Start Birding

Birdwatching Classes
and individual tuition

Getting the basics right: understanding and using your binoculars

Introduction

Whether you're new to birdwatching, or you've been enjoying the hobby for a while, it's important that you spend some time getting to know about how to use the tools of the trade effectively. In fact, it's an essential stage to becoming a good birdwatcher and one that is frequently bypassed in the eagerness to learn more about birds.

This guide will teach you what you need to know about binoculars. It will help you to understand the ones you already have, by learning about their strengths and limitations, and it will help you to get the best out of them. It will also give you enough knowledge to make an informed choice if you decide to buy new optical equipment in the future. For peace of mind, book onto a Start Birding binocular coffee morning at In Focus Optics.

Understanding your optical equipment

What are we aiming to achieve?

Before we go into detail, let's take a look at what we're aiming to achieve with our optical equipment (binoculars and telescopes). Obviously, we want to be able to see and identify birds but, in order for us to do this effectively, we need the following:

- Magnification – but not as much as you might think. Too much will cause problems
- A bright, clear image with no interference or colour separation (**chromatic aberration**)
- To be able to see as much as possible in one view – known as the **field of view**
- To have as much in focus as possible at any one time – known as **depth of field**
- To be able to focus on a bird (or butterfly) when it lands close by- known as **close focus**
- Good contrast and high resolution to bring out the detail of a bird
- Waterproofing and no condensation in extremes of temperature – known as **fogging**
- And above all, comfort and balance in the hand and ease of use.

What main components help us achieve this?

Optimal performance in any optical equipment is achieved by a combination of the following:

- **The body:** needs to be as light as possible (metal or polycarbonate) to avoid shake, but also sturdy (binoculars are usually rubber armoured) to prevent breakage if dropped.
- **Lenses and type of glass used:** there can be up to 11 lenses in a pair of binoculars, all of which will separate light into its component parts. Specialist glass is used to increase the focal point and counteract the dispersion of light preventing chromatic aberration. Lenses can also be arced or straight to minimise light dispersion.

- **Prisms:** these help reduce the amount of light lost. They make sure that what you see isn't upside down or a mirror image of your subject. The prism used determines the shape of the binoculars (see below)
- **Lens coatings:** as much as 4% of light can be reflected off each lens so glass is coated with several layers of metal oxides to reduce this to as low as 0.2% per lens in higher priced optics. Coatings can also repel water making the lenses easier to clean.
- **Gases:** nitrogen filling prevents fogging as it doesn't contain water. Argon is also used as it doesn't absorb or react chemically with water. Most binoculars are now gas filled.
- **Eyepieces:** these magnify the image coming from the prisms. The outer **ocular lens** size is important for easier set-up, field of view and sharper images.
- **Eye cups:** these need to be adjustable for spectacle wearers. They provide the optimum distance from the ocular lens to the eye and minimise ambient light interference. The importance of their design can be much overlooked, especially for spectacle wearers.
- **Focusing wheel/s:** a good focusing range is needed to enable quick focus of the subject while maintaining a clear image. **Close focusing** (around 4 metres) is important so that you can follow birds flying near to you or if you want to look at butterflies etc. Focusing wheels also need to be easy to use when your fingers are cold or when you are wearing gloves.

When buying binoculars, you can compare the performance of the range of binoculars on offer using the criteria mentioned above and the setting up your binoculars for your vision (information below). First let's look at the types of binocular in use today.

Binocular types

Your binoculars will belong to one of the three basic types highlighted below:

Conventional or Porro-prism: This is the classic binocular shape and uses the prism invented by Ignatio Porro which takes light through right angles to your eye. This model has an external focusing mechanism. It is sturdy but can be heavy.

Roof Prism: This is now the preferred style by most manufacturers. This model uses an internal focusing mechanism which reduces wear and tear. It has a straight design, using (mainly) the **Schmidt-Pechan prism** which is less heavy and has better light gathering facilities. Due to the pathway of light with this prism, the binocular can be shorter in length and therefore less heavy. Older varieties can be difficult to use but past difficulties with usage have now been rectified

Compact: Older or cheaper compacts are not recommended as a main pair of binoculars and certainly not for beginners. They provide you with the worst birding scenario as they will impair the image quality; close focus; ease of focusing; field of view, brightness etc. However, recent advances in technology have revolutionised the optics industry and some small binoculars can now perform well enough for a novice birder. A reputable birdwatching optics company will be able to advise you about compact binoculars but be aware that compacts will still have limitations.

There are also **Galilean** binoculars (most commonly used as opera glasses) which don't have prisms at all and use a concave eyepiece and a convex objective lens. The field of view is narrow and the magnification is low.

What do the numbers mean?

When buying binoculars you will see that there are two numbers that look like a multiplication sum i.e. 7x42, 8x40, 10x50, 7x20. **These numbers in no way represent the quality of the binoculars.**

The first figure is the magnification produced by the eyepiece lens i.e. 7x42 binoculars magnify the image 7 times and 10x50s magnify the image 10 times. New birdwatchers are often tempted to buy the ones with a high magnification. There are many reasons why you shouldn't do this.

- High magnification binoculars are heavier and may become uncomfortable to carry over time. You may end up with pain in your neck or shoulders or it may become difficult to raise the binoculars to your eyes for more than a few seconds without causing the image to shake. Shake will affect your ability to focus effectively and is a good indicator that you've chosen a magnification that is too high.
- In some cases, they may have a smaller field of view which may mean that you find it difficult to pinpoint a bird, especially when watching birds in woodland. However, the field of view in more modern binoculars is determined by the eyepiece construction. More expensive binoculars are constructed with **flat field lenses** to give an edge-to-edge sharp image correcting the curvature seen in standard lenses. Less expensive binoculars may only show sharpness from the centre for 60% of the image.
- Increasing the magnification also gives a darker and less defined image and a narrower depth of field.

The second figure is the size of the diameter of the objective lens in millimetres – the lens at the end of the binoculars furthest from your eye. The larger the number means:-

- the larger the lens
- that more light is let into the eye and the brighter the image

As you will be able to deduce, magnification and the size of the objective lens are inextricably linked. So how do you assess the optimal performance of a huge range of binoculars at the same price range? There is a simple calculation you can use to assess the potential performance and assess the **EXIT PUPIL** in millimetres. The exit pupil can be seen when you hold your binoculars away from your face and look down the barrels. The higher the final number, the better the binoculars are for light transmission and field of view (i.e. the more land you can see).

Going back to **'What do the numbers mean'** divide the second number by the first i.e. with 10x50 binoculars, divide 50 by 10. This equals 5. With 7x42 binoculars divide 42 by 7 (which equals 6). The final number is the size of the exit pupil in millimetres (NB: eye pieces with wider ocular lenses usually increase the size of the exit pupil).

If you have compact binoculars, you will now be able to see that those with a very high magnification in relation to the objective lens will obviously produce a very poor quality image. However, the advance in technology mentioned earlier has allowed the diameter of the objective lens to be reduced in higher end models. This has significantly reduced the overall weight without compromising performance; something that is of great advantage to female birdwatchers in particular.

Things to remember when buying binoculars

- Don't buy your optical equipment by mail order or recommendation. Always buy from a specialist dealer who understands the needs of a birdwatcher (dealers such as In Focus hold open days at reserves). Be wary of your high street camera shop. A camera specialist is unlikely to know anything about the binocular performance requirements for birdwatching.
- For the reasons mentioned above, don't be tempted to buy the highest magnification. To use in a variety of habitats, choose 7x and 8x with around a 40mm lens (10x for sea watching in a specialist hide). Larger binoculars with low magnification give the best flat field images (sharper from edge to edge). 7x50s are a prime example. With 7x50s you get constant focus across the field. They require very little focus or right eye adjustment.
- Test the binoculars for field of view; weight; ease of focus; sharpness of image etc. Work out what you think you can afford then try to go a little bit higher. This will save you wanting another pair in a couple of years and you just might be happy with what you've chosen for life. Consider looking at second hand deals. Many birdwatchers like their new gadgets and will often trade up when new models appear on the market. If you look at second hand optics, check that the dealer has serviced them and gives you a guarantee.
- Treat them with care and they will last a lifetime. Make sure they are completely dry before replacing lens covers, and putting them back in a case, to avoid mould. Clean regularly with a lens cloth or lens tissue. Never use a paper handkerchief, your T-shirt or gloves!
- Comfort and ease of use is the overriding objective when buying new binoculars

The final deciding factor

We are all built differently, our eyes are different distances apart and our eye sockets are at different depths. We have different shaped hands. Comfort and ease of use are the most important factor to consider when making your choice so, once you have made your shortlist, personal preference must be the overriding objective.

Using your binoculars in the field – the most important part!

Don't worry if you've been having trouble using your binoculars. Everyone struggles initially to find the birds they've seen with their naked eye. Using your equipment is a learned skill, just like anything else. Have patience, practise the exercises given to you in this handout and follow these simple rules:-

Optimising the eye relief: Your eyes need to be at a certain distance from the eyepiece lens for you to get a clear image. If you wear glasses then you already have the optimal gap so either fold down the rubber on the eyepiece or drop down the eye cups. If you don't wear glasses, ensure that you create the optimum eye relief by extending the eyecups.

Correcting the eye space: The aim here is to get each eye looking directly in a straight line through each 'barrel' of the binocular i.e. when opening and closing each eye you ought to be able to view one circular image (without any interference or blackness). If you can see two circles joined together (like that shown in James Bond films) then move your binoculars closer together. If you have any blackness showing then you just need keep making these adjustments until you have one clear image regardless of which eye you have open. This might take some time to get right but, once you've done it, keep them in this position. If you have a double image no matter how you try

then your binoculars are out of alignment. Take them to a reputable birdwatching binocular shop (I recommend In Focus) to see whether they can be repaired.

Setting up your binoculars for your vision: Your binoculars will have two focusing systems; a general focusing wheel in the middle, and a right eye focus (called a dioptre) which has a + or - scale. This can be on the right eyepiece or, with newer roof prisms, part of the central focusing wheel (some binoculars might have a dioptre for each eye). Set the dioptre at 0 or on the central point. If you intend to wear glasses while birdwatching, then the dioptre ought to remain set at 0 unless it's a while since you had an eye test.

Find something flat with detail on it, like a road sign. Close your right eye (or cover the right objective lens) and, with the general focusing wheel, focus your binoculars for your left eye so that the image is sharp. Leave the general focus where it is and close your left eye (or cover the left objective lens). Now use your dioptre to adjust for your right eye. Make a note of the reading on your dioptre scale and keep it fixed in that position. The general focus is then used while birdwatching.

To check that you've done this right, look at another object at a different distance using only your central focusing wheel. If the image isn't sharp for both eyes, go back to the beginning of this section and repeat the process. You should only need to do this once if you're the only person using your binoculars however, if you share binoculars, you'll need to do this each time you use them. Also, be aware that if you spend a lot of time looking at a computer screen, you may need to adjust your binoculars if you have eye strain. You'll be able to tell this if images don't appear sharp and you're struggling to get things in focus on a particular day. Ensure you reset them the next time you use them after your eyes have rested. **NB: If your binoculars are slightly out of focus, the six muscles in each eye will compensate for this and focus the image, but this will tire your eyes and strain the muscles.**

Accurate and efficient use: Practise the following exercise regularly to become more proficient with your binoculars. Find a static object. Before raising your binoculars, look at the object with your naked eye and hold your head still. Adopt a good standing posture (body straight, pelvis tucked inwards, shoulders back and relaxed, head held high). Hold your binoculars slightly above horizontal in your hands. Keeping a good posture and without dropping your head (or your eyes), raise your binoculars to your eyes using your upper arm muscles. The aim is to see your subject immediately. Focus using the general focusing wheel. Practice this technique daily on static objects such as your bird table, instead of trying to focus on a jittery woodland birds or diving ducks.

Your focusing technique: You need to move quickly from one bird to another so practice your focusing technique on birds at different distances. Always keep your finger on the main focusing wheel. If you look at something close up or far away then get into the habit of returning your focusing wheel to roughly the middle distance. This will enable you to find your next bird without having to turn the wheel too many times.

Caring for your equipment: Always carry two lens cloths with you and use these to clean your lenses. Never use a paper tissue, T-shirt or glove! Blow on your lenses or use a puffer brush to remove grit or sand before using a lens cloth. Use a lens cloth or lens tissue regularly. Never spray insect repellent near your binoculars as it may contain Deet which can destabilise modern coatings on lenses and rubber body. Take care when applying suntan oil and ensure your hands are clean when using your lens cloth. Wash your lens cloths regularly to minimise grease build-up.

Comfort and usage problems

It's important that you feel comfortable when out birding and that, eventually, your binoculars feel like they are a natural extension of yourself. To feel comfortable, you will need to look after your neck. You'll be carrying a significant weight around with you for a reasonable amount of time so it's vital that you pay some attention to the type of strap that you use. Your binoculars will come with the manufacturer's strap but, depending on how much you spend on a new pair, or how old your original pair is, you might experience some difficulties. Here are some common problems and possible solutions.

Layers (or lack of them): When you are birdwatching in winter, chances are you'll be wearing a fleece or two, a coat (perhaps with a rolled-up hood) and a scarf. Then you'll hang your binoculars around that ensemble. This will spread the weight of your binoculars significantly and you may not experience any problems at all until the summer comes. Then, if the weather is fine, you'll be wearing a T-shirt and there will be nothing between your neck and your strap. The weight will be concentrated over a smaller area and there is a chance you might start to experience neck ache. If you are using a rucksack then this might be a good time to fasten your strap with a karabiner to the loop at the top of your rucksack. This will take all of the weight off your neck, but it can be a bit fiddly. Alternatively, use a harness (see below) however this does have its limitations.

Straps: There are now some excellent binocular straps to minimise neck strain. They are made of neoprene and work in two ways. They spread the weight of your binoculars over a larger surface area and also absorb the bounce when you are walking.

Harnesses: If neck pain is really a problem, no matter what you do, then you can get a shoulder harness. This might seem like the obvious solution but be aware that our temperamental weather will mean that you have to keep taking it off and adjusting it for different thicknesses of clothing. You could opt to carry binoculars in your hand, but this usually results in them being dropped.

Shake: If you are having problems keeping your binoculars still and you have a shaking image, then you may be using binoculars that are too heavy for you. This will be the case if you've opted for a high magnification binocular but if you've chosen wisely, stick with it, because it could be that you are using muscles that you haven't used for a while. If you have followed the guidelines given on purchasing your first pair of binoculars then it is probably the latter. You'll get used to this. Some days you may just be tired after a long day's birding, especially if you are also carrying a telescope and/or a rucksack and you have been walking all afternoon. Until your muscles develop, try watching birds while resting your arms on a wall, or the shelf in a hide, if you are going to be birding for long periods. You may need to cut short your day until you build up your muscles.

Steaming up: If your binoculars are steaming up then it could be down to 2 things.

1. Your binoculars are moving between two extremes of temperature and they are 'fogging up' on the inside. This happens in winter with old air-filled models when you move between two extremes of temperature. They will clear when they warm up or cool down, but it makes it hard to watch birds for a while. New designs are filled with nitrogen or argon gas to prevent this from happening (see above) but may steam up on the outside of the glass when you breathe. Best to avoid heated hides.
2. Your eyes water and you are creating a seal with the eyecups against your eyes. Try holding your binoculars against your brow bone to leave a gap for moisture to escape.

Hopefully, this guide has helped you to understand and get the most out of your binoculars.