The Technical Side of Birding

Choosing the Right Binoculars for Birding

By Stan Barrack

As birders, binoculars are one of our most important tools. They hang around our necks so much they could be considered fashion accessories. So how do we select the right pair? How do we separate artful marketing terminology from the specifications? What are the specifications of a good pair of binoculars for birding?

The most common binocular you'll see hanging around a birder's neck is an 8x42 roof prism. Why do most birders choose that binocular? Should you choose the same binocular? What do those numbers mean? Let's start at the beginning and work our way through the specifications.

Magnification

What is it?

The first number you'll see is the magnification of the binoculars. It's the number before the "x". For example, the 8x42 binoculars referenced earlier will magnify the image 8 times. A 7x35 binocular will make your bird appear 7 times closer.

Why is it important?

To state the obvious, we need the right magnification to enlarge those frantically moving little dots in the tree tops. Unless we're birding for ostriches, we need enough magnification to distinguish eye rings, wing bars, and notched tails. Too little magnification and we cannot capture all the details we need for identification. Too much magnification and the field of view becomes smaller (more on this later), the image gets darker (more on this sooner), and the scene gets shaky (more on this now).

Magnification also "magnifies" minute hand movements. As magnification increases, it gets more difficult to hold the image still. Most people can hold a pair of 8x binoculars pretty steady. A magnification of 10 is about the limit for most people. A magnification of 12 may work for those that can tolerate a little shaking. Holding binoculars steady with a magnification of 15 could be difficult even for a surgeon. Realistically, at 15x and above, you're in tripod territory.

Objective Lens

What is it?

The second number you will see is the diameter of the objective lens in millimeters. It's the number following the "x". When you look through your binoculars, you are looking into the ocular lenses and out through the objective lenses. The 8x42 binoculars have an objective lens of 42mm in diameter.

Why is it important?

The objective lens is where you get your light. I stated earlier that you look into the ocular lenses and out of the objective lenses. Though true, it's really the other way around that is more important. Light enters through the objective lens and exits through the ocular lens, allowing you to see the image.

Binoculars are all about light. Therefore, larger diameter objective lenses allow the binoculars to gather more light for brighter images. All things being equal, 8x42 binoculars will have a brighter image than 8x32 binoculars.

But as usual, there's a yin for every yang. Larger objective lenses mean more glass. More glass means more weight (and more money). Larger objective lenses also increase the size of your binoculars. That is one of the reasons you see a lot of 8x42's. For a magnification of 8, 42 mm objective lenses let in a good amount of light, while keeping the binocular size, weight, and cost manageable.

Field of View

What is it?

Field of View (FOV) is a metric of viewing width; in other words, how wide is your viewing angle through your binoculars? FOV can be specified in number of feet at 1,000 yards, or number of meters at 1,000 meters, or simply as a number of degrees. For example, if your binoculars has a field of view of 4.7 degrees, that means at whatever distance you focus your binoculars, your view will be 4.7 degrees wide, with you standing at the center. If you are focused on an object 1,000 yards away, your view will be 246 foot wide. (Shortcut: <degrees> x 52.5 = <feet>/1,000 yards). If you are focused on an object 1,000 meters away, your view will be 82 meters wide. (Shortcut: <feet> / 3 = <meters>/1,000 meters).

Why is it important?

FOV typically decreases as magnification increases. FOV is really a function of ocular lens size. If the ocular lens size is constant, then the FOV will decrease as magnification increases. If you are increasing magnification to see that warbler high in the canopy, then your reduced FOV means when the bird moves, it's out of your view and you have to find it again. Therefore, if you are comparing two similar binoculars, perhaps you'll want the pair with the higher FOV so you can follow that warbler as it jumps branch to branch. A pretty good target FOV for birding is 6 degrees or better.

Exit Pupil

What is it?

This is the actual diameter of the light out of the ocular lens that lets you see your image.

The average adult has a pupil diameter of between 2mm to 7mm; smaller when light is bright and larger when light is dim. For your 8x42 binoculars, the exit pupil will be a little over 5mm (42/8=5.25mm). When it's bright outside and your pupil is 2mm, the light coming from your binoculars is larger than your pupil, so you perceive the image as normal brightness. If you are looking through your 10x25 binoculars at dusk, your pupils have expanded to 7mm, but the light coming from your binoculars is 2.5mm (25/10=2.5mm). Now your image is going to appear darker because you are not getting as much light as you need.

Why is it important?

If you are going to be using your binoculars during the daytime, then an exit pupil around 5mm or higher should give you plenty of light in most situations. If you only use your binoculars to look across the open plains in bright sunlight, the 10x25 binoculars will give you all the light you can use because your pupils will be smaller in the bright light. But, if you are using your binoculars in the dense forest, or on a heavily

overcast day, or at dusk, you are going to want larger exit pupil. One rule of thumb for astronomy binoculars is to get binoculars with objective lenses 7 times the magnification. A pair of 9x63 binoculars is great for astronomy because of their 7mm exit pupil (63/9=7mm).

Eye Relief

What is it?

This is the optimal distance your eye needs to be from the eye piece. It is measured in millimeters. Binoculars with an eye relief of 15 mm means you will get the best view (without the dark outer circles) through those binoculars with your eye exactly 15 mm from the eye piece.

Why is it important?

This is very important if you wear eyeglasses or sunglasses. When you wear glasses, your eyes are already some distance from your glasses. If there is 17 mm from the outside of your glasses to your eye, then looking through binoculars with a 15 mm eye relief will be like looking through a tunnel. You'll end up needing to take your glasses off every time you use your binoculars.

If you wear glasses, you're best with binoculars with an eye relief of 17 mm or more. If you don't wear glasses, this is probably not a big deal. Most binoculars now have adjustable eye cups to move your eyes the appropriate distance away from the eye piece.

Close Focus

What is it?

This is the closest distance at which you can focus on an object. If a sparrow just flew into the reeds beside you, this is the minimum distance that you need to be from that sparrow before you can focus and identify it.

Why is it important?

The importance of close focus distance depends on how you use your binoculars. If your primary use is to identify raptors or shorebirds, then close focus is not all that important to you. But, if you do your birding in the thick of the forest, then you will want to look at this number closely. Look for a pair that can focus 3m (9 feet) or closer.

Prism Type

What is it?

This identifies the type of glass used in the internal prisms. Prisms are used to redirect (or bend) light. In binoculars, they correct the image orientation (the objective lens inverts the image) and they reduce the length needed, which is why your binoculars can be smaller than those long pirate spyglasses.

Generally your choices are BaK4 or BK7, both are standards of glass quality by German manufacturer Schott AG. Most of the higher quality binoculars use Bak4 because it has a higher refractive index than BK7.

Why is it important?

It's all about the light. Better glass will usually mean less light lost.

Be aware that BaK4 is not an international standard. There is a Chinese BaK4 standard that is somewhere between Schott BaK4 and Schott BK7 in quality.

In high-end binoculars, you may see ED glass (Extra Low Dispersion Glass). This glass is used in the lenses (not prisms) to minimize light dispersion, reducing chromatic aberration (color fringing).

Glass Coating

What is it?

Coatings are put on the surfaces of the glass components of binoculars to reduce light reflection and therefore increase light transmission.

Why is it important?

Glass is a very reflective material. Light reflects off both external and internal lens surfaces. Coatings help reduce those reflections for a specific light frequency (color). Multiple coatings can reduce reflections for multiple frequencies. Fewer reflections has the added benefit of reducing the light bouncing around inside your binoculars which can make the image cloudy.

Marketing continuously comes up with novel ways to hype lower quality coatings. You should be aware that there is a difference between coated, multi-coated, fully coated, and fully multi-coated (sometimes FMC). I'll just cut to the chase and tell you that FMC means every glass service is fully coated with multiple coats and that's the one you want.

Phase coating is a plus. You'll find it on mid to high end binoculars. The short of it is that phase coating eliminates the phase distortion that is inherent in the roof prism design, keeping colors accurate and the image sharp.

Depth of Field

What is it?

Depth of Field (DoF) is the distance between the nearest object and the farthest object that can be in focus at the same time. In other words, if you have an American Robin in focus, how much is in focus in front of her and how much is in focus behind her?

Why is it important?

In general, the closer your focused object is to you, the shallower the DoF will be. The farther your focused object is from you, the deeper your DoF will be. If your binoculars has a shallow DoF, you could end up with a close view of a sharp bird head and a blurry bird tail. This effect might be great for photography, but can be frustrating in binoculars.

This falls in the category of try before you buy. DoF is not usually among the manufacture's published specifications, and the math to calculate it requires specific knowledge of the binocular's internal components and architecture.

Size and weight

What is it?

Binoculars will of course vary in size and weight.

Why is it important?

After reading this article, you may think a pair of high quality 10x70 binoculars are the perfect birding tool. You might consider how long you can hold those 3lbs binoculars up to your eyes while trying to get just a glimpse of that tiny warbler that you can hear somewhere up in the canopy above you. You will be spending a lot of time with these binoculars. Make sure they "fit" you.

The Punchline

The prevailing wisdom seems to be to buy *the best pair of binoculars you can afford*. I think that is true for your SECOND pair of binoculars.

If this is your first pair, compare the 8x42 binoculars from Athlon, Bresser, GPO, Hawke, Nikon, Steiner, and Vortex. They each have multiple tiers of binoculars, so find the first tier of each that has FMC Bak4 prisms and pick the one with the best specifications for your needs. Each of these companies make quality products. (July 2020) Don't forget to check the eye relief if you wear glasses while birding.

If possible, try new binoculars before you buy them. Keep in mind that the person writing the specifications is not often the same person who designed and manufactured the binoculars. Mistakes happen. A dark and stormy day, too rainy for birding, is great for comparing binoculars at your favorite sports or optics store. Those conditions are perfect for evaluating light gathering and clarity in a pair of binoculars.

If these are your second pair of binoculars, then you can move on to *the best binoculars you can afford*. You will have a better understanding of what you need. Your current 8x42's can go in the glove compartment. You need a backup pair of binoculars anyway, don't you?