the universe in their orbits (very non-uniform/non-random; (f) and the most problematic: quantization of energy levels!

Scientists seem to gravitate toward the desire for continua—of fossils, of energy states, of behavior in naturally occurring compounds across the periodic table. Were one, though, without this emotional commitment or desire for a continuum (perhaps born of each man's need for a connection with the whole plan of things—for the time-based security of Linus' blanket) his thinking would be freed of uniformitarian bias.

Men of God in science are not so bound. Were they capable of objectivity in this area they would choose a creationist stand rather than that of the evolutionist, and would do so on scientific evidence alone. The faith required to fill in vast gaps ("missing links") is staggering, not only in the realm of biological and geological evolution, but, as noted in this article, in the realm of materials behavior, at the microscopic and macroscopic levels.

Such faith is great in mass and fantastic in quality if one considers merely the scarcity of continua. By adding the questions of the origin of the first Energy-Mass and of design probability (even allowing for a generous supply of "natural selection"), the faith required becomes humorous. How much more logical to believe in the all-wise and all-powerful Creator who planned and shall consumate the four dimensions in which we move! But one cannot be logical or objective in this regard without a life regenerated by this Creator—and Savior.

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[8]Lucken, *Op. cit.*

[9]Kubo and Nakamura, *Op. cit.*

[10]Pople, *Op. cit.*

HOW MANY ANIMALS IN THE ARK?*

ARTHUR J. JONES**

Biological arguments against a universal flood are answered through a comprehensive study of the relevant Biblical and scientific evidence. Biblical evidence bearing on the following points is studied: animal groups represented on the Ark, animals classed as clean, number of animals taken from each clean kind, and the gathering of the animals to the Ark. This is supplemented by a biological study of the number of kinds, the relative diversity of clean and unclean animals, and the problem of hibernation. It is concluded that biological arguments against a universal flood are invalid, and that the number of animals under Noah's care probably did not exceed 2,000.

1. Introduction

In the continuing debate over *The Genesis Flood,*[1] one particular group of criticisms has not been answered adequately. These criticisms are usually presented as a series of questions centering around the number of animals in the Ark:

(1) How was it possible to gather representatives of every type of animal?

(2) How could room for so many animals be found on the Ark?

(3) How could eight people feed and care for all these animals?

(4) If only a smaller number of creatures was involved—representatives of the main "kinds" or "orders" of animal life—then we have the evolution of thousands of new species in a far shorter time than the most ardent evolutionists have ever believed possible. Does belief in a universal Noachian Flood entail belief in extremely rapid evolution?

This article is an attempt to provide a comprehensive reply to these criticisms. The first

*This article is the third in a series dedicated to the memory of Dr. Jacobus Johannes Duyvené, de Wit (1909-1965), late Professor of Zoology, University of the Orange Free State, Bloemfontein, South Africa. The other two articles in this series are found in the *Creation Research Society Quarterly,* 9(1):53-57, June 1972; and 9(2):114-123, September, 1972.

**Arthur J. Jones, Ph.D., is a science lecturer at Bournville College, Birmingham, United Kingdom.

three sections contain a review of the Biblical evidence and the subsequent sections analyze the relevant taxonomic data. On this basis upper and lower estimates of the number of animals taken into the Ark can be provided.

2. Animal Groups Taken into the Ark

Any attempt to discover the limits of the groups represented in the Ark entails a thorough analysis of the usage of the Hebrew terms involved. This usage has been summarized in Figures 1-5 of the first article[2] in this series to which reference should be made.

Representatives of all the major groups of animals were taken into the Ark except the water swarmers *(sherets hammayim)*—no water-dwelling groups are listed.[3] But—and this has generally been overlooked—the terms are heavily qualified to make it clear that Noah did not take representatvies of all the subdivisions. All the subdivisions of beasts *(chayyah)* are included,[4] but invertebrate land swarmers *(kol marbeh raghlayim)* and swarming fliers *(sherets ha'oph)* are excluded, i.e. Noah was given no instructions concerning invertebrates. This is such an important point that the evidence must be given in full, as follows:

(1) All the animals taken into the Ark are described as *basar*, "flesh." This term (when used of whole living animals rather than simply the animal body) is never used of invertebrate animals.

(2) "the life (*nephesh* "soul") of all flesh is the blood of it" (Lev. 17:11, 14; Deut. 12:23; Gen. 9:4). In the Biblical and everyday sense, invertebrates do not have blood (Heb. *dam*).

(3) *Basar* is qualified by the phrase *"asher bo ruach chayyim,"* "which has in it the spirit of lives" (Gen. 6:17; Gen. 7:22). This additional phrase is likewise never used of invertebrates.

(4) In Genesis 7:14 *kol ha'oph* (every flier) is defined (through apposition) as *kol tsippor kol kanaph* (every bird every wing i.e. every bird of every sort).[5] The phrase *tsippor kanaph* definitely excludes insects.[6]

Thus only the following groups were taken into the Ark: (1) all birds, (2) all land-dwelling reptiles and mammals,[7] (3) possibly some of the more terrestrial amphibia.[8] This is not to say that land invertebrates were not present on the Ark (it would be impossible to exclude them!), but simply that Noah did not have to make arrangements for them nor to *take* them onto the Ark.

3. Clean and Unclean

3.1 Animals classified as "clean"

It is difficult to determine exactly which groups were regarded as "clean," but a survey of the Biblical references to animals legally used for sacrifice and (in the Post-Flood era) for food[9] suggests that only the following groups were included:

(1) Cervoidea: deer (Cervidae); giraffes (Giraffidae).

(2) Bovoidea: pronghorns (Antilocapridae); cattle, antelopes, sheep and goats (Bovidae).

(3) Columbiformes: pigeons (Columbidae); dodos (Raphidae); sandgrouse (Pteroclidae).

(4) Galliformes: megapodes (Megapodiidae); curassows (Cracidae); grouse (Tetraonidae); pheasants (Phasianidae); guineafowl (Numididae); turkeys (Meleagrididae).

(5) Passeres many families of song bird—sparrows, finches, etc.

(6) Probably also ducks, geese and swans (Anseriformes, Anatidae).

3.2 Two by two

The first command given to Noah was that he was to bring the animals into the Ark in pairs: "pairs (*shenayim*, collective[10]) of all you shall cause to come into the Ark" (Gen. 6:19). Later he was instructed as to the *number* of pairs which he was to take: *one* pair of each unclean kind, but *seven* pairs of the clean *behemah* and clean birds (Gen. 7:2-3). The only point which needs to be discussed here is the question of the number of clean animals, since commentators are divided between "seven" and seven pairs."[11] The arguments for "seven" are as follows:[12]

(1) Hebrew parallels support "seven."

(2) "Seven, seven" (Gen. 7:2-3) is a most clumsy method of trying to say "fourteen" (which is usually *"arba asar,"* four (and ten).

(3) The seven consists of three pairs and one supernumerary which Noah could conveniently offer for sacrifice after the Flood (Gen. 8:20). Significantly Man also comes from three pairs—the three sons of Noah and their wives.

(4) For what reason would Noah have to crowd the Ark with so many extra clean animals?

Although most creationists have accepted these arguments, they do not seem to be valid; for the following reasons for each of the four arguments:

(1) True Hebrew parallels (i.e. repetition of the numeral only) are in fact quite scarce,[13] the following being all that I can discover: a) Gen. to you *seven seven* man and his wife" = ?, b) Gen. 7:3—"also from (all the clean) fliers of the heaven (you shall take to you) *seven seven* male and female" = ?, c) Num. 3:47—"you shall take *five five* shekels for a poll" = "*five* shekels for *each* poll," d) Num. 7:86—"twelve golden pans . . . *ten ten* (shekels) the pan" = "*ten* (shekels) *each* pan," e) I Chron. 26:17—"to the storehouses *two two* (Levites)" = "*two (Levites)* for *each* storehouse," f) Ezk. 10:21, "*four four* faces to one (cherubim)" = "*four* faces to *each* one."

Less exact parallels (i.e. repetition of both numeral and antecedent) are more common,[14] e.g.: g) Ex. 36:30—"*two sockets two sockets* under one board" = "*two sockets* under *each* board"; h) Num. 34:18—"*one prince one prince* from a tribe" = "*one prince* from *each* tribe";[15] i) Isa. 6:2—"*six wings six wings* to one (seraphim)" = "*six wings* to *each* one," Cf. Num. 17:2—"*rod rod* for a father's house" = "*a rod* for *each* father's house."

Those commentators who state that this repetition of the noun expresses distribution are clearly correct. However this does *not* settle the issue in favor of "seven," because the meaning of Genesis 7:2-3 hinges not on the idiom "seven 7:2—"from all the clean behemah you shall take seven," but on the antecedent. The distributive numeral always has an antecedent, either expressed (see nos. c & f above) or clearly understood from the immediate context (see nos. d & e above).

In Genesis 7:2 I would suggest that the antecedent is "man and his wife." In this verse the phrase "from all the clean *behemah*" occupies an emphatic position at the head of the sentence. Its normal position would be after "man and his wife," i.e. "you shall take to you seven man and his wife (i.e. seven mated pairs) from each and every *behemah*."[16] The evidence for this interpretation is as follows:

Firstly, if "man and his wife" is not the antecedent, then none is available. In all other cases the antecedent immediately accompanies the distributive (or is so understood), or is actually included in the repetition. Thus this interpretation brings Genesis 7:2 into exact parallel with the cited references.

Secondly, in Genesis 7:2 we have the unusual phrase "*'ish we'ishto* 'man and-his-wife"[17] instead of the usual "male and female" which is resumed in verse three.[18] The phrase *'ish we-'isshah* means simply "man and woman" but *'ish we'ishto* specifically designates a married couple. In such a context as Genesis 7:2 *'ish* also carries a distributive connotation, i.e. "every male with his mate."[19] This decisively supports our interpretation.

To interpret the verse as "seven of each kind" is to create a major problem—the unpaired supernumerary—for which the text provides no solution but only aggravation. Four times (Gen. 6:19-20; 7:2-3, 8-9, 15) the account emphasises that all the animals were taken into the Ark in pairs. The account also makes it clear that the purpose was propagation: "to keep seed alive upon the face of all the earth" (Gen. 7:3).

Thirdly, "In the case of the unclean animals we have *shenayim* (two) once, i.e. 'one pair', and we may reasonably presume that had the narrator intended seven individuals here, we should have had *shibh'ah* (seven) once."[20]

(2) "Seven seven" is indeed a clumsy method of saying, "fourteen," but Moses didn't want to say, "fourteen"! He is establishing the principle of *mated pairs* and for this the Hebrew "four ten" is quite inappropriate.

(3) The numeric argument is hardly coercive. There is no Biblical reason why there should be a stock of three pairs, nor, in fact, are we told how many animals from each kind were sacrificed.[21] If any significance is to be given to the numbers then it should be remembered that in Biblical numerics both two and fourteen signify some form of separation. Be that as it may, the presence of supernumerary animals on the Ark is very unlikely.

(4) The prime object of this article is to demonstrate that there was no population problem on the Ark! Since the number of clean kinds is relatively small, the interpretation "seven pairs" has only a small effect on the calculated total.

The reason for the taking of seven times more clean animals than unclean seems straightforward: firstly, clean animals were required for sacrifice; secondly, they would be required to provide clothing and food (cf. Gen. 9:3) after the Flood (the environment being radically changed); thirdly, as these were becoming vulnerable prey animals they required a head start for survival (cf. Gen. 7:3).[22]

4. The Number of "Kinds" in the Ark

In the second article[23] of this series, it was demonstrated that the Biblical Kind is generally equivalent to the *family* of our current vertebrate classifications although the separate created kinds may have been much smaller in scope than the "Families" of modern taxonomy. This being so we can at last make some meaningful calculations.

The following figures for vertebrate families can be extracted from the lists compiled by Romer:[24]

Table One: Vertebrate Families

	Living	Extinct	Total
Amphibia	23	58	81
Reptilia	38	192	230
Aves	155	39	194
Mammalia	125	163	288
	341	452	793

The total figure of 793 is subject to two reductions. Firstly, many Amphibia must be excluded. I would in fact argue that few if any of the 81 families were represented on the Ark. (See Reference and Note no. 3 again.) Secondly, all water-dwelling groups must be excluded.

These comprise the following 84 families:

(1) Reptiles: Mesosaurs (Mesosauria), Turtles (Chelonia), Mosasaurs; water snakes; sea snakes (Squamata: Mosasauridae, Acrochordidae, Hydrophiidae), Crocodiles (Crocodilia), Nothosaurs, plesiosaurs (Sauropterygia), Placodonts (Placodontia), and Ichthyosaurs (Ichthyosauria).

(2) Mammals: Dolphins, whales (Cetacea), Seals (Pinnipedia), and Dugongs, manatees (Sirenia).

A conservative estimate of the number of kinds to be cared for by Noah is thus 628 (i.e. 793 — 81 — 84). For a liberal estimate, two factors which enlarge the total must be considered. Firstly, there must surely be some extinct families, fossil remains of which have not yet been discovered (and perhaps never will); and, secondly, some of the families listed by Romer almost certainly comprise several "kinds."

I feel that these sources of error are to some extent balanced out by those families (e.g. amongst bats and song birds) which comprise only a part of a kind, but 800 may fairly represent the end of the range of kinds. Thus between 628 and 800 kinds were taken into the Ark, 700 being about the figure I would favor.

5. The Number of Animals in the Ark

5.1 Clean and Unclean: Diversity and Paucity

In order to convert the total number of kinds into a total number of animals, we need to know the number of clean kinds. This presents a major problem, but the analysis is very revealing. The problem is the familiar one created by "splitting" and "lumping," i.e. some workers "lump" a diversity of forms into one taxa of a particular rank, whereas others "split" the group into several taxa of that rank. The point of interest, however, is that at the family level this problem especially – and often exclusively – attends the groups of clean animals.

On the whole unclean animals fall into clear-cut, basically homogeneous groups and present few taxonomic problems at the family level. A few quotations will illustrate this. Of the perching birds Van Tyne and Berger write, "there is considerable disagreement both on the number and arrangement of passerine families," while in contrast "many (avian) families are so well marked that there is not the slightest disagreement among ornithologists about which species should be included in those families."[25]

This difference is easily emphasized by comparing the work of Van Tyne and Berger with that of Thomson.[26] Van Tyne and Berger list 101 extant non-passerine families, Thomson lists 98—a 3% difference. But whereas Van Tyne and Berger list 67 passerine families, Thomson lists only 56—a 16% difference!

If we turn to the deer, we find Simpson writing, "Almost every genus of living cervids has been taken as type of a supposedly distinct family."[27] Of the bovids Ellerman and Morrison-Scott write, "This family is very difficult to classify and no two authors agree on the various subfamilies or minor divisions, some of which seem to be indefinable and unconvincing."[28] Simpson writes that with the possible exception of some rodents, the Bovidae is "the most difficult of all mammalian families from a taxonomic point of view."[29] Gray,[30] for example, split the bovids into fifteen families!

Several creationists have noted this situation; and pointed out, that there seems to be a definite correlation between the greater number of clean animals taken into the Ark and their present diversity, as compared to the single pair of unclean animals and their present paucity.[31] A detailed comparison abundantly confirms this suggestion. In Tables Two and Three I have set out the extinction ratios for clean and unclean hoofed animals *(behemah)*:[32] the contrast is quite evident:

Table Two: Extinction Ratios for Unclean Hoofed Animals

FAMILIES		GENERA	
% extant	% extant in Pleistocene[33]	% extant	% extant in Pleistocene[33]
25.0	31.8	5.7	15.3

Table Three: Extinction Ratios for Clean Hoofed Animals

FAMILIES		GENERA	
% extant	% extant in Pleistocene[33]	% extant	% extant in Pleistocene[33]
100	100	26.3	62.2

5.2 The number of clean kinds

With this background we can turn to an analysis of the clean families. In most cases the number of currently recognized subfamilies will be adopted as a liberal estimate of the number of kinds.

(1) There are two families of Cervoidea, the Cervidae comprising four subfamilies,[34] and the Giraffidae three. This gives a range of 2-7 "kinds."

(2) The Bovoidea comprises two families, of which the Antilocapridae contains two subfamilies and the Bovidae five. This gives a range of 2-7 "kinds."

(3) The Columbiformes contains three clean families which comprise seven subfamilies, a range of 3-7 "kinds."[35]

(4) Most authors recognize six families of game bird, but Romer[36] recognizes only four

and hybridiization data[37] would suggest that even this is too many. Possibly only two kinds (the two superfamilies)—or even one—need be considered. The Phasianidae comprises two subfamilies so the range is 1-7 "kinds."

(5) The duck family (Anatidae) contains three subfamilies giving a range of 1-3 "kinds."

(6) Romer[38] lists 48 families of Passeres (song birds). Of these about 30 would be clean. But whereas the clean mammals have possibly been excessively "lumped," the clean birds have suffered the opposite fate.[39] A range of 15-35 "kinds" seems fair.

Thus the total number of clean kinds will fall between 24 and 66 and the unclean between 604 and 734. At one pair for each unclean kind and seven pairs for each clean kind this gives extreme estimates of 1,544 and 2,392 for the number of animals taken into the Ark. Of these two numbers the lower is doubtless nearer the truth than the higher. It need hardly be emphasized that even the liberal estimate is far lower than any of the calculations given by those who argue either for or against the universal flood position.

The Size of the Ark

The proposal that the Ark was basically for only 8 people and 2,000 animals is rather startling and of course invites the response, "Why, then, was the Ark so large?" Morris[40] notes that the Ark had a volumetric capacity equal to that of 522 standard railroad stock cars. This number of cars could carry over 100,000 animals of the size of sheep. Evidently there is some discrepancy!

I share with Dr. Morris the belief that the Ark would have been perfect for its task, but I have long been unhappy about this particular argument. In the nature of the case, discussion of these matters must be somewhat speculative; the Bible simply doesn't give us the details we desire. Nevertheless we have, I believe, sufficient grounds for concluding that, large as the Ark was, it was not too large for only 2,000 animals.

In brief, the Ark was not designed for short-term *transport*, but for longer-term (one year) *living*. It was designed to preserve a world of living creatures through a cataclysm; thus:

(1) The extensive subdividing and bulkheading of the floors and nests,[41] the ramps for exit from the Ark and for access from floor to floor and the gangways to the nests (Gen. 6:14-16) would significantly reduce the space available for animals.

(2) Since the Ark had to be completely watertight (Gen. 6:14), there also had to be sufficient internal free space to prevent unbearable fouling or heating of the air.[42]

(3) Living space for four couples (Noah and his three sons and their wives) for a year would have been substantial.

(4) Noah was instructed to take onto the Ark, "all food that may be eaten and gather it together unto thee that it may be to thee and to them (the animals) for eating." (Gen. 6:21). Even though periodic hibernation (see below) would reduce the amount of food needed, the volume occupied would still be considerable, especially since the food would be largely, if not entirely, vegetable. The food may well have filled more space than the animals. Provision for water storage would also be needed.

(5) Space for the collection and temporary storage of excreta would be needed.

(6) The animals were to live on the Ark for a *year*. Must we consign the animals to cramped conditions for this length of time? Sufficient space for exercise and simply living would be required so that the characteristic behavior of each kind would not be stifled.

(7) During the year on the Ark, many of the animals would have reproduced and thus would have created further demands for space (although food storage areas will have become available during the year).[43]

6. Gathering the Animals

An answer to the question regarding the gathering of the animals is very straightforward. It probably was impossible to gather representatives of every kind, because Noah was not told to do this. The Lord commanded Noah to "cause (the animals) to come *into the Ark*" (Gen. 6:19) and to "take to you (*into the Ark*—Gen. 7:1)" all the *behemah* and birds (Gen. 7:2-3), but he was told that they would come to him for this purpose:[44]

(a) Gen. 6:20—"pairs of all *shall come unto you*"

(b) Gen. 7:9—"two by two *they came unto Noah*"

(c) Gen. 7:15—"*they came unto Noah* unto the Ark two by two"

(d) Gen. 7:16—"*the coming ones came* male and female of all flesh."

"Consequently, all thoughts about elaborate trapping expeditions may readily be dismissed."[45]

7. Caring for the Animals

7.1 Preliminary considerations

Whitcomb and Morris calculated that "at the outside, there was need for no more than 35,000 individual vertebrate animals on the Ark."[46] Filby, a proponent of the local Flood theory, compares this with the fact that there are only 720 minutes in a 12 hour working day, i.e. each member of Noah's family would have to see to six animals every minute.

According to the figure of 2,000 animals used in this paper, the burden is reduced to about one animal every three minutes, but this type of calculation is really quite meaningless. If some university or zoo staff members were to so meditate on the number of animals in their charge, they would soon look for another job! Noah and his family would certainly have a lot to do, but it does not take that long to look after animals.[47]

7.2 Hibernation

In common with many others, Whitcomb and Morris suggest that the animals may have hibernated on the Ark, thus obviating the need for extensive care.[48] To this Filby replies that Noah was commanded to take of all food that is eaten "for thee and for them" (Gen. 6:21): "one doesn't feed hiberating animals."[49] However this is beside the point.

No one is suggesting (I hope) that the animals slept throughout the Flood year, but simply that they would have slept during the worst periods. Faced with the conditions on the Ark (falling temperature; reduced light; restriction on movement, etc.), the natural reaction of many animals would be to go to sleep.[50] Hibernation, in the strict sense, is only a small part of a wide spectrum of animal behavior.

In the tropics many small animals go to sleep to avoid the peak of the dry season—a phenomenon distinguished as *aestivation* although physiologically it is probably the same as hibernation.[51] Even an occasional short period of unfavorable conditions will prompt many animals to sleep through it; and larger animals, such as bears, will remain in a semi-dormant state in their dens for months during the winter.[52]

When hibernating, animals do not remain in that condition indefinitely, but arouse periodically in a rhythmic manner every few days or weeks.[53] As soon as conditions on the Ark improved the animals probably awoke and ate. The ability to enter into prolonged "sleep" is probably a common property of animals. That property was originally intended very possibly to meet the need for a period of rest.[54]

8. Speciation

An answer to the final item of the criticism must be deferred to following articles in this series, since a detailed scientific analysis of the "kind" is required. Suffice it to say that speciation can indeed be very rapid for the simple reason that it is not an *evolutionary* process.

9. Conclusion

The biological criticisms of *The Genesis Flood* which center around the number of animals on the Ark have been examined and found wanting. The number of animals under Noah's care probably did not exceed 2,000.

References and Notes

[1]Whitcomb, J. C. and H. M. Morris. 1961. The Genesis Flood. Presbyterian and Reformed Publishing Co., Philadelphia. Criticisms have been put forward in the *Christian Graduate* 22, p. 27 (1969) and *The Witness*, November 1970. p. 429 and *Faith and Thought*, 98 (2-3):61-68. 1972. See also issues of the *Journal of the American Scientific Affiliation*, U.S.A.

[2]Jones, A. J. 1972. Studies on the Biblical "Kind." A general analysis of min (kind), *Creation Research Society*, 9(1):53-57. June.

[3]Inclusion of amphibians must be left an open question, although many forms would clearly be excluded. Frogs (*tsephardea* Ex. 8:2-13; Psa. 78:45; Psa. 105:30) are almost certainly classed as water swarmers. See note 8 below.

[4]Genesis 7:14. Note that the terms are identical to those used in Genesis 1. The attempt which is often made to restrict the cargo of the Ark to domestic animals would require that only domestic animals are mentioned in the account of creation!

[5]This verse is generally interpreted as if the phrase meant "every sort of bird *and* every sort of winged creature" (e.g. by Calvin, Delitzsch and Leupold), but this would require a copulative *waw* ("and") before *kol kanaph*. The phrase strictly and only means "every sort of bird" (Spurrell, Cassuto). The phrase occurs again in Ezekiel 17:23; and 39:4, 17 where its meaning is beyond doubt. Similar constructions are found in 2 Chronicles 32:15, "no god of any nation" *(kol 'Eloah kol goy)*, and Ezekiel 44:30, "all first fruits of all kinds" *(kol bikkure kol)*, "all offerings of all kinds" *(kol terumath kol)*.

[6]Deut. 4:17; Psa. 148:10.

[7]Forms which spend their whole life in the water are classed as water swarmers, e.g. ichthyosaurs, whales.

[8]I think particularly of the earthworm-like caecilians (Caecilidae).

[9]The possibility must be borne in mind that the categories "clean for food" and "clean for sacrifice" may not be co-extensive, i.e. the latter may be wider than the former.

[10]Martin, W. J. 1955. Stylistic criteria and the analysis of the Pentateuch. Tyndale Press, London, p. 16; and Kitchen, K. A. 1966. Ancient Orient and Old Testament. Tyndale Press, London, p. 120.

[11]Of 42 commentators I have checked, 23 argued for "seven pairs" and 19 for "seven."

[12]Whitcomb and Morris. *Op. cit.*, p. 65.

[13]Repetitions with a connecting *waw* are also found: 2 Sam. 21:20; 1 Chron. 20:6 and Zec. 4:2. Repetition also serves other functions, e.g., "two *by* two" (Gen. 7:8-9, 15), "day *by* day" (Gen. 39:10).

[14]A connecting *waw* is often found: Ezk. 40:10, 12; and 41:1.

[15]Also Num. 13:2; Jos. 3:12; and 4:2, 4; and 22:14.

[16]"each and every"—an attempt to represent in the English translation the emphasis created by the combination of *kol*, "all," with a distributive repetition.

[17]The term *'ish* or *'adham* with *'ishto* is elsewhere only used of mankind and always denotes a married couple (Gen. 2:25; Num. 5:15; and 30:16; Jdg. 21:21, 22; Jer 3:1). Contrast Isa. 34:15-16 where *re'uth* "fellow" is used of animals.

[18]"since the text has here *the male and his mate*, the expression is repeated in the second half of the verse, in order to preserve the parallelism, and to make it clear that the clean and unclean animals differed only

in regard to the *number*—not the principle—of (mated) pairs. In verse 3, after the signification of the numerical idiom *seven seven* had been established, it was possible to revert to the use of the normal formula male and female." (Cassuto, U. 1964. A commentary on the book of Genesis. Part II From Noah to Abraham. The Magnes Press, Jerusalem, p. 74.)

[19]For the distributive use of *'ish* see Genesis 11:3, 7; 9:5; 10:5; 40:5; etc. For this usage with *'ishto* see Judges 21:21-22.

[20]Spurrell, G. J. 1896. Notes on the text of the book of Genesis. Second Edition. Clarendon Press, Oxford, p. 80.

[21]If Noah sacrificed one animal for each member of his family (cf. Job 1:15) then three pairs would be left. This is highly unlikely but serves to show the inconclusiveness of this type of argument. Many of the animals will have reproduced during the Flood year so it is probable that young forms were sacrificed and not breeding adults.

[22]A comparison of extinction ratios for clean and unclean *behemah* illustrates this point extremely well. See section 5.1 for Tables Two and Three.

[23]Jones, A. J. 1972. Boundaries of the Min: An analysis of the Mosaic lists of clean and unclean animals, *Creation Research Society Quarterly*, 9(2):114-123.

[24]Romer, A. S. 1966. Vertebrate paleontology. Third Edition. The University of Chicago Press, Chicago, pp. 362-396.

[25]Van Tyne, J. and A. J. Berger. 1959. Fundamentals of ornithology. John Wiley and Sons, Inc., New York, pp. 368, 376.

[26]Thomson, A. L. (Editor). 1964. A new dictionary of birds. Thomas Nelson and Sons Ltd., London.

[27]Simpson, G. G. 1945. The principles of classification and a classification of mammals, *Bulletin of the American Museum of Natural History*, 85:152.

[28]Ellerman, J. R. and T. C. S. Morrison-Scott. 1966. Checklist of Palaeartic and Indian mammals, 1758-1946. Second Edition. Trustees of the British Museum, London, p. 377.

[29]Simpson, G. G., *Op. cit.*, p. 270.

[30]Gray, J. E. 1872. Catalogue of the ruminant Mammalia (Pecora, Linnaeus) in the British Museum. Trustees of the British Museum, London.

[31]E.g. Lammerts, W. E. 1966. The Galapagos Island finches, *Creation Research Society Quarterly*, 3(1): 73-79.

[32]Based on Romer's data for the Hyracoidea, Perissodactyla, Artiodactyla and Lagomorpha.

[33]I suspect that the figures for the evolutionist's "Pleistocene" give a truer picture of the situation immediately after the Flood.

[34]For convenience I have taken all the mammalian figures from Simpson (*Op. cit.*, 1945) as modified by Romer (*Op. cit.*). However I dissent from the figure for the Cervidae. The peculiar antler-less musk deer (Moschinae: *Moschus*) is almost certainly unclean and belongs either to a separate family, Moschidae (Garrod, A. H. 1877.) *Proceedings of the Zoological Society of London*, pp. 287-292; and Pocock, R. I. 1910. *Ibid.*, pp. 937-939) or, as Romer suggests (*Op. cit.*, p. 287), to the otherwise extinct Palaeomerycidae. The Chinese water deer (*Hydropotes*—included in the Odocoileinae) is also possibly an unrelated form.

[35]Figures for the bird families are taken from Thomson, *Op. cit.*

[36]Romer, A. S. *Op. cit.*, pp. 375-376.

[37]Gray, A. P. 1958. Bird hybrids. A check-list with bibliography. Commonwealth Agricultural Bureaux, Farnham, pp. 77-119.

[38]Romer, A. S. *Op. cit.*, pp. 378-379. The figure for clean families includes all those whose members are primarily herbivorous/insectivorous.

[39]The family Muscicapidae (Flycatchers) includes forms which have been placed, at various times, in some 25 families!

[40]Whitcomb, J. C. and H. M. Morris. *Op. cit.*, p. 67. Also *Creation Research Society Quarterly*, 8(2):142 (1971) where Morris gives a larger figure.

[41]The force of the accusative plural "nests" in Gen. 6:14 is "make it (all) nests."

[42]The only window space in the Ark ran along under the roof (Gen. 6:16).

[43]In the detailed description of the disembarkation, it is not said that the animals left the Ark in pairs (as is said of the embarkation in Gen. 7:9, 15), but simply that they left according to their kinds. The description in regard to Noah and his family is the same in both cases (Gen. 6:7, 13 and 8:18).

[44]Leupold, H. C. 1942. Exposition of Genesis. (1968 printing). Baker Book House, Grand Rapids. Volume I, pp. 276-277, 299.

[45]Leupold, *Ibid.*, p. 277.

[46]Whitcomb, J. C. and H. M. Morris. *Op. cit.*, p. 69.

[47]I speak from experience. I have had to look after some 30 tanks containing several hundred fish in breeding condition. These all had to be cared for every day!

[48]Whitcomb, J. C. and H. M. Morris, *Op. cit.*, p. 71.

[49]Filby, F. A 1970 The Genesis Flood (letter to the editor), *The Witness*, p. 429. Cf. Filby, F. A. 1970. The Flood reconsidered. Pickering and Inglis Ltd., London, p. 85. (Also available from Zondervan Publishing House, Grand Rapids, Mich. 49506.)

[50]See articles in Mammalian Hibernation III (K. C. Fisher *et. al.*, editors) Oliver and Boyd, Edinburgh and London. 1967.

[51]See Pengelley, E. T. 1967. The relation of external conditions to the onset and termination of hibernation and estivation *(in)* Mammalian Hibernation III. *Ibid.*, pp. 1-29.

[52]See Folk, G. E. 1967. Physiological observations of subarctic bears under winter den conditions *(in)* Mammalian Hibernation III. *Ibid.*, pp. 75-85.

[53]Pengelley, E. T. *Op. cit.*

[54]That hibernation satisfies a need for rest was suggested by Walter Heape in Emigration, migration and nomadism. Edited by F. H. A. Marshall. W. Heffer and Sons Ltd., Cambridge, chapter IX, pp. 304-320. 1931. (This suggestion should be followed up. Was there, for instance, an animal equivalent of the one day of rest in seven established for man?)