PHASE 1

BEFORE YOU EMBARK ON THE FIELD WORK

As described in the main text, most of the hard work in any field study occurs before anyone goes into the field. You need to dearly identify what questions you are interested in and where and how you think you are going to answer them. Advice to help you to do this is given below.

STEP 1: DECIDE ON THE QUESTIONS As in most other studies, questions in ecology can be divided into broad categories of What, Where, Who, When, How and Why, although there are many variations on these general themes.

What? If you know little about your study area, you will probably begin with the simple question What lives there? Which animals and plants are found in the study site? what? This actually covers a range of questions. Are you interested in all of the animals and/or plants? If you think that you are, it is important to realise that you cannot see many thousands of them. Despite good intentions, even the best field observers only see the largest and the slowest organisms, so you are necessarily only going to get information about a subset of all those present. This is not a problem but it does need to be kept in mind when you are describing what you have found.

Instead of all species, you may only want to know whether certain species are present or absent, especially if you are interested in endangered species or weeds. Another reason that you might want to focus on only one or a few species is because it is difficult to identify all species in any study area. If you are planning to compare your area with others, or to examine how it changes through time, you might want to choose obvious or numerous species, *e.g.* blue periwinkles or cunjevoi on seashores, or Indian mynahs and noisy miners in local parks and school grounds. This choice will, to some extent, be governed by the questions you are interested in but, realistically, will also be governed by your abilities. There is little point in pretending that you can tell all of the different seaweeds apart - even experts can't do this without a microscope. But most people could learn to identify a few obvious types, such as Neptune's beads, *Hormosira banksii,* or sea cabbage, *Ulva lactuca*. This also stops you getting overwhelmed by the task of trying to identify everything at the expense of enjoying what you are doing.

How Many? Questions about What? quickly lead onto How many are there? It is obvious that there is a wealth of difference between one individual being present and many hundreds being present. For this reason, ecologists spend a lot of time in the field counting things. Many people have the idea that this is what ecology is - counting and measuring things. It isn't - it is trying to understand why animals and plants are found where they are, but to do this we do need to know how many are where! The questions What? and How many? require different data to answer them, but for each you will need to know how to find, identify and possibly count organisms. Details on these procedures are given later.

Where? The next question that you might want to think about is Where? This question has two different components. The first is to do with where you want to do your study. Are you looking at one particular place, e.g. one piece of bushland or one rocky shore, or are you interested in a number of apparently similar places, such as school yards or neighbourhood parks. It is best to start thinking about your ideal study, but be prepared to scale it down if it becomes too large. A small study done thoroughly is more useful than a large study that is full of holes or meanders around aimlessly.

This is where networking comes in. Networking will allow a number of small studies to be integrated into one larger study. Knowledge is built up slowly, but if you are patient and develop an d stick to a well-thought out set of appropriate procedures, you will make progress. An ideal result of networking is that the same sorts of information will be collected from different sites, perhaps patches of mangroves down a river, a number of local seashores or school grounds in the inner city or near the mountains. These results together will give you some idea about how similar or different study areas are. You might then want to think about why some places might be different from others - keeping in mind, of course, that no two places are naturally the same.

Once you have decided on your study area, you may be interested in other questions about Where? Wherever you are, if you look around, you will see that the same animals and plants are not found everywhere. Most barnacles on seashores are not found where there are lots of seaweeds. Some weeds seem to grow more profusely where there are few trees. Some birds are often seen feeding on the ground, whereas others are usually found in bushes or trees . These patterns of distribution and abundance of animals or plants tell us a lot about their ecological relationships. This information might be very important for their future well-being. You might want to look at where different species are found within your study area to get some idea about the sorts of habitats they use.

These questions require the development of different skills, such as mapping and identifying what is meant by different habitats. Identifying different habitats seems easy, but isn't. You must avoid getting into the circular argument "This species seems to only occur in holes in the rock. How do I define what a hole in the rock is? That is easy, it is where this species is found." This may seem trite, but it is difficult to avoid circular reasoning unless you develop good, objective observational and mapping skills.

When? When? Is also an interesting question. You may be interested in when certain species are found in your study area. Are the same animals or plants there during the day and night, during summer and winter? If different species are found in your area at different times, you might get the wrong impression about what lives there if you only look at it once. This will also make it impossible to compare your area with someone else's, especially if they have also only looked at it once. How much time you want to put into this question, will depend on your interests and, of course, the amount of time that you have. Be realistic about this. And then be realistic about the value of the information you are collecting if you only look at a place once or twice.

It is very important to collect information in the same habitat on many different occasions if you want an idea of natural rates of change, or if you want to see if a place is changing because of some managerial strategy. There is overwhelming public perception that natural habitats do not change unless we come along and mess around with them. This is nonsense. Many ecologists spend a lot of time measuring natural rates of change, so that they will be able to detect whether we are having an adverse or beneficial effect on the natural environment. Networking is probably the only way that unpaid community groups or schools can collect sufficient information about natural changes in habitats. It is also the only way that they will see the world the way it really is.

Who? This leads directly to Who is going to be involved in the study? Networking will encourage co-operative programmes of investigation across schools and community groups. The more people that contribute to a study, the more information that can be collected, the more people you will meet, the more you will learn and the more understanding of the local environment you will develop. It certainly seems worth the effort. Who? might also include questions about people interacting with the environment. You may be more interested in what people are doing in the study area, rather than what animals or plants are found there. Who uses this patch of bush or rocky shore? This may go hand in hand with questions such as What do they do there? Are they taking animals and plants away? What are they leaving behind? And so on.

Why? How? Questions about why animals and plants are found in certain places or How they interact with each other or their environment are best left to experts. They can only be answered by trained ecologists using properly-designed field experiments and a vast amount of learned theory. Public misunderstanding about the way nature works has often arisen from people jumping from finding out where different species are found to explaining why they are found there, without the necessary work to bridge this gap. If you are studying large animals, such as birds or fish, you can ask some questions of how they interact with their environment. Do they shelter in certain trees at different times? Are they eating certain foods? How do they behave towards each other? Recording an animal's behaviour is very important but will not tell you why animals do what they do. It is important not to impose your motives on an animal's behaviour.

STEP 2: WORK OUT HOW TO ANSWER THE QUESTIONS

Where? You need to start by defining where you are going to do the study. This is very important if you are going to network. You need to be able to find the same area again.

Start by dearly defining your study area. This may need an earlier visit, or you may be able to do it using prior knowledge or common sense. Use existing boundaries that will not move or disappear. In some areas, such as a park, school grounds or small rocky shore, boundaries are clear-cut and unarguable (Fig. la).

Other areas are not very distinct. For example, it is no use defining the edge of a rocky shore as the place where the rocks meet the sand because sand moves. It covers and uncovers different areas depending on the weather. Therefore, your study area may change from time to time. For similar reasons, do not use stones, the edges of patches of vegetation, *etc*. to mark the boundaries. The positions of these can change and confuse you if you want to find the site again later. Use large, distinct, permanent landmarks. Large trees are good because the stumps remain in place, even if the trees are blown or burned down. Otherwise use roads, telegraph poles, buildings or other relatively permanent features for your landmarks. Measure from two landmarks to each corner of your study site using a measuring tape, as in Fig. lb. Then draw a map of the area, clearly noting which landmarks were used and the distances from each landmark to each corner of your study site.

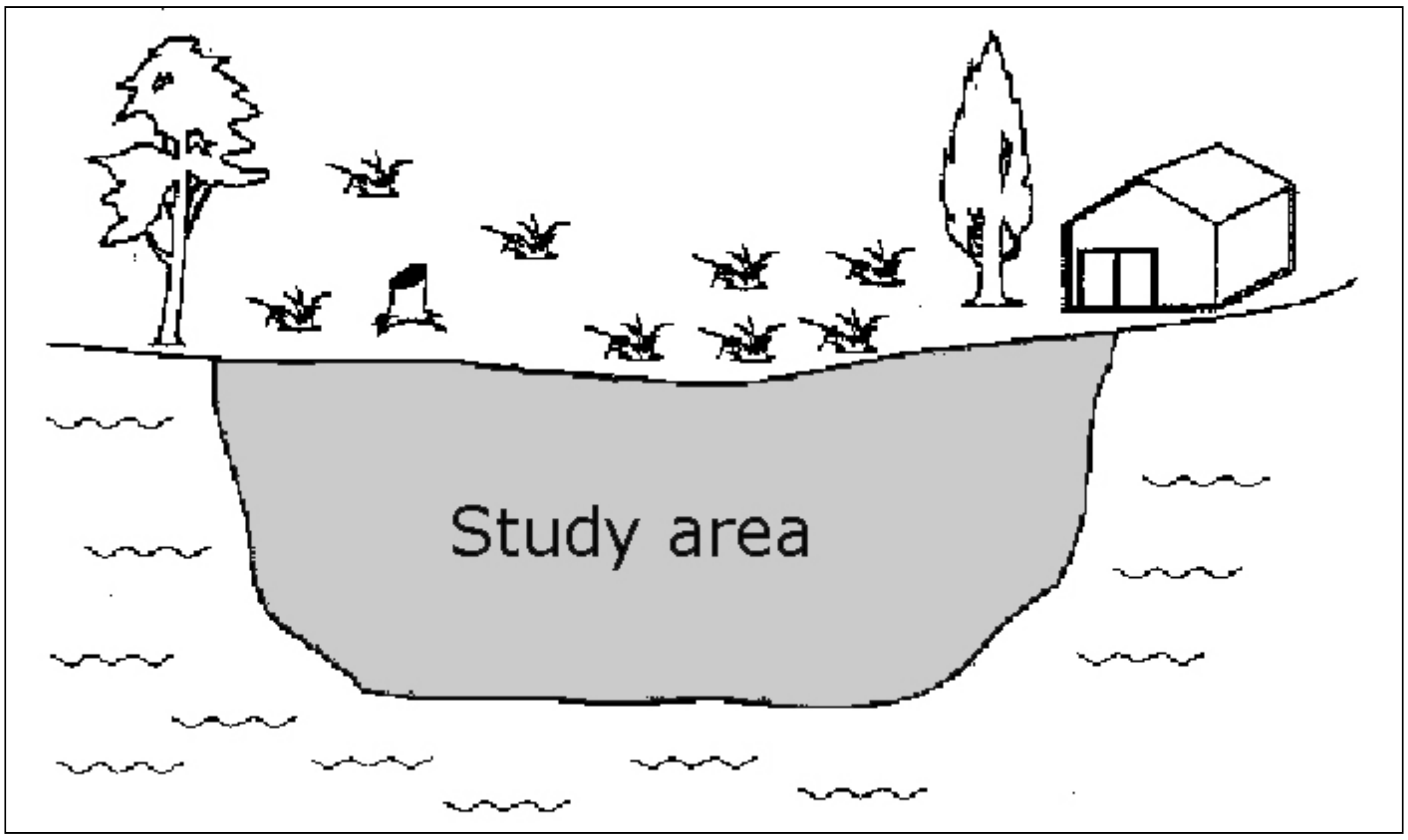


Figure 1a. If there are natural boundaries, these can be used to identify your study area.

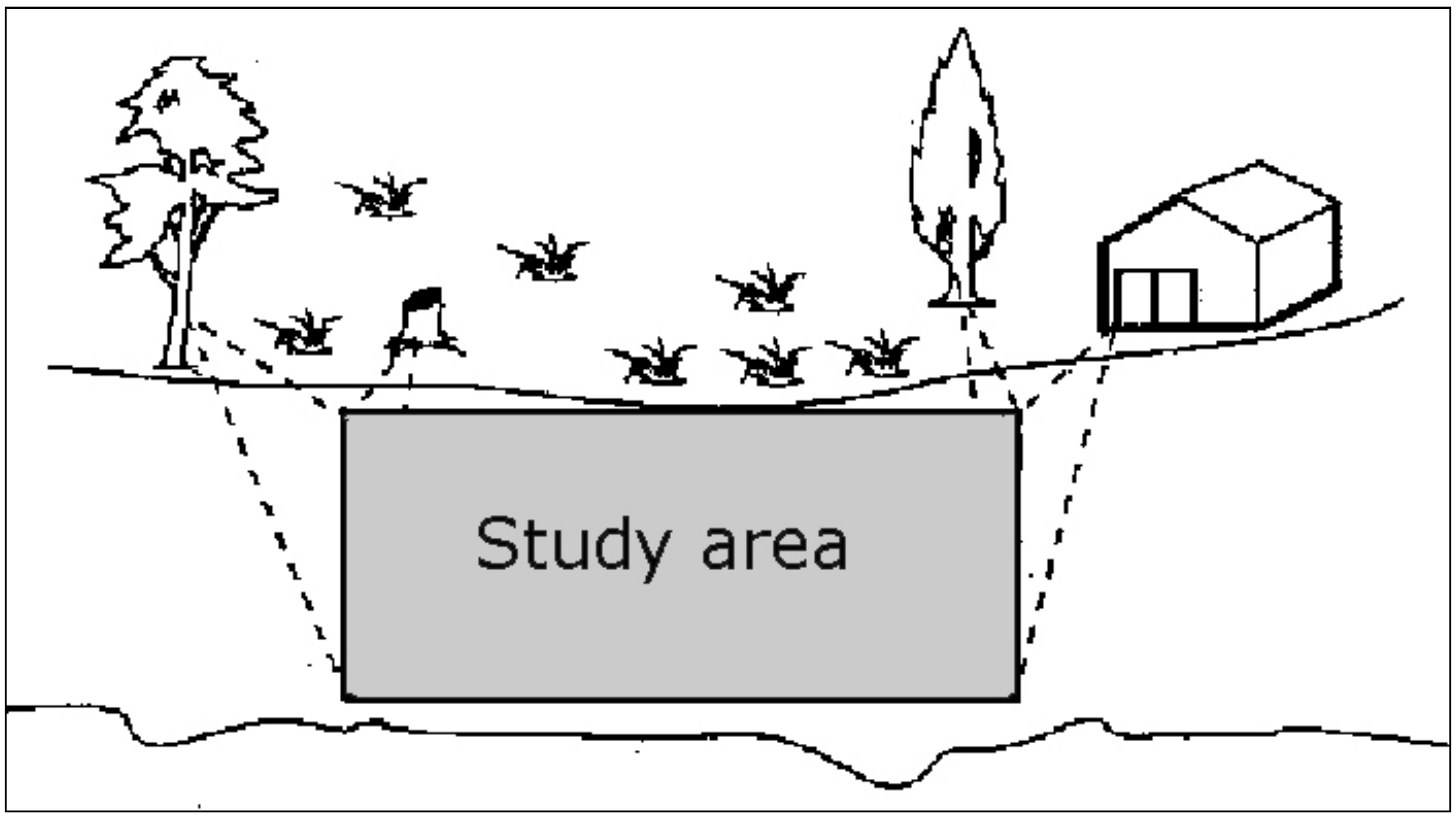


Figure 1b. If there are no natural boundaries to your study area, measure each of the corners of the area from two set landmarks. This will allow you to identify the same area in the future. Make sure that you check the measurements, write them down and store them away somewhere safe.

If your study area is very large, you will only be able to look at the animals and plants in some parts of it. Do not worry about this. This will be discussed later under sampling. At this stage, simply identify the area that you are interested in learning about.

If planning to network with other groups to work in the same area or in another similar area, talk to them now. If looking at more than one area, choose areas that are comparable and include the same range of habitats. This will allow you to make comparisons between them. If others are going to do later work in the same area as you, make sure that they can understand your map and find the same area.

What? There are three main ways of finding out how many different types of animals and plants are found in your study area. These can be loosely called area searches, transect searches or point searches. Note that these methods will not give you measurements of how many different individuals of the each species there are. They are simply easy ways of searching for many different species, while trying to ensure that all parts of the study site are fairly searched. This will ensure that you do not bias your results by searching more thoroughly in some areas than others.

For species that stay still or move very slowly, like barnacles or weeds or snails, you can do a systematic search of the entire area, noting any new species that you find. You may do this by dividing the study site into grids and allocating each grid (or area) to one person or a small group of people. This is called an area search (Fig. 2a). Each person or group carefully searches their allocated area, making a note of all the new species they find. You have to know when to stop, so this sort of search is usually done for a set period of time, *e.g.* 10 or 30 minutes depending on your enthusiasm. Otherwise you can continue until no new species have been found in a pre-determined period of time, *e.g.* 5 minutes. You must be careful not to let different people choose the length of time they want to search for. Then some areas will be better searched than others and your search will not be representative of your entire study area.

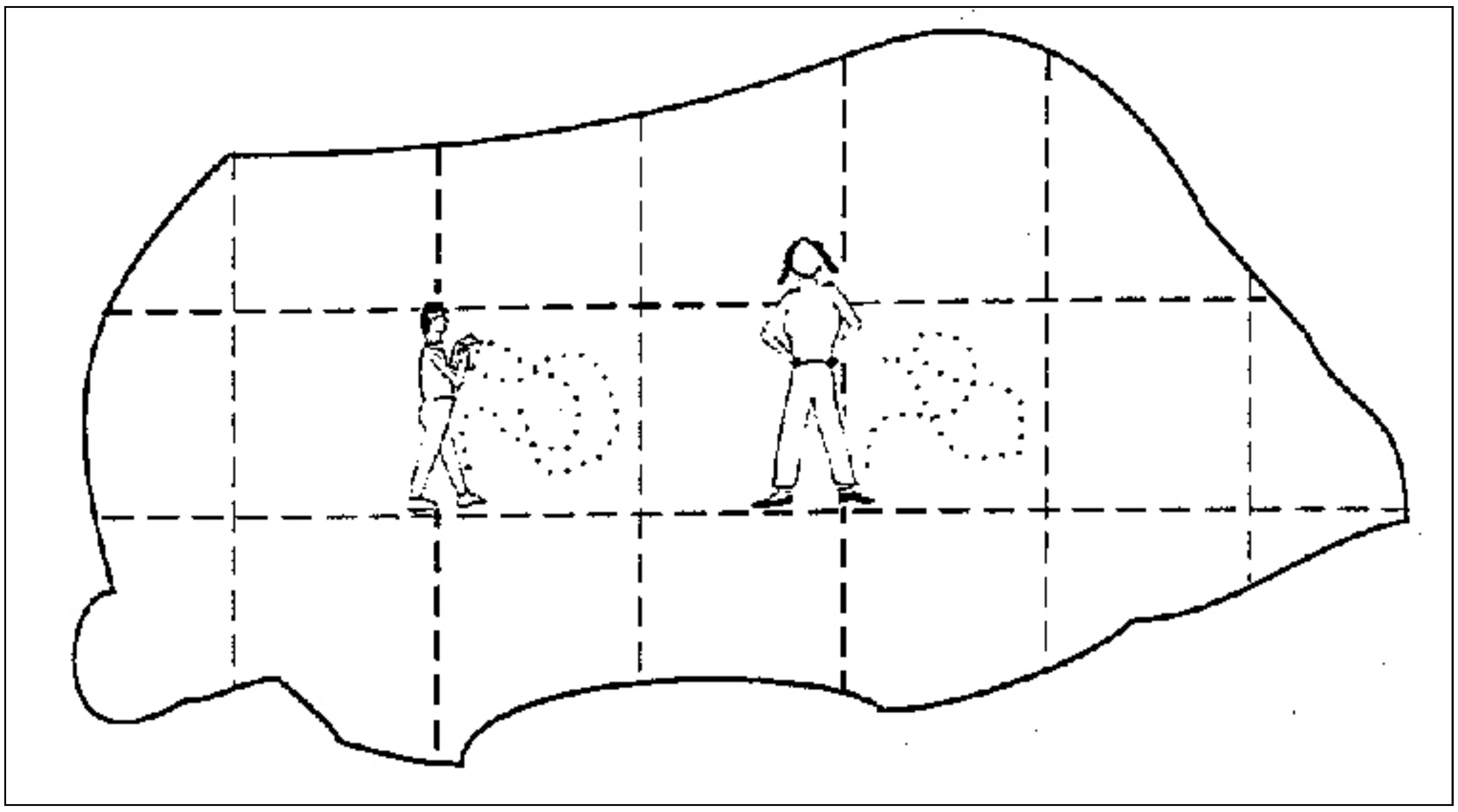


Figure 2a. An area search.

Alternatively, you can do what is called a strip or transect search (Fig. 2b). This is like an area search, but people search along a strip of countryside, rather than within a grid. To do this, a row of searchers walk relatively close to and parallel to each other across the area, somewhat similar to a police search. In this case, you note each new species either side of you in your transect. This can be easier than an area search because people are working in closer co-operation and tend to stay in contact with one another. This makes it much easier to talk about any problems that you find or difficulties that you may have identifying something.

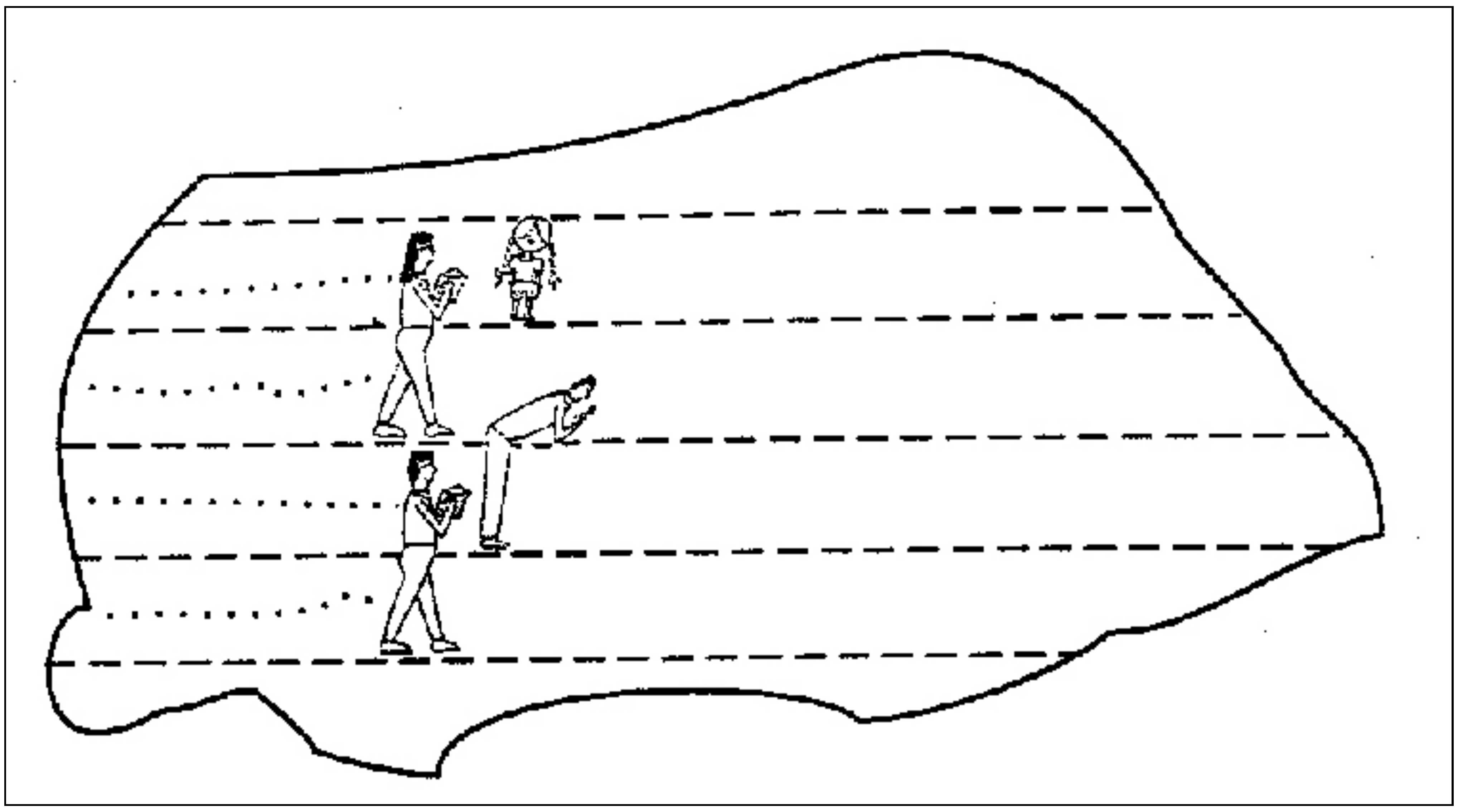


Figure 2b. A transect search

Animals that move around a lot or which might be easily disturbed, such as birds or butterflies, can be studied a different way - in a so-called point search (Fig. 2c). To do this, each searcher is given a place in the study site where they sit still. They then record the animals that they can see or hear during a set period of time. This does not disturb easily frightened animals, such as birds, but it has some drawbacks. If people are too close to each other, they may count the same few animals time and time again, especially if these move around a lot. Alternatively, if people are too spread out they may miss many animals.

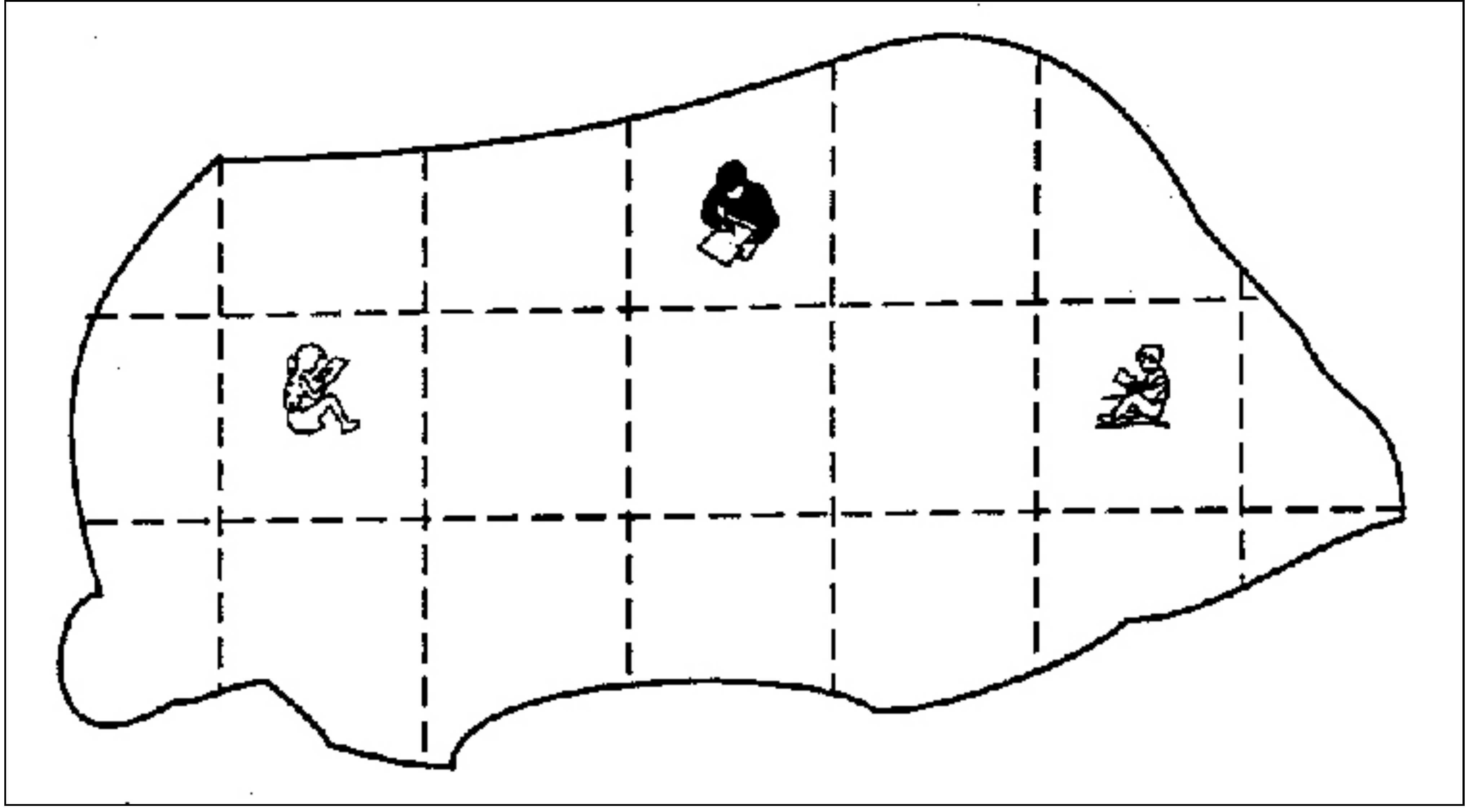


Figure 2c. A point search

Using any of the above methods, you may not be able to search the entire area because it is too large or you do not have enough time. In this case, you want to cover representative parts of the area. Do this systematically. Do not simply tell people to spread out and look around because they will congregate in those parts that they think are most interesting. Large patches may then be left out of your study. - as in Fig. 3a.

To prevent unintentional bias, divide the entire study area into transects or grids as described. Then decide how many of these you can accurately census and spread this number out over the study area (Fig. 3). Then identify the animals and plants in these fewer transects or grids. Do not cluster them together in one part of your study site, but spread them over the entire area.

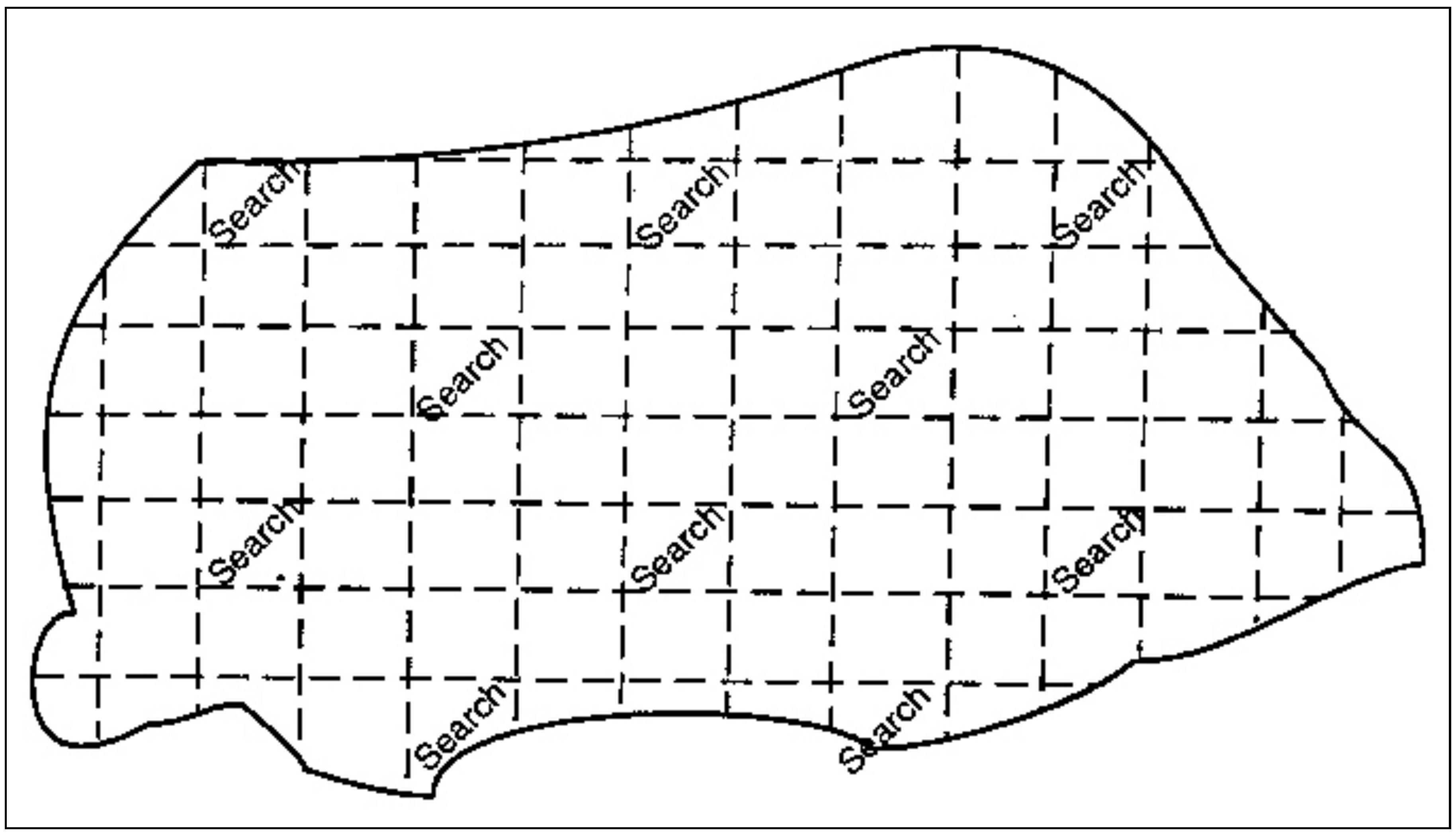


Figure 3a. An area or point search

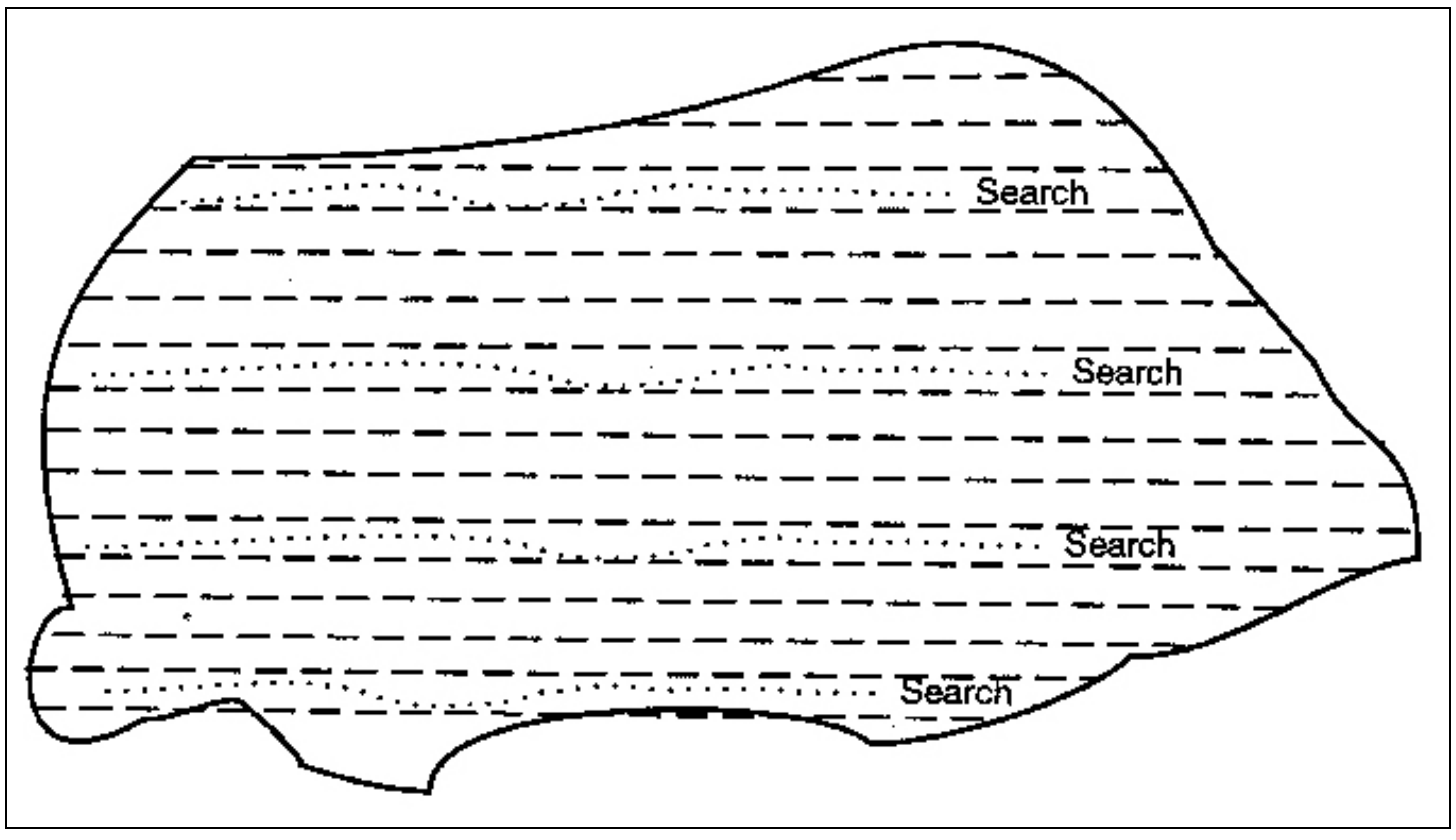


Figure 3b. A Transect Search

What? To be able to record what is in your study area, you are going to have to know what is what. How are you going to know what things are called? Do not worry about the "correct" names. Six good reasons for this advice have been given earlier. Learn how to make your own identification guides - something that is user-friendly and that you can all use and understand. Then you won't make mistakes.

For a few habitats and some groups of animals there are extremely good identification guides available from bookshops. For example, birds are well-illustrated in a number of easy-to-read guides, with pictures, maps and general information about their habitats and habits. Information about other organisms, such as the insects in streams or leaf litter or seaweeds on rocky shores, is generally less accessible to the public. Advice about assistance in identification is given on the Resources sheet (Sheet 8).

Otherwise treat the task as a challenge. If not much information is available about species in your area, you have a clean slate on which to write. Who knows - you may well become the experts that other people consult! Begin by realising that scientific names don't matter at this stage of the study. What you need is a guide that is easy to use and with which you won't make mistakes. Getting bogged down in unpronounceable Latin names is the worst path to take. Learn to make descriptions using a few words of text and simple line drawings. If you have time for a prior visit, you might start by going into your area, wandering around by yourself and making short descriptions of some of the things you see. Then get hold of your friends or colleagues and see if they can identify what you were describing from the way that you described it. If they can, you have a pretty good field description of that animal or pl ant. If not, start again, being more careful with the words that you use. Then get together and decide on some names that you will remember. If you will all recognise a "multicoloured starfish with eight short arms" or "a Persian-carpet starfish", then that is a more useful name for the animal than *Patiriella calcar*. If you all know what a "gum-shaped leaf" or "heart-shaped leaf" is, or what you mean by dark green and light green, then these descriptions are good enough. Also, more importantly, you will end up with a field guide that everyone can use.

Do not simply record what you think are common names. If someone else uses the same name for a different species, or thinks that this species has a different name and no information other than the name is recorded, your data will be worthless.

If you are interested in long-term records of your study area, or you are networking with other groups to compare several areas, you may want to set up permanent field guides. Interested photographers or artists may be able to help you to illustrate these guides. Perhaps, the art or photography teacher at the local high school will use her/his class to help to prepare the guides. Art and photography clubs at your school or in the neighbourhood may also help you out if you explain the problems to them. But this does not necessarily matter. Clear concise descriptions and simple line drawings are often what professional ecologists use to identify species.

To find out what lives in your area you need to record the different animals and plants on data sheet, similar to those provided. Prepare these data sheets in advance and give them to all members of the group. After the field study it is easier to put together lists of species if everyone has recorded his or her data in a similar way.

Sheet 1 shows the type of data sheet that can be used for rocky shores or other habitats. Species that you know and recognise might be listed in the first column on the sheets in advance if you are sure that you can identify them. They will simply need a tick mark in the 4th column to indicate that they were found. You are bound to come across some new species, so leave plenty of room to describe or draw these in Columns 2 or 3. Features such as the general shape, size, colour, *etc*. should be recorded. The 4th column is simply there to record the presence of each species. We have provided an example of a completed data sheet, showing the types of descriptions and drawings that are useful. There is also a blank data sheet that you can use as is or modify to suit yourselves. Do NOT take live animals or plants home for identification.

A species list of large obvious animals, such as birds, can be built up in the same way, but more detailed data sheets can be provided in advance (see Sheet 1 for completed and blank data sheets). As all birds have similar features, a diagram of a "typical" bird can be given. The searchers can fill in details, such as the colour of the bill, legs, wings, *etc*. on these diagrams. Frequently, birds are heard but not seen. Therefore, leave room to describe the calls the birds are making. If possible, a small tape recorder may make this task easier, especially when it comes to identifying the birds from their calls (see Sheet 6 for suggested field equipment). Sheet 2 provides places to record the bird's habitat and behaviour if you are interested in more detail than simply which birds are there.

If you are recording plants - either native plants or weeds - you might use a data sheet similar to Sheet 3. If you know the names of the plants, well and good. If not, you should record basic information about the size and shape of the plant, the size, shape and colour of the leaves, form of branching, details of flowers, fruit (if available), *etc*. The interesting features are illustrated in Sheet 3a. Again, draw the plants. Do NOT take parts of the plants, particularly the flowers and fruit home for identification.

How many? As described in the main text, if you want to know how many animals and plants there are in your study area, rather than simply which sorts are there, it is extremely unlikely you will be able to count them all. If you can't count them all, how do you decide which ones to count? You need to get your counts from representative parts of your entire study area. You cannot usually do this by taking random areas in which to do your counts.

Fig. 4a shows what can happen if random areas are chosen for counts. Most people would realise that this is not what you want to do. The middle part of the study area has not been sampled at all. You will not get a good idea of how many barnacles are on a shore if all of your random samples are placed above or below the range in which barnacles are found. You will not get an accurate idea of how many weeds are in the area if all of your counts are on open grassland and not in the adjacent forest. Therefore, you do not necessarily want random samples - you want representative samples, *i.e*. samples that are most likely to represent your study area.

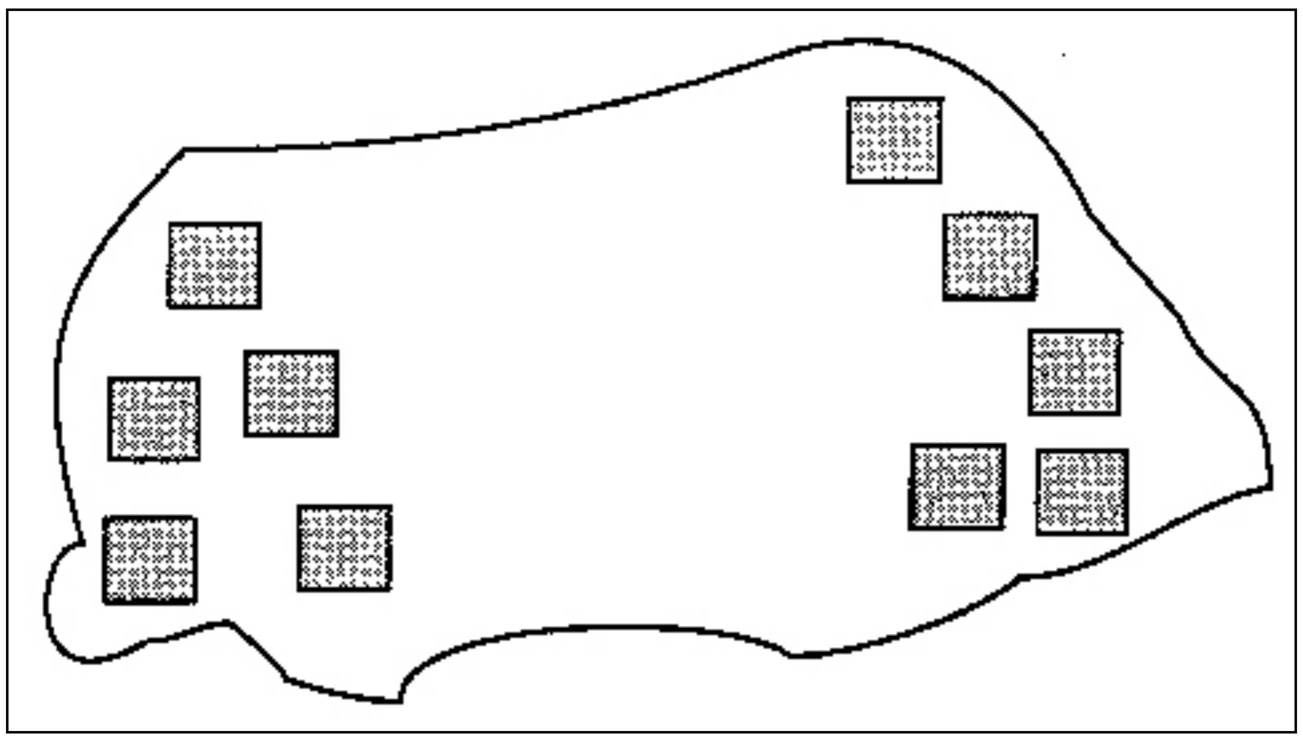


Figure 4a. A potential problem with random samples. Simply by chance, the middle of the study area has not been included in any of the samples. Your samples, therefore, are not representative of the study area.

To achieve this, you start in the same way as you would for a species search if you could not cover the entire area. If patches of different sorts of habitat are easily visible (*e.g*. different patches of vegetation), you can divide the entire area into these patches. Then you would choose of few sites within each of these patches of habitat in which to count the animals and plants (Fig. 4b).

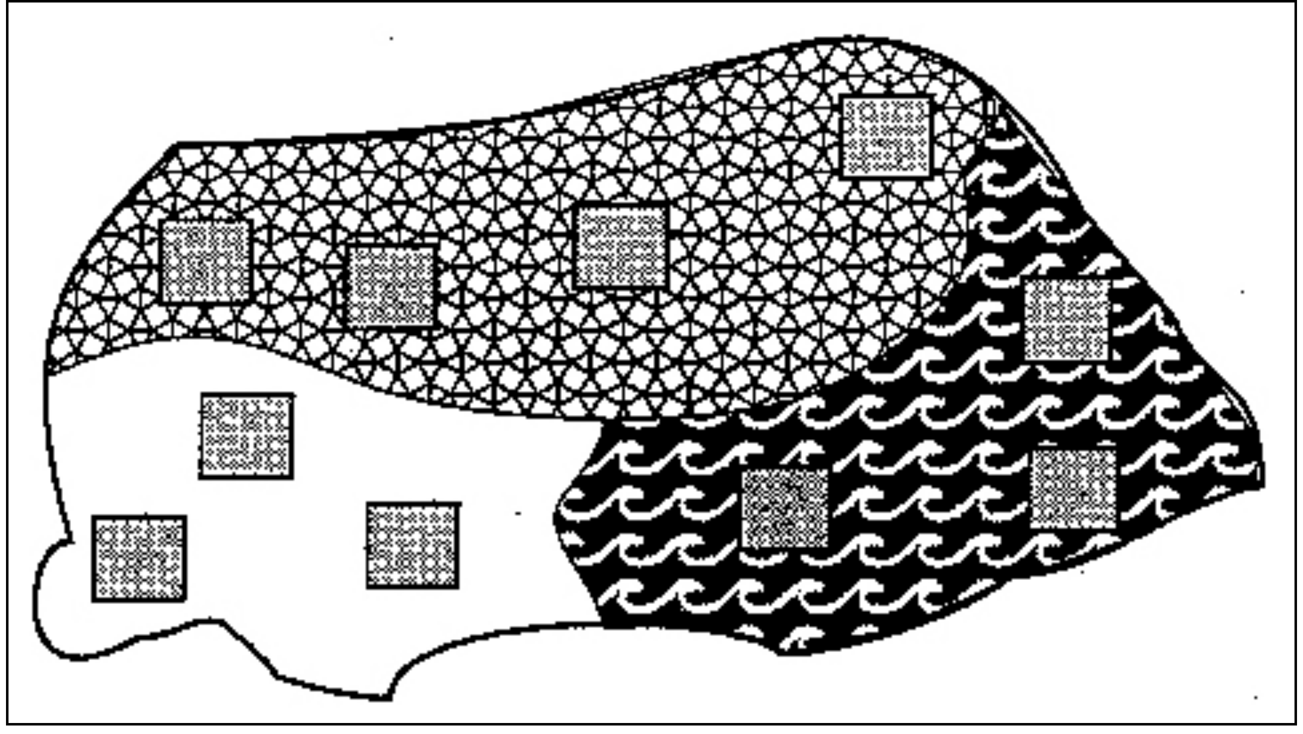


Figure 4b. If you can identify patches of different habitat in your study area, choose samples in each of the patches.

If different patches of habitat are not clearly identifiable, you can simply divide the area into patches of similar size, *e.g.* thirds, quarters or eighths. Using a grid is a convenient way of doing this, but you do not have to use a grid. You decide how many sites you will be able to sample, depending on how much time you have and how many of you there are. Then spread this number among the different patches, so that all parts of your study area are represented in your samples (Fig. 4c).

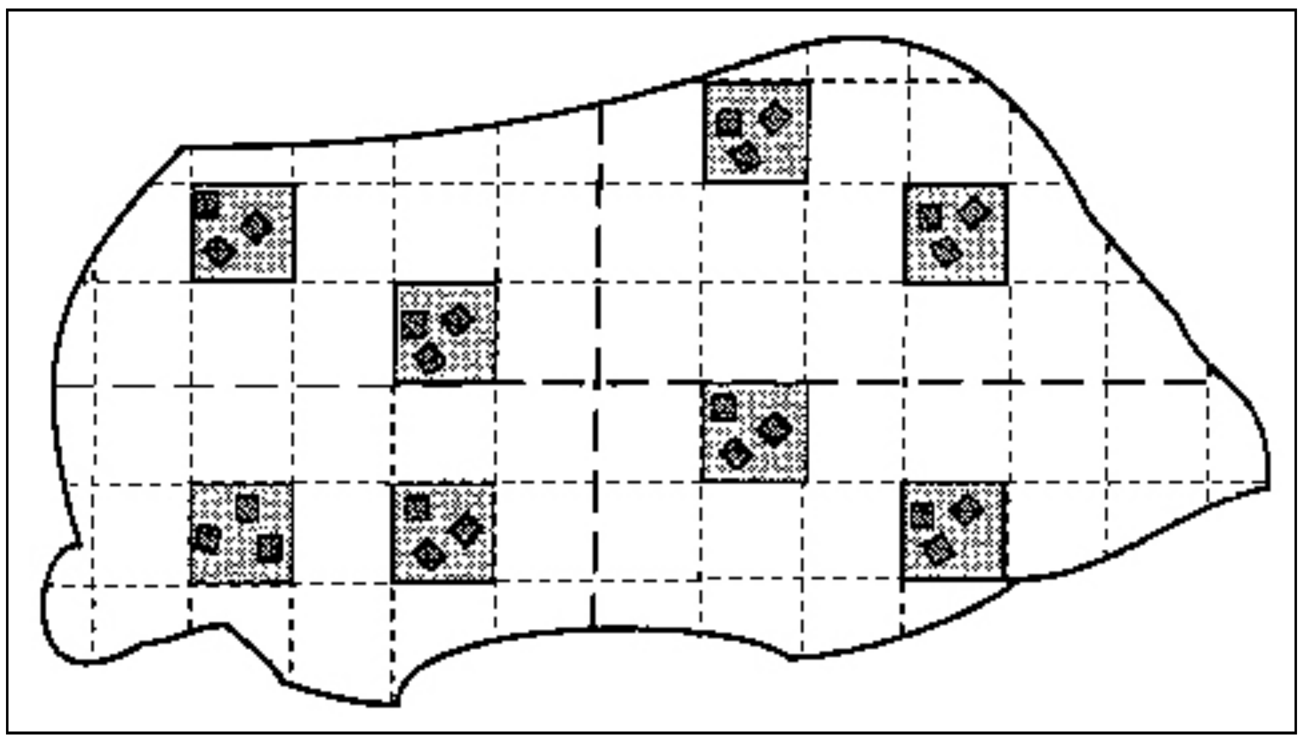


Figure 4c. If you cannot identify patches of different habitat, divide your area into smaller patches and take some samples in each patch. If you still cannot count everything in each sampling site, choose smaller samples within each sampling site. These should be random samples to remove bias.

Do this systematically. Do not walk around saying "We should sample here because there are lots of these or few of those." That is guaranteed to give you biased samples. People will either choose to look for their favourite animal or plant and will overestimate their abundance in the study area. Or, they may be lazy and stick to places where there are very few, thereby underestimating how many there really are.

It is important to realize that sampling will not identify everything in the area - a thorough species search throughout the whole study site is more likely to achieve that. On the other hand, a species search will not tell you whether there are many or few of anything. These are different techniques to answer different questions, which is why you must be sure of the questions before you start. Sampling will, however, tell you a lot about the relative abundance of the more common species.

Within each patch or habitat, you may then still not be able to count everything. You can then choose even smaller plots within each patch to represent them. You want unbiased and representative samples of your entire study area. You get representative samples by making sure that you collect samples from different patches or sites across the study area, making sure that any identifiable habitats are represented in the samples. If your area is about 80% grass and 20% forest, you could choose four times as many samples in the grassy area than in the forest. If habitats are not easily identifiable, *i.e.* in school grounds, you could divide the area into smaller patches, into quarters or smaller, depending on the size of the area. You would then sample in an unbiased way within each site.

To count the animals and plants in your study area, you will need a sampling device. A sampling device is anything that identifies that part of your study area in which you are going to get your counts of the different animals and plants. Its size and shape depends on the types of organisms you are counting and the habitat in which they live. For mud and sand, corers or grabs collect some of the sediment and the animals in it. You can make these using empty tin cans. For fish, plankton and aquatic insects, we sample using nets which are dragged through the water. For many plants and slow-moving or attached animals, ecologists usually mark off an area of the ground and sample the organisms in that area. These areas are called quadrats.

For large species, such as trees or shrubs, a quadrat is usually paced out or measured with a tape and may be as large as 50 m x 50 m. For smaller plants and flowers, it may be only 2 m x 2 m or5 m x 5 m. There are no simple rules for the size of a quadrat. The decision depends entirely on the sizes and approximate numbers of the species you are interested in. You must use quadrats that are large enough to contain the species - you would not try to count trees in 1 m x 1 m quadrats. The quadrats must also be small enough that you can actually count all of the individuals in them - you would not try to count barnacles in 5 m x 5 m quadrats.

You can use different sizes of quadrats in your area at the same time to count different types of species. For example, marine ecologists on seashores often count large species, like sea urchins, in1 m x 1 m quadrats, smaller barnacles and snails in 50 cm x 50 cm quadrats (right) and very small species in5 cm x 5 cm quadrats .

Large quadrats are usually marked out in the field. The best way to do this is for one person to hold one end of a measuring tape (or piece of string of the right length) and another to walk in a straight line (not looking for specific species as they go - thus not biasing their sampling). Once they have walked the length of one side of the quadrat, they mark the ground. A tent peg can be placed in soft ground or a chalk mark can be made on rock. Then the person holding the tape moves to that mark and the measurer heads off at a 90 degree angle from that point. This is repeated until the quadrat is marked out (left). There is no reason why a quadrat need be a square, but, for convenience, it often is.

Smaller quadrats, such as 50 cm x 50 cm or 5 cm x 5 cm quadrats, are often built in advance because they are easy to carry and quick to use. Wood ca n be used to build a 50 cm x 50 cm frame, but 16 mm electrical conduit is more convenient. It is light, easily cut with a hacksaw and you can buy corners so it can easily be joined together and does not rot when it gets wet. Smaller quadrats can be built easily from wire - a wire coat-hanger can be transformed readily into 2 or 3 small quadrats by cutting and bending it into small squares and joining the ends with insulation tape.

If networking with other people, it is essential that the size and type of sampling unit being used for each species is clearly agreed to and used by everyone. You will not be able to make valid comparisons if different people sample using different sizes of quadrats and different numbers of samples in the different places or at different times.

One difficult decision that you might have to make is what to do about those animals or plants that are partly inside and partly outside of the sampling area. You might try to estimate whether something is mostly in or mostly out, but this can lead to considerable bias and many arguments. An unbiased way to deal with this thorny issue is to count an individual as in the unit if it occurs along two sides of the quadrat and out of the unit if it occurs along the other two sides (Fig. 5). This means that approximately equal numbers of the "half-way ones" are included in the count and half of them are excluded.

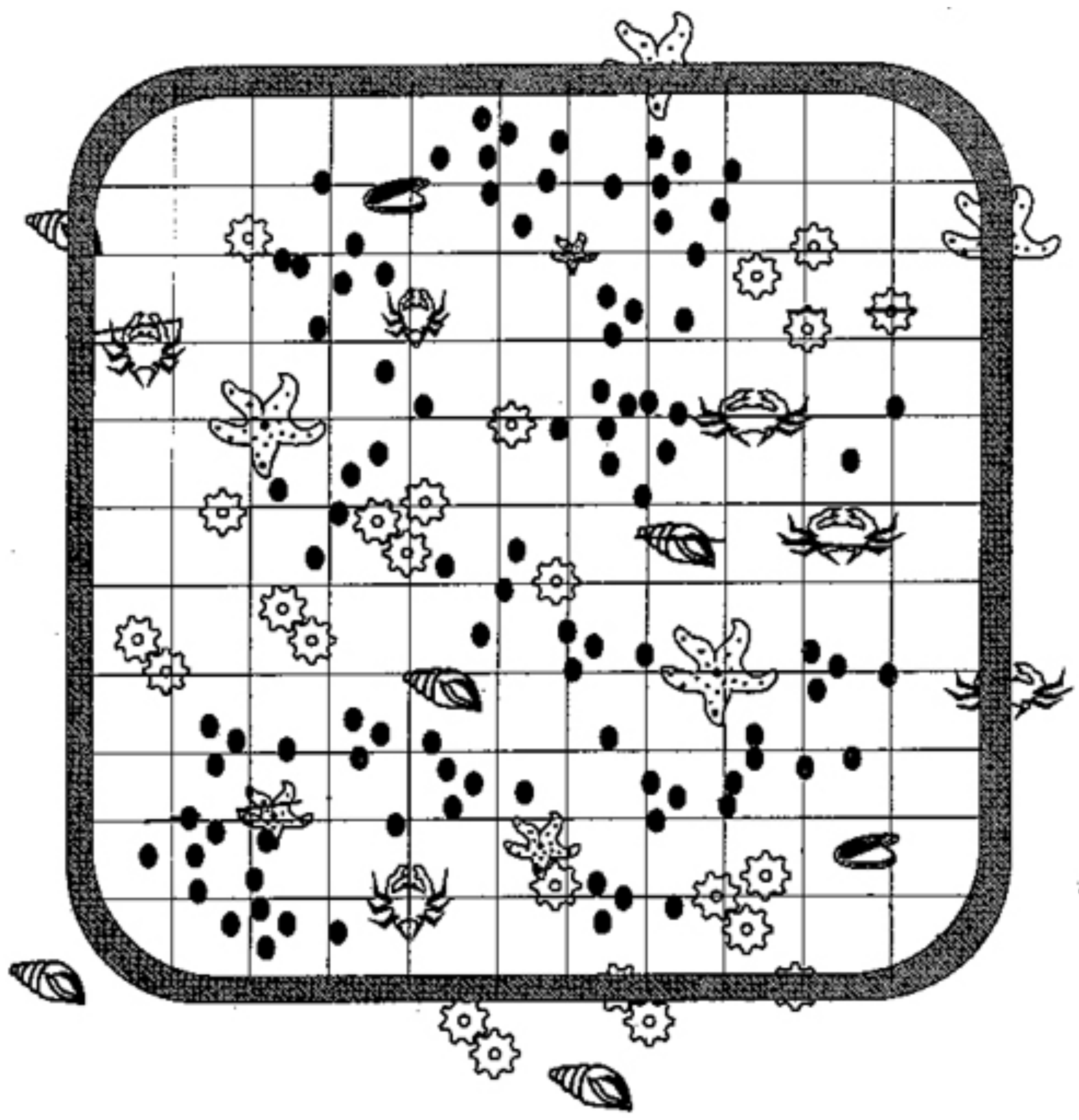
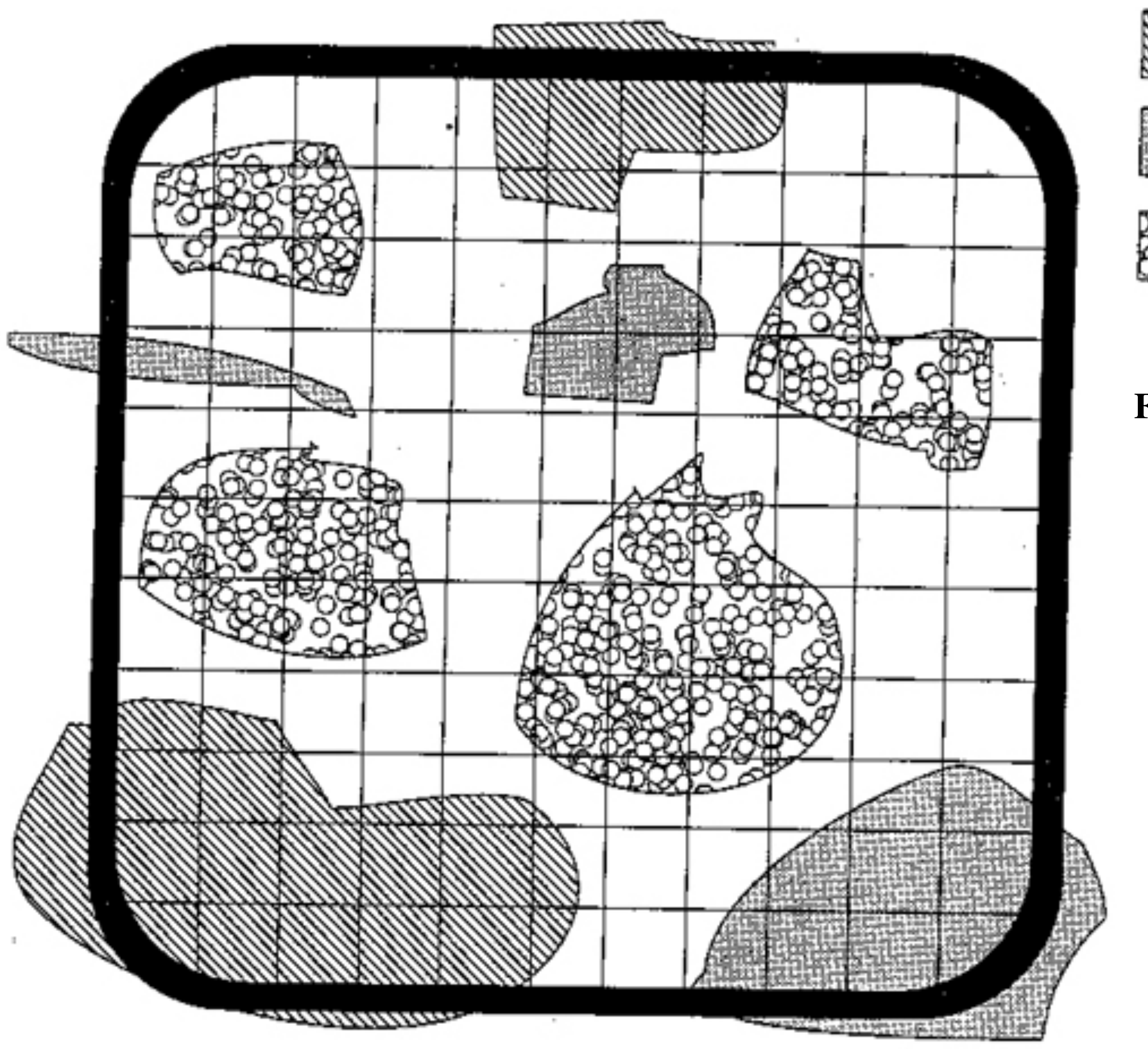


Figure 5. A method to get around the fact that some organisms are half in and half out of the quadrat. Top and left individuals are included in the count whereas bottom and right individuals are not included.

This works well with animals and plants which you can identify as individuals. It does not, however, work for many species. How do you tell where one moss begins and the other ends when all you can see is a dense mat of moss? The same is true of many seaweeds and colonial animals, such as sponges and bryozoans. To solve this problem, ecologists measure how much habitat these sorts of organisms occupy, rather than how many of them there are.

They do this by placing a grid of points on to the ground and noting what species is under each point. Then the numbers of points occupied by each species gives you an estimate of the area it occupies. This is called estimating its percentage cover. If you have 100 points and 20 lie above a blue sponge, 31 lie above a brown encrusting seaweed and 49 lie above bare rock, the sponge occupies 20% of the habitat, the seaweed occupies 31% of the habitat and 49% is unoccupied (see Fig. 6).



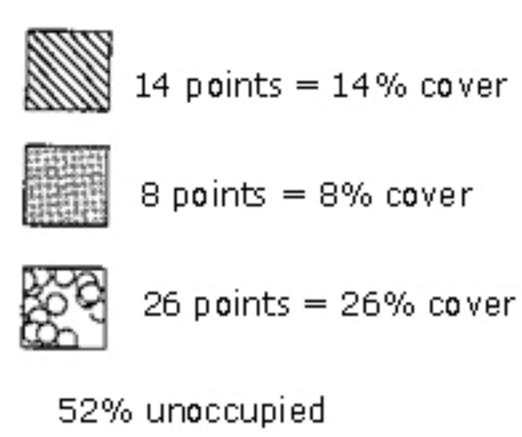


Figure 6. Determining percentage cover

You can measure percentage cover in many ways - a series of dots made with waterproof ink on a plastic sheet will do. Place the sheet on the ground and note what lies under each dot. Then estimate the area occupied by each species. If you are already using a quadrat, thread 10 equally-spaced rows of string in each direction across it (Fig. 6). There are 100 points at which these strings intersect. These points of intersection can be used to measure percentage cover. In addition, the small squares made by the string are slightly smaller than 5 cm x 5 cm and can easily be used to count small animals. So with one sampling device (a 50 cm x 50 cm quadrat), you can count the densities of larger animals, measure the percentage cover and count densities of smaller animal in a few, smaller quadrats (Figs 5 and 6).

Of course, not all species will occur under a dot, but they are obviously in your sample and are occupying space. They are usually recorded as "present, but occupying less than 1% of the space" (if you used 100 dots in your sampling area).

Large, mobile animals that move around throughout the study area while you are trying to count them are particularly hard to count, unless they are individually marked so that they can be recognised. Unless you are sure that you can sample them without re-sampling the same individuals more than once, you might be better off making a list of these species and not trying to answer questions about how many of them there are.

Data sheets for recording the numbers of animals are different from those for recording which species are present in your study area. You may need to measure the percentage cover of some species and the numbers of others in quadrats of different sizes. Data sheets therefore need to be carefully planned and drawn up in advance. An example is provided as Sheet 4. Data sheets should be prepared in advance so that everyone starts with the same type of sheet. Then it is more likely that they will collect data in the same way. Waterproof plastic "paper" is available in specialist stationery shops. This is ideal for data sheets because you can write on it when it is wet. It is amazing how many times it rains when you have to do field work! Also, it will not break into small pieces when you drop it in a pool. Write on it with pencil - not pen - because pencils do not run out of ink, smudge, dry up, etc. (As another aside, you will notice that ecology is not a technologically specialised and expensive science. Most of us do very well with pencils and paper, string and tape measures, chalk and insulation tape, wood and plastic, *etc*. This equipment is readily available and cheap - well within the means of most people).

Where? Where different species are found in your study area can be answered in different ways. The first - sampling in different patches of habitat or in a grid - has been discussed in detail. Another method often used is vegetation mapping. As well as mapping patches of vegetation, you can map animals that form distinctive patches with boundaries, such as beds of cunjevoi. You might do this if you were trying to answer questions about where and how large these patches are - for example, because you are concerned about anglers collecting cunjevoi for bait or because you are concerned about patches of weeds.

The easiest way to draw up a vegetation map is to walk along as many transects as you can, evenly spaced across your study area. One person holds a measuring tape at the start of each transect and the other person walks along the transect, unraveling the tape as they go. The walker writes down the distance at which each patch of habitat starts and finishes.

When this has been done for a number of transects, a map of the patches can be drawn from these measurements (Fig. 7). Transects should be as close together as feasible because patches that only occur between transects will be missed. In addition, your maps will be more accurate if you have smaller distances between points.

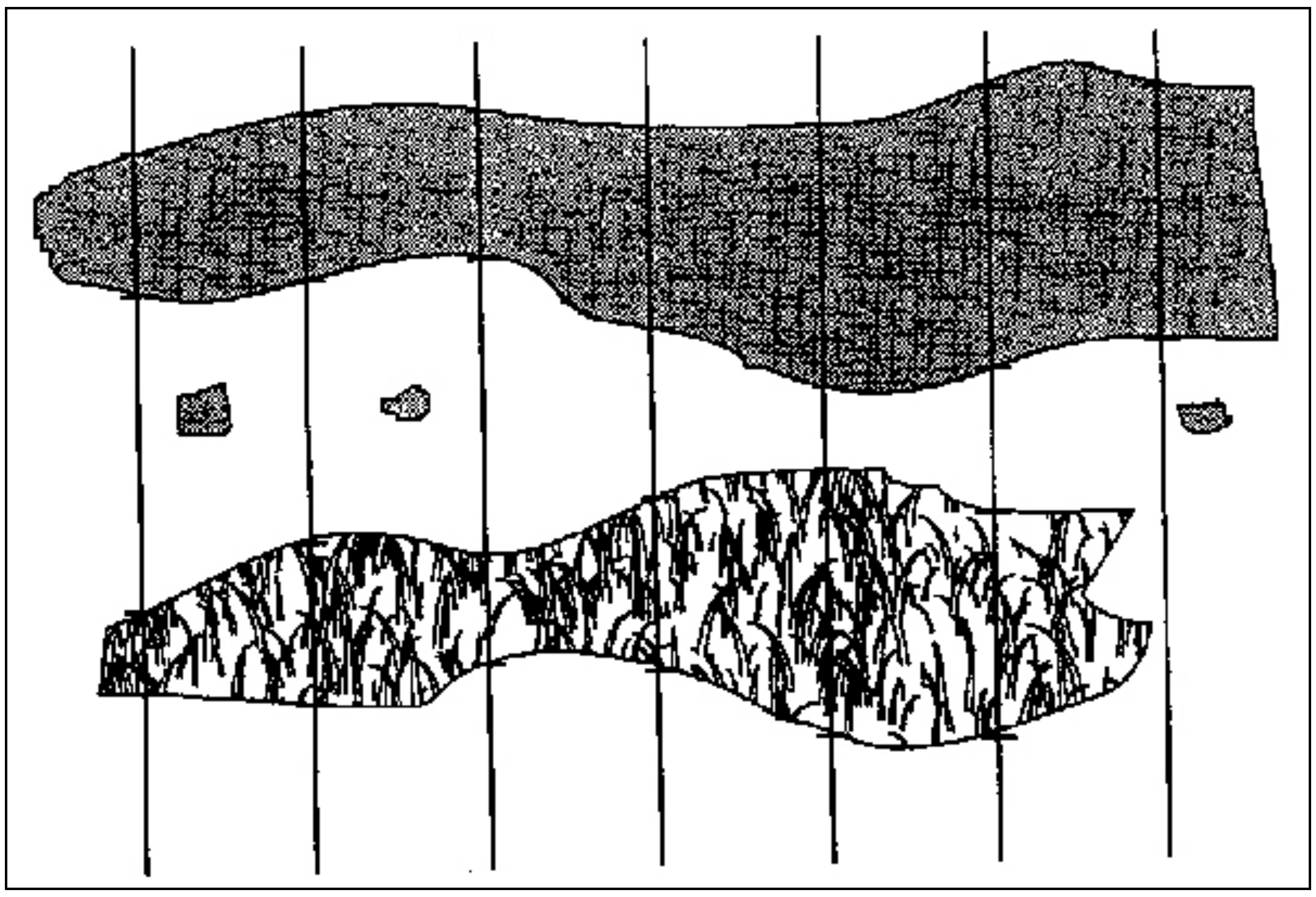


Figure 7a. Walking along transects across your study area, note the distance at which each type of habitat starts and finishes.

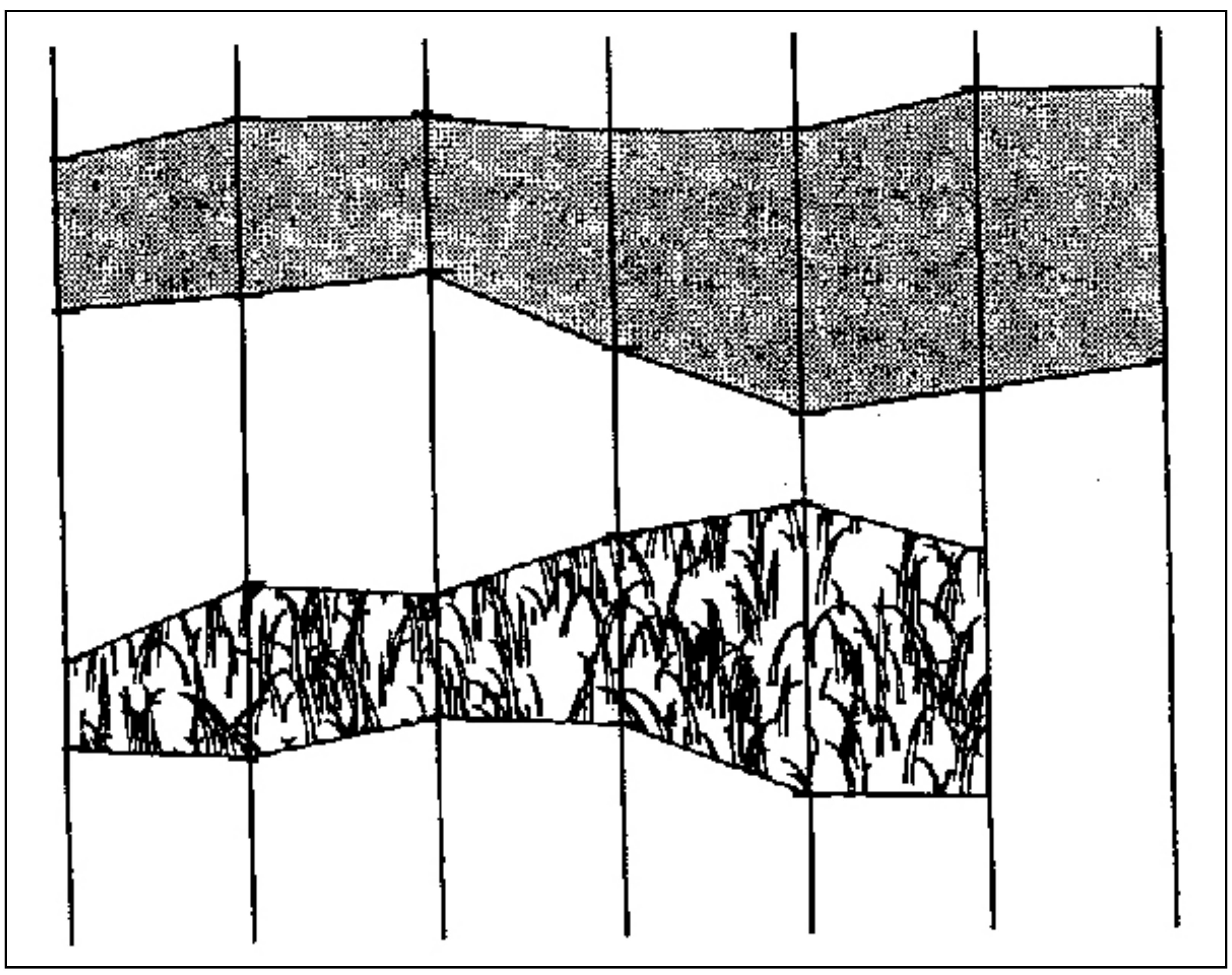


Figure 7b. Using these measurements, you can draw an approximate map of the positions and sizes of each patch of habitat. You will not find small patches that occur between your transect lines.

This method is also a very convenient way of identifying different patches of habitat in your study area for sampling. Some habitats have identifiable patches that are clearly visible from some distance away. If you are working in a forest, such as a mangrove forest and the adjacent saltmarsh, mapping may be the only way of finding out where the different patches of vegetation are located and how large they are. This information is important in deciding how many samples to take in each place to properly represent your study area (see earlier).

How? How can you measure how animals or people interact with their habitat? Birds are ideal subjects for studying animal behaviour because they are large, active and exhibit a wide range of different behaviours. You can investigate how they use different parts of the study area and how they interact with other species. This information will be invaluable if you are attempting to understand how the birds use different parts of their habitats, perhaps because you wish to make your school grounds attractive to native birds.

The behaviour of people can be studied in the same way. How people interact with the environment is the sort of study in which community groups can get involved and collect a lot of useful information. You do not need to be able to recognise different animals and plants or know what they are called and the study does not involve counting lots and lots of small creatures.

When recording the behaviour of animals, including people, do not attempt to describe everything that you see. Even if you successfully record accurate observations, which is extremely unlikely because of the vast number of different things that will be going on, you will end up with an unwieldy mass of information that you will not be able to do anything with. Divide the behaviour into broad categories of things in which you may be interested: e.g. preening, roosting, feeding, drinking, calling, fighting, *etc* (for birds) or perhaps picnicking, fishing, walking, sun-baking, swimming, *etc* if you are looking at how people use the local seashore. Prepare a data sheet with these as the headings of columns. On the left-hand side, you could add a list of habitats which the bird use, or perhaps divide the people you are studying into different categories of age (see Sheets 5 and 5a).

Now you have a prepared data sheet on which you can record the behaviour with a tick-mark (see completed sheet).

There are three ways to record behaviour. You can follow an individual and tick everything it does for a set period of time (see completed Sheet 5). Something like 10 minutes is usually long enough. If this is confusing or you are disturbing the animal, you can stay in one place (similar to a point search, described earlier) and record the behaviour of those that come within your sight for a set period of time. Finally, if it is difficult to mark down everything that the animals (or people) are doing, you can follow an individual, but record what is happening at discrete intervals of time. You might look at your subjects for 10 minutes, but you would only mark down what they were doing every minute. These data are easier to collect.

To make it easier, work in groups of three. One person, the observer, watches the animal and tells the others when the behaviour changes. The second person is armed with a stop-watch and times the behaviour. The third person writes down the time spent behaving in each way. Coordinating in this way will not be easy, but it will give you a lot of detailed information.

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