Choosing a Binocular

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VER THE YEARS, THE stereotype of the birdwatcher has changed quite a bit. The uniform has evolved from tweeds and oxfords to Gore-tex and gumboots. And while in the early days, birdwatchers were seen as passive observers of their natural world, today they are seen as more active, pursuing species aggressively, and keeping competitive lists of their sightings. Even the name has changed to reflect the more active nature of the game; birdwatchers now almost universally think of themselves as birders.

But one thing has remained the same. Ask anybody to describe a birder to a you, and, no matter what else they say, they'll bring the word "binoculars" into it. Binoculars have long been used by birders, and today they remain, with the possible exception of the field guide, the single most important bit of equipment that a birder uses.

Not only do virtually all birders use binoculars, but as a group, they use binoculars more than anyone else. They expect more of binoculars, and they depend on them to perform well under a wide range of conditions.

Now if we birders are to get the most out of our binoculars, it makes sense that we should know something about them. The better we understand binoculars, the better we know what to expect of them, and the better we know what to look for when the time comes to upgrade.

Let's start by looking at a standard, all-purpose binocular. You'll notice I didn't call it "pair" or a "set"; the term "binocular" is singular.

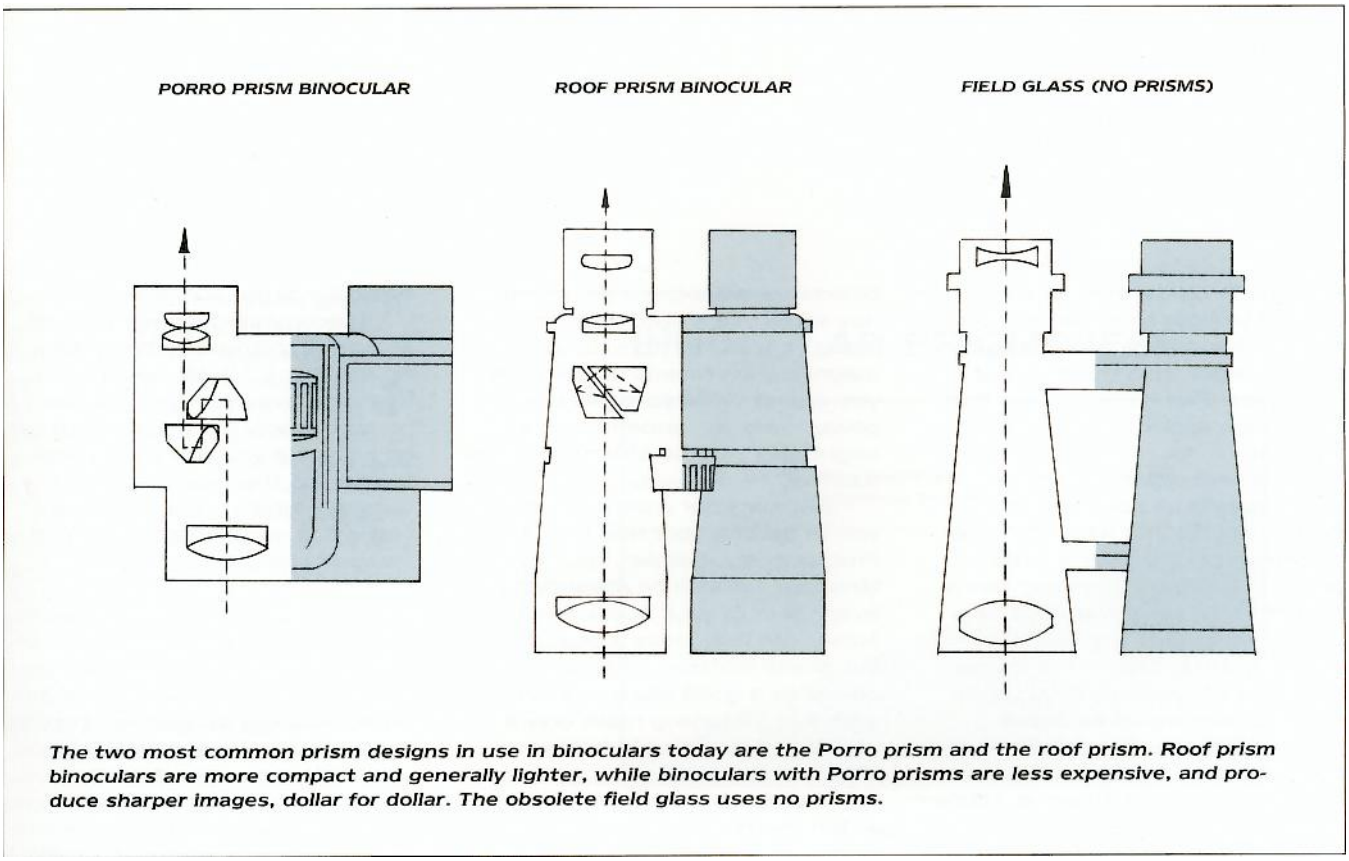
The binocular is descended from the field glass, which is essentially two telescopes fastened together. The field glass was a remarkable advancement, but it was limited to low magnification.

An Italian by the name of Porro determined that if prisms were employed in a field glass to fold the path of light, greater magnification could be achieved with no attendant increase in size. Today, the majority of binoculars sold still use the prism system that bears his name.

Porro prism binoculars have the typical binocular shape, with objective lenses set wider apart than the eyepieces. Some have bodies that are cast in one piece, and others are assembled from several pieces; there is no difference in performance.

The other prism design in use today is the so-called dach or roof prism. It gets its name from one of its faces, which, instead of being flat, is ground to look like a gable roof. Roof prism binoculars normally look like a letter H; usually the light path is folded inside such that it appears to enter and leave the binocular in the same line. Roof prisms come in several designs, each with its advantages and disadvantages.

If we look again at our sample binocular, we'll see an array of numbers and words on it. They all tell us something. First of all, we see the designation "7x35". The first number says that the binocular magnifies the subject seven times (7x); a Peregrine on a distant pole will look seven times bigger.



The two most common prism designs in use in binoculars today are the Porro prism and the roof prism. Roof prism binoculars are more compact and generally lighter, while binoculars with Porro prisms are less expensive, and produce sharper images, dollar for dollar. The obsolete field glass uses no prisms.

The second number is the diameter in millimetres of the objective lens (the big end). In our sample, it is 35 millimetres across.

The larger this lens is, the more light it lets in to the binocular. But the larger it is, the larger (and heavier) the binocular is too. We're going to have to compromise; so, how much light do we need?

In daylight, the pupils of our eyes are normally dilated to a diameter of about 2.5 or 3 millimetres. But in low light, for example, at dawn or dusk, or looking for antpittas in a Central American rainforest, our pupils can expand to as much as 7 or 8 millimetres.

Let's look again at our sample binocular. We know that the objective is letting in a shaft of light that's 35 millimetres in diameter. But how much is coming out? To find out, we divide the diameter of the objective lens by the magnification: 35 divided by 7 is 5; our binocular is delivering a 5 millimeter shaft of light to each eye. You can see this on your own binocular if you look into the eyepiece from a distance of a foot or two; the circle of light you see is called the exit pupil.

Now, if we consider a 7x20 compact binocular, we'll find that the magnification is the same, but the exit pupil is a little less than 3 millimetres; just fine on a sunny day, but with no leeway when the light is poor. There is another point to consider, too.

The Pentax 7x35 PCF is a typical general purpose binocular. Visible between the two eyepieces are numbers denoting magnification, size of the objective lens, and width of the field of view.

Trying to line up your pupils on the two images formed by your binocular is much easier when the binocular's exit pupil is larger than the pupils of your eyes. This is one reason that 7x50's are easier to use on a moving boat.
The next number that concerns us tells us how wide the field of view is. It's written in one of two ways. The first is in degrees: our sample binocular has a field of view that covers 9.3' of a circle. Sometimes the field is given as the width in feet of the image seen at a distance of 1,000 yards; our binocular would be about 500'@ 1,000 yds. For purposes of comparison, one degree is approximately equal to 52.5 feet at 1,000 yards.
Now that we're armed with a bit of information, we should be able to determine which is the best binocular for birding, right? Wrong. No matter what anybody tells you, there is no one best binocular for birding. But you will be able to settle on a binocular that's best for you.
For example, while 7 power binoculars were the order of the day some years ago, today most birders use 8's or 10's. Greater magnification means bigger birds, yes, but at what cost? As the power goes up, remember that brightness may be affected, or the size may be unwieldy.
But consider another factor: If you're getting your first look at a Prothonotary Warbler, your 10x binocular will also be magnifying every beat of your accelerated pulse. You may have a beautiful but shaky warbler. I'd suggest 8 power as a good place to start, with 9 or 10 having merit only if you're certain you can hold them steady comfortably. Try reading a typed page at a distance of eight or ten metres with a ten power binocular and you'll see what I mean.
The next feature to look at is objective size. Your choice here will be influenced by two factors: magnification and weight. The higher the magnification you choose, the smaller the exit pupil will be, unless you choose a larger objective, which will make the binocular larger and heavier.
I recommend an exit pupil of at least 4 millimetres for birding. An 8x32 or a 10x40 would meet this requirement. If you are prepared to carry more glass, you can go higher. If you find even these too heavy, then you may find a compact which will suit you, but you will at least occasionally find yourself short of light.
There is another important factor which affects brightness in a binocular. Every time a beam of light passes from air to glass, or from glass to air, about 5% of it is reflected away or scattered inside the binocular. In an average binocular, with many refracting surfaces, the total light loss can easily be as high as 40%. To reduce this loss, ultra thin coatings, typically of magnesium fluoride, are applied to the refracting surfaces. This results in a light transmittance of something better than 80%.
Even better results can be achieved if the coating consists of several thin layers of different compounds; transmittance will climb to over 90%, and some manufacturers claim 95 to 97% transmittance. This advancement is known as "multicoating".
Obviously, we should be looking at binoculars with coatings on all refracting surfaces. Look for the term "fully coated optics". Today, even some moderately priced binoculars offer multicoated lenses, and this makes for good value if the binocular is otherwise suitable.
There are different opinions about the optimum field of view in a birding binocular. One school argues that a wide field of view makes it easier to track fast-moving birds. The other maintains that it's better to put all your glass on the subject. Binoculars which do not

The circles of light visible in the eyepieces of these two binoculars are called the exit pupils. Both binoculars have the same magnification. The Bausch & Lomb 7x50 Discoverer, below, delivers much more light than the compact Nikon 7x20 Travelite M, above, but the Nikon is much smaller and lighter.

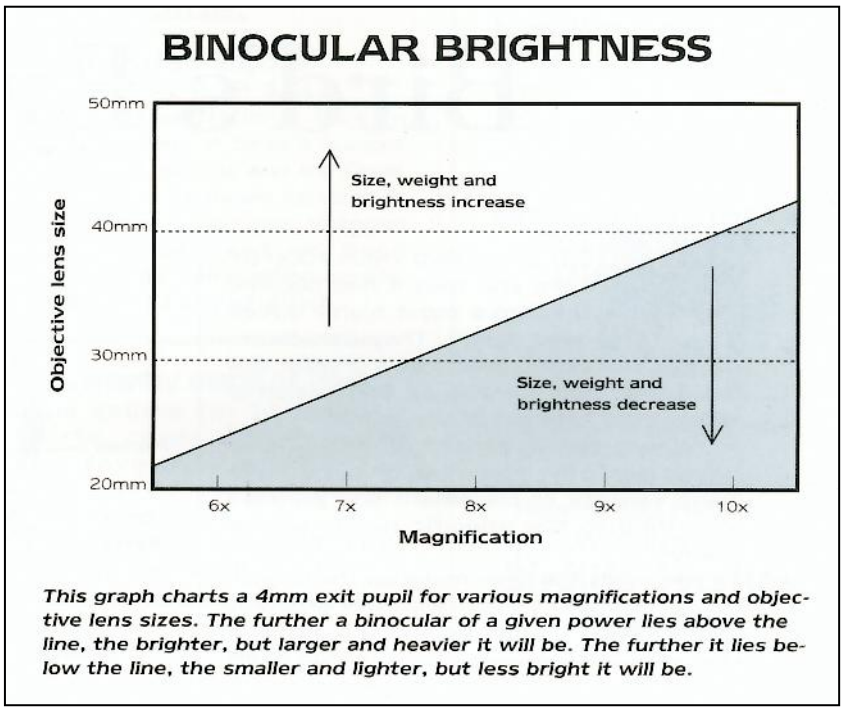
have wide fields have less glass in them, and are thus lighter. They also show greater sharpness and less distortion at the edges of the field. In any case, width of field de creases as magnification increases, so be sure to consider this fact in your "best binocular" equation.

There is an important function of binoculars which is seldom discussed. This is the ability of the binocular to focus on objects near by. For birders, often the subject is only a few metres away, and many binoculars will focus no closer than 8 or 1 0 metres. The figure will vary with magnification and model, and roof prisms are inherently poorer at this. I suggest 3 to 4 metres as a minimum; some binoculars will focus down to less than 2 metres. Try them yourself, because this distance varies among individuals.

For those birders who wear eyeglasses, rubber eyecups (now almost universal) are essential. Fold them down, to bring the binocular closer to your eye. Better still are the long eye relief models, which give eyeglass wearers a full field of view even with glasses on.

Most binoculars are not waterproof. Truly waterproof binoculars are sealed and filled with nitrogen; they work very well, but repairs are more costly, and must be done at an authorized facility where resealing and nitrogen purging can be done. Some of the so-called showerproof models have performed very well in tests.

Next we get into an area where personal preferences and individual requirements come into play. Large hands may be uncomfortable with a small binocular. Long eyelashes may require deeper eyecups. Narrow eye-spacing will eliminate many models. Some birders prefer faster focussing, while others want the precision of a slower mechanism.



This graph charts a 4mm exit pupil for various magnifications and objective lens sizes. The further a binocular of a given power lies above the line, the brighter, but larger and heavier it will be. The further it lies below the line, the smaller and lighter, but less bright it will be.

The real test is using the binocular. Tack sharpness is little consolation if the binocular just is not comfortable. My suggestion is that you narrow the field to several models which come close to meeting your criteria, and then base your decision on which of those binoculars feels the best. It's better to compromise a little on one feature or another than to saddle yourself with a theoretically ideal binocular that feels foreign every time you pick it up.

Finally, a list of dubious features, and reasons to consider avoiding them. Fast-focus mechanisms are imprecise, and can even be affected by pressing the binocular to your face. Permanently focussed binoculars (with no adjustment) will not focus closer than 12 to 15 metres and are useless for birding. Zoom binoculars are fraught with limitations. At higher magnifications, there is too little light, and they cannot be handheld. E>ctra glass means lower resolution and greater light loss. More moving parts means less precision and less optical quality for your dollar. Stay away from any of these binoculars. If you presently own one, learn to minimize its limitations until you can retire it.

If all of this sounds a bit overwhelming, just give it a while to sink in. Remember that minor differences in magnification or field of view are not going to be noticed. You'll do well to buy the best that you can afford, but you can maximize the value you are getting for your dollar by checking the various models for the performance features you want. Once you've made a choice, your binocular will soon become an old friend, and you can get down to the business of finding and enjoying birds.

Bruce Whittington is an active birder who lives on the Saanich Peninsula, north of Victoria, B.C. He writes a weekly column about birds in the Victoria Times-Colonist, and has taught many birding courses. Since 1984 he as operated The Field-Naturalist, a store specializing in optics, books, and other supplies for naturalists, in downtown Victoria.