Mecklenburg Audubon Society

Understanding Scopes - The Basics

Scopes can range in price from $200 to $2,000. So what's the difference between a cheap scope and an expensive one? Let's start with the basics and then define and compare the different features of spotting scopes to help you decide on a purchase.

Consider before purchasing:

Magnification

In general, a good magnification range for your bird watching spotting scope is between 15-60x. Below 15x, you might as well use your binoculars. Above 60x, the field of view becomes too narrow and image brightness begins to dim, especially a problem in low light conditions. Most often, 20-40x gives both the best field of view and image brightness for bird watching.

A point to remember: The higher the magnification, the larger the objective lens is needed to maintain image quality. Additionally, any distortions (heat waves) or scope movement (tripod tremors) will be intensified at higher magnifications.

If you do want more magnification, remember that the quality of the lenses and prisms (which affects transmittance) become increasingly important. Low quality lenses and prisms will produce low quality images, especially above 45x. The highest useful magnification of your scope depends on the quality of the lenses and prisms, the objective lens size (discussed below), and outside conditions (low or bright light, haze, heat waves, etc.)

Objective Lens (Aperture)

The size of the objective lens determines the light-gathering capacity of a spotting scope. More light = more clarity and detail which = a brighter, clearer image. Aperture is defined as the diameter of the objective lens, usually measured in millimeters. Bird watching objective lenses normally range between 50-80mm.

In general, a larger objective lens equals more weight and more $$. When deciding on the objective size for your scope, get the largest objective you're willing to pay for, but also willing to carry. If you're willing to carry a little extra weight, an 80mm objective lens will give you good images in nearly all light conditions,

especially at higher magnifications.

Think about where and when you will be doing most of your birding. If you live in Seattle (many cloudy days), go for the bigger objective lens. If you live in a dry, sunny location, i.e. Arizona desert, and do most of your birding during the day (not dusk or dawn) and you want to carry something lighter, perhaps you could consider going a little smaller.

Exit Pupil

Along with objective lens size, the exit pupil is the best measure of image brightness. The exit pupil is the diameter of light in millimeters visible through the eyepiece. To calculate the exit pupil divide the objective lens size by magnification. So the higher the magnification, the larger the objective lens needed to maintain image brightness.

As a general rule of thumb, try to get a scope where the exit pupil does not go below 1.33mm. Because in conditions besides optimal (bright, calm), an exit pupil below this will be insufficient, especially at higher magnifications.

So if you had a scope with a 20-60x zoom eyepiece, an 80mm objective lens would be suitable for all magnification ranges. 80mm(objective lens size)/60 (highest magnification) = 1.33mm (exit pupil size). However, a 50mm objective lens at 60x would give you an exit pupil of .83 mm (50/60=.83). Not as good, especially in lower light conditions.

Eyepieces

The eyepiece is what determines the magnification of your scope. It is also is a factor in determining field of view, exit pupil size, and eye relief. Eyepieces sometimes are included with you scope but more often are sold separately. Most scopes have interchangeable eyepieces, specific to manufacturer and line, allowing you to choose one or more that fits your preferences. You can get either interchangeable fixed or single zoom (variable) eyepieces for your scope. There are some spotting scopes, usually zooms or waterproof scopes, which have eyepieces that are non-interchangeable.

Zoom eyepieces have a range of magnification levels from low to high, usually 15-45x or 20-60x. Birders find these very useful because they can scan at the lower magnification (wider field of view) to find the bird, then use the higher magnification to see details.

Why get a spotting scope? Advantages over binoculars

Spotting scopes are for long-distance bird watching. They provide the magnification necessary to see distant birds that are beyond the reach of your binoculars and to admire details at closer ranges. There are times when you physically cannot get close enough to see what you want with your binoculars. It may be because you are trying to view waterfowl in a lake, shorebirds on the mudflats, or cliff-nesting birds. Perhaps you want a closer look, but don't want to disturb the bird, especially sensitive species, say on a nest. Or in open spaces, trying to get close enough with binoculars will scare them away. With a spotting scope, you can admire birds from a distance.

Spotting scopes on a sturdy tripod can also allow you to study birds in more detail. You can locate a sandpiper or duck in the scopes, twist the tripod handle to lock the view in place, open your field guide, go back to the scope to reexamine the bird, look back at the field guide, turn a few pages, go back to the scope, and so forth. You can study the bird as long as you want without hand tremor or arm fatigue.

It's also nice to have a spotting scope when birding in groups so that everyone can get a closer look. It's a great way to share bird watching with beginners, especially young birders.

Just remember to get a scope with an objective lens size that will be able to provide you with good images at all magnification ranges (review objective lens size and exit pupil size). The quality of the eyepiece glass and design affects image quality as well. So selecting an eyepiece is just as important as selecting the scope body.

Note that manufacturers may have eyepieces that can only be used on one design line while other may be used on multiple lines. You

may want to consider this and see what eyepieces can be used on your scope if you plan on getting more than one.

Field of View

The linear field of view (FOV) is measured as the width of area visible at 1,000 yards (or meters) from the observer. It can also be expressed in degrees as the angular field of view. Normally as magnification increases, field of view decreases.

In general, a wide field of view is better for following fast-moving objects or for scanning and finding birds in the scope. As discussed earlier in the eyepieces section, if most of your birding is done in wide open spaces, i.e. ocean seabird watching, hawk mountain ridges, then you may want to get a fixed wide-angle eyepiece that will provide you with a wider FOV.

You will notice that when comparing a 20x fixed eyepiece with a 20-60x eyepiece that the fixed 20x will have a wider field of view than the zoom at 20x. That is the result of its design.

Optical Design

The 2 basic optical designs of scopes are refractive and catadioptric. Nearly all birding spotting scopes are refractive. The reason being that even though catadioptric scopes provide clearer images at higher magnification (of same weight of refractor), they cost significantly more than refractive scopes and are not as strong and durable for field use as refractive scopes. If you want that extra bit of edge for better images, have the cash, and think your scope won't get bumped around too much, then go for the catadioptric. Otherwise, a refractive scope is what you want. But remember, catadioptric scopes may have images that are vertically correct, but reverse the image left and right.

Body Design: Angled or Straight

There are two basic body designs of refractor spotting scopes: straight and angled. Straight scopes have the barrel and eyepiece aligned with each other, angled scopes have the eyepiece offset 45° or 90° from the barrel. There are pros and cons for both.

It's easier to follow birds that are moving with a straight design. Also if you use your spotting scope from inside the car with a window mount, a straight scope is not a problem. Many people find the straight line of sight is easier for accurate aiming. A straight design is also easier to use from an elevated position. For example, viewing your backyard birds from a second-story deck.

On the other hand, if you are tall or do a lot of birding with groups, or most of your viewing is above the horizon (looking at cliffs, viewing soaring raptors, birds on tree-tops) than perhaps an angled design would be a better choice. An angled scope can be shared easier than a straight scope because more people of different heights can comfortable look into the scope without adjusting the height.

Think about how you will most often be using your spotting scope. This will help you decide which design best suits your needs.

Focus Mechanism

There are 3 basic focusing mechanism designs: single knob, double knob, and helical. If you can, try different mechanisms and see which one works best for you. If you can't, then choose a knob focuser, which is generally preferred for bird watching and nature viewing.

Glass Composition/Coatings

Color aberration is sometimes noticeable with refractor scopes. This can be eliminated with the right kind of glass and coatings. Look for scopes with ED (extra-low dispersion); FL (Fluorite); HD (High Density); and/or APO (apochromatic) glass. These elements will provide you with an image of higher clarity, detail, and sharpness, which in turn will reduce eyestrain.

Of coarse scopes with these extras add extra cost and weight, but you'll be paying the cost in frustration when you can't see those details on that special bird on an overcast (low-light) day.

Spend the extra money on your spotting scope, save by making coffee at home, renting movies, skipping the fast-food, or make your own Christmas presents. Not eating french-fries for a month may buy you the feathered look of a lifetime!

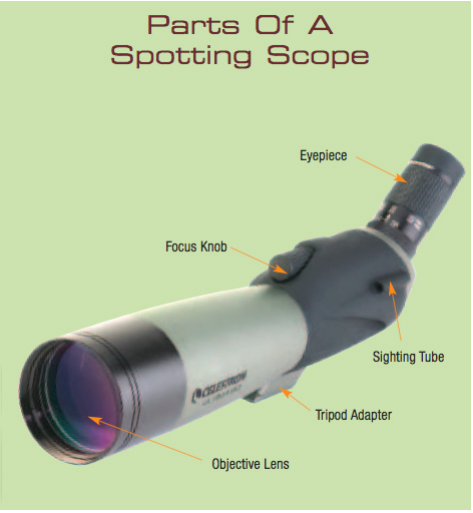
Weather Proofing/Protection

Unless your scope is going to reside inside your home, weather-proofing is not an option. You never know when that rain cloud will just pop-up out of nowhere. Look for scopes with waterproof and fogproof (nitrogen/dry gas filled) designations. Rubber armoring is also a nice addition. It provides protection against abrasive materials, corrosion and helps cushion the scope against unexpected impacts (oops!). It also makes it easier and more comfortable to handle in cold, wet weather.

Eye Relief

Eye relief is an important feature on for eyeglass wearers. It is the distance in millimeters between the eyepiece of the spotting scope and your eye that still allows you to see a complete field of view image in focus.

When someone is wearing eyeglasses thier eye is further away from the spotting scope eyepiece, which means a longer eye relief is needed in order to see the entire field of view. For most eyeglass wearers, an eye relief between 12-15mm is adequate. Without adequate eye relief, you won't get a complete field of view and you'll need to remove your glasses in order to see the image properly. So long eye relief promises full field viewing with eyeglasses. As mentioned previously in the eyepiece section, there are eyepieces specifically made with long eye relief. You may also want to select eyepieces that have folding or rollback eyecups so you can get your eyes closer.



Close focus

Close or near focus is the distance between the scope and the nearest object you can focus on, while maintaining a good image and sharp focus. In general, as magnification increases, the minimum close focal distance also increases. So scopes will typically have longer close focus ranges than binoculars. For bird watching, a short close focus is beneficial for seeing details of a bird that has landed up-close to your scope. It is also better for taking photographs. So if this is important to you, selecting a scope with a close distance of 15 ft. or less would be optimal.

Summary:

Get a lightweight, strong & sturdy scope. If it's not lightweight, it will be uncomfortable to carry around. And if it's not well built with strong housing, the first time it gets bumped when you're frantically grabbing it from your back seat to see that lifetime peep (a.k.a sandpiper), you may be very disappointed when the focus doesn't focus. You get what you pay for - so don't go cheap.

As with anything else, weigh the cost against the benefits, and get the best spotting cope you can afford. If you can't afford a Swarovski, Leica or Zeiss (most expensive manufacturers) then look at others such as Kowa, Nikon or Pentax, which can have just as good designs but are significantly loser in price. And don't forget to leave money in your budget for a sturdy tripod to support your scope otherwise it's like putting a Mercedes on golf cart tires.

Adapted from BirdWatching-Bliss.com