The various aspects related with animal behaviour can be studied by employing following methods :

1. Under natural conditions
2. Experimental analysis
3. Statistical interpretation of data.

1. Under Natural Conditions

The best way of studying animal behaviour is under natural conditions. Observations may be in the form of field notes, check-list of behaviour patterns, tape recorders, motion pictures, etc. While studying animal behaviour in natural surroundings, circadian rhythms and seasonal cycles are taken into consideration.

2. Experimental Analysis

Experiments are conducted in two ways *viz.* **field experiments** and **laboratory experiments.**

1. Field Experiments : These are performed with least disturbance to the animals. The first phase involves a thorough description of all aspects of the animal under observation. For this, binoculars and infra-red devices are required. When more than one individuals are to be observed, it is desirable to make cinematographic or portable TV recordings. In field experiments it is most essential to identify the animal correctly.

For the next phase of study, following aspects of study are more important :

(a) **Protective behaviour** : It involves defensive behaviour against predators like **camouflage** (a form of visual deception) and **threat** (a form of communication that usually occurs in situations involving mild aggression and fear).

(b) **Social system** : It is the most complicated behaviour as the animals under study occupy the same ecological niche and competition tends to be more among members of the same species. Social behaviour makes it possible for the individuals of a community to make adjustments between the antagonistic tendencies to cluster and to disperse in a way that suits them the best. This social system in animals can only be revealed by field studies in the natural habitat. The most appropriate approach to study behaviour is on comparative basis.

(c) **Communication** : The conclusions derived from comparative observations can be tested experimentally by studying **Fixed Action Patterns (FAP)** or **stereotyped patterns** which are similar to reflexes.

It is now established that many FAP are controlled by brain, e.g., rapid escape responses of squid and crayfish, the flight of locust and the song of cricket.

Some FAPs subserve the purpose of communication within a species. Examples of communication are numerous, *viz.* song in birds, whales and cricket; flashing in fireflies and deep sea fishes; tail-wagging in dogs, roaring in lions, hissing in snakes and cats and waving of arms in man and jumping spiders.

To investigate these signals, one should study the consistency of the reactions of an animal, while attempting to manipulate the behaviour by presenting it with the essential features of different signals.

Nervous and hormonal systems affect the animal behaviour thus giving a large number of variables. These can be reduced by keeping animals in captivity and using them in laboratory studies.

2. Laboratory Experiments : Laboratory studies can be done adopting the following methods :

(1) **Measurement of behaviour by direct observation** : Recording of preliminary observations may be in the form of notes, recording on tape recorders and photographic recordings.

The analysis of behaviour requires proper categorisation of behaviour patterns. In simple behavioural studies the records maintained on paper, tape or video-films are satisfactory but complex behaviour patterns can directly be observed by using event recorders which register sequences of events continuously for a period of time.

(2) **Automatic measures** : Operant method is the most common automatic method. It mainly consists of training an animal to perform a task to obtain a reward. It is a psychological process of learning, e.g., rat may be trained to press a bar or a pigeon to peck a prey to obtain a food reward.

Many types of experiments utilize operant procedure. This technique has proved useful for studying the effect of different types or patterns of reward.

(3) **Control** : Control is essential in experimental studies. These are of two types :

(1) **Control of experimental design** : In this case the control animal and the experimental animal are tested simultaneously. When the experimental animal responds, the same consequence is given to both the animals. For example, a monkey which received electric shocks for making incorrect responses for a simple task developed gastric ulcers, while its control remained healthy because he did not have to make decisions though it also received the shocks.

(2) **Control of environment** : Experimental data usually shows variability. It can be reduced by careful control of environmental factors. Food and water availability and ambient temperature should all be controlled in the animals' environment. Following precautions should be taken before performing the experiment :

(a) Control and experimental animals should be tested simultaneously.

(b) It is best to rotate the order on repeated tests.

(c) Every invividual behaves in a different manner. Therefore, only those animals should be taken which match to the maximum extent.

(d) Social environment should be maintained constant by raising animals in isolation.

(e) As light, temperature and noise affect the animals, they should be controlled.

(f) To achieve accuracy of the tests, tests should be carefully repeated.

3. Statistical Analysis

After performing the field or laboratory experiments, the data is reduced to numerical values by statistical methods. Arithmetic mean is usually sufficient and should be accompanied by some measure of variability.

Descriptive statistical data are used to help draw inference concerning conditions which brought about the change in statistical value e.g. it is known that density of animals may be related to geographical conditions (latitude, longitude and altitude), climate and other ecological aspects. Suppose we have data showing relative population densities of a species for a period of 10 years and a systematic shift out of one region into another was observed. This shift may be related to certain ecological factors and thus be able to predict that when certain aspects of the ecology changed, there would be a movement out of a particular region.

Table 1 : ADVANTAGES AND DISADVANTAGES OF THREE METHODS

Method	Advantages	Disadvantages
Natural	Best way to gain knowledge concerning natural behaviour patterns, both individual and social variables for future experimental analysis may be isolated.	Lack of controls may lead to ambiguity in interpretation.
Experimental	Rigid control over environmental events. Ability to manipulate variables in systematic manner. Excellent for isolations of relevant antecedent conditions.	Artificiality of laboratory conditions may affect generality of findings.
Statistical analysis	Excellent for population descriptions. Relationship among many measures can be determined by correlation techniques.	Lack of control leads to difficulty in interpretations.