone. I do see a single comment in your report about the husbandry and management decisions that would ensue if there are incompatible social settings. The tone conveys that all animals live in this **ideal Rousseauian world** (if only mother nature were truly that benevolent).

I also didn't see any option provided for **quarantine**. I find it interesting that vets are so willing to give up this traditional and important aspect of clinical care.

As you point out, there are national and cultural differences in values and expectations. I believe that I live up and achieve all of the goals listed below, but with a very different strategic plan.

* The young animal should be able to ingest and digest food such that separation from the parent does not lead to illness or death;

* The immune system of the young animal should be developed such that it can produce its own antibodies, such that separation does not lead to illness or death;

* The young animals should be able to develop such behaviour that separation does not lead to long-term tension, stress or behavioural problems;

* The suffering, which the parent animal experiences as a result from separation, should not be such that it leads to long-term stress symptoms of disturbed physiology, immunology or behaviour;

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E29-230313a

Thanks for your tolerance with my comments (even if they differ from yours and what others may believe).

I think if **you saw our monkeys, you would be favorably impressed by their health, appearance and behavioral wellbeing**. Indeed, **most American researchers and vets comment on how calm and acclimated our monkeys are compared to others they have seen** in different settings. **I would challenge anyone to match our fecundity, growth rates, reproductive success, and low illness rates, etc.**

Obviously, primates are not a major issue for the Netherlands. And your zoos will probably be able to tolerate this **attempt to mimic the natural setting** and living condition.

Fortunately, your **new guidelines** do not apply to us in the US who need to care for animals involved in biomedical research. They would be **unduly prohibitive**.

-

E18b-250313

...interesting just how much debate this can generate!

After consideration, please can you remove my name from the acknowledgments.

-

E8-250313

I am fine to have my name in the acknowledgements

The report looks very well-done. Congratulations

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E29-250313

You should probably remove my name from your report given that I disagree with several of the central tenets and recommendations. I wouldn't want it misconstrued to appear as if I concurred with its conclusions and guidelines. Would you please remove my name from your list of consultants?

I would prefer to have the freedom to publicly disagree with its conclusions and to point out the potential for actually causing harm and for being overly restrictive. As I understand the guidelines, there would even be the freedom for a vet to rescue a failure-to-thrive infant who might not be faring well with its biological mother, and be better off in a different setting away from her. Just to name one of many scenarios that were not given appropriate consideration.

-

Reply by Mod: OK. No problem to not-list your name. (Your name didn't have to be removed, as you never confirmed I could list it).

Of course an infant can be separated from its mother/natal group earlier for welfare and/or health reasons, and of course being listed in the acknowledgements wouldn't imply agreement with the recommendations. I could make that more clear.

I would be interested esp. to know why you concluded that the (recommendations for) legislation would not allow for earlier separation in specific cases (=6th recommendation).

-

Reply by E29-280313:

If your report permits any **flexible options**, or an administrative group to whom one can appeal for options, it's certainly not prominently described in your recommendations.

Obviously, this is your call. But you might want to provide the attending veterinarian with some discretion in the event of illness, injury, failure-to-thrive infants, etc. Unless it is assumed that vets can override these housing requirements for treatment and quarantine, as needed. [Note from Mod: In my view this point has been made sufficiently clear.]

I also sense that the guiding spirit and principle of this report is that **all social life is benign and benevolent**. Ask the female at the bottom of the dominance hierarchy how enriched she feels, and whether her welfare has been all that advanced as she is displaced and pursued by an aggressive monkey. As we know from human sociality, there is another side to group-living. It is also quite different in captive settings, where space is limited and emigration is not an option.

Assuming your social groupings include **adult males**, I fear you will also induce some unwelcome **injuries** by recommending that young males be maintained in the natal group as long as **3-4 years of age**. Even under natural conditions, subadult male monkeys in some species may be compelled to emigrate by that maturational point. [Note from Mod: Again, I believe this point has been accounted for in the report.]

I could go on criticizing the report and its assumptions at much greater length. **The notion that monkey females suffer undue stress and a decline in health by weaning their infants at 6-8 months is just factually untrue**. Yet, you state that conclusion as if a proven and known fact. [Note by Mod: I have strong doubts as to whether this has been stated anywhere in the report. If anything, it could/should only have been cited as implied by a consulted expert.] **Many seasonally breeding**

monkeys begin to cycle again and conceive their next offspring at this time point. So birthing an infant at annual intervals is not out of the realm of normalcy for some species, such as the squirrel monkey.

I know that I am repeating myself, but it is a **serious omission that the report fails to acknowledge the importance of the peer play group in monkey socialization.** When this type of juvenile peer group is used effectively, it lessens the need for the extended duration of contact with the mother through 2 years of age. [Note from Mod: This is indeed partly repetitious, partly it is an aspect that has not been emphasised by the other experts as much (though to some extent it has been and has been cited as such).]

But since these recommendations are for the Netherlands, **I will leave it to Dutch scientists, vets and care providers to raise these concerns. In 5 years I will be happy to challenge any Dutch facility with a head-to-head comparison of the health and behavioural wellbeing of their animals versus the ones we care for.** [Note from Mod: the main Dutch facility is already working within the constraints set by the recommendations.]

My criteria will also **include how many viral pathogens your facilities have passed on from the adults to the descendants. I find it very interesting that vets have become this focused on behaviour to the point that nutrition, growth, reproductive success, and disease transmission have almost become secondary issues.**

I appreciate you have good intentions. But **we have an expression in English about where good intentions can inadvertently take us.**

-

Reply by Mod: This latter point that should be taken seriously. I have previously suggested that **scientific evidence/empirical data** supporting this claim **seems indicated**, also taking into account the publication by Prescott et al. (2012). In addition, **critical monitoring of the consequences of any revised (and non-revised) legislation should be standard operating procedure.**

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