



## Basic Information about Binoculars

# Exit pupil

The exit pupil is the bright circle that can be seen in the center of each eyepiece when you hold the binoculars about 30cm away from your eyes with the objective lenses pointed toward a bright light. The larger the diameter is, the brighter the viewfield is, which is an important consideration when using binoculars in dark situations and for astronomical observation.

Exit pupil = The effective diameter of the objective lens ÷ Magnification

With 8x42 binoculars, the formula is  $42 \div 8 = 5.3$ .

Therefore, the diameter of the exit pupil is 5.3mm.

This figure indicates the brightness of the image in view.



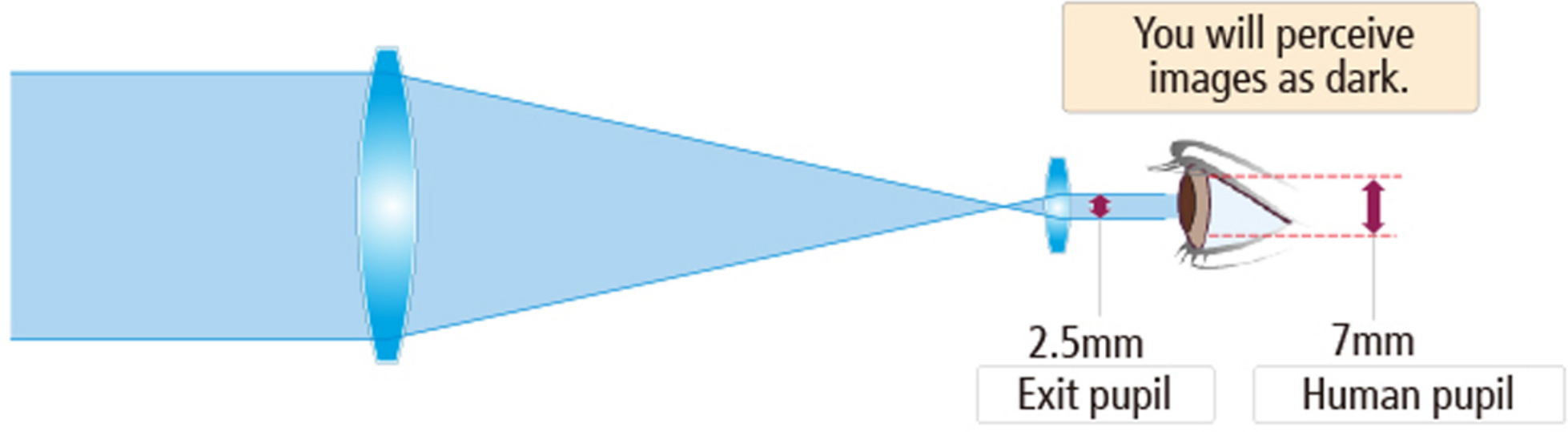
## What is the relationship between bright/low-light conditions and the exit pupil of binoculars?

The pupil diameter of human eye changes depending on the ambient light conditions.



### In low-light conditions (comparing 8x20 and 7x50 binoculars)

#### 8x20 binoculars



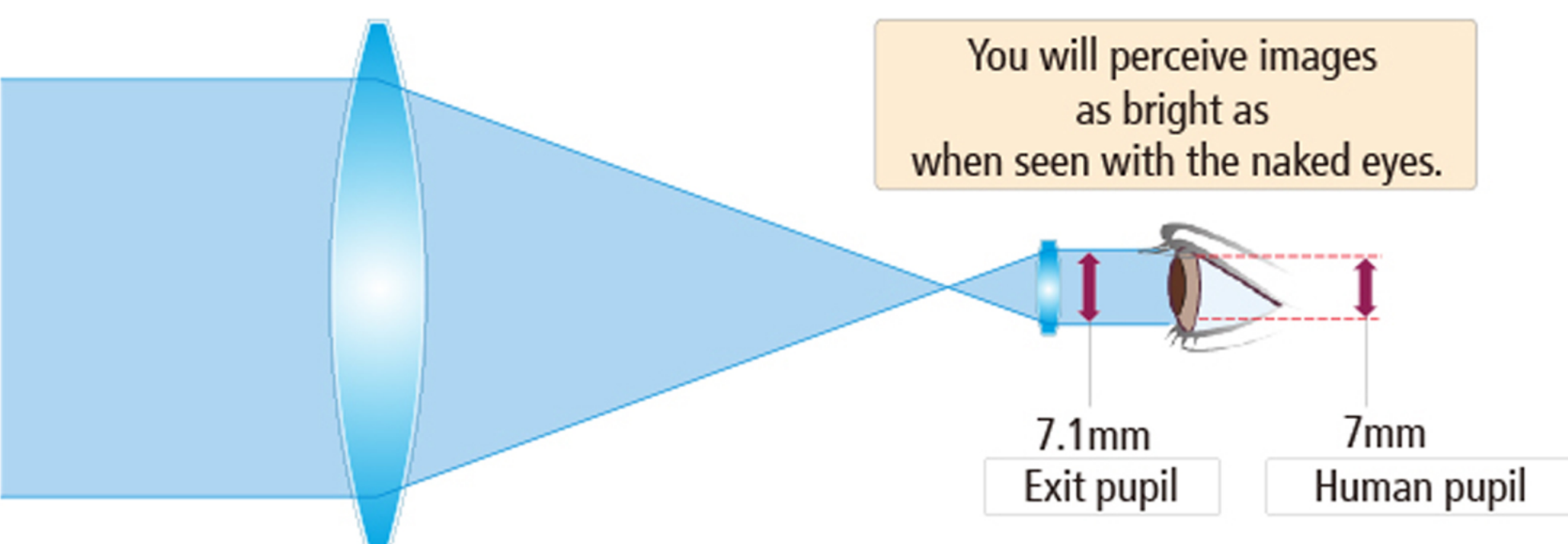
With 8x20 binoculars

Pupil diameter of human eye: 7mm

Exit pupil of binoculars:  $20 \div 8 = 2.5\text{mm}$

Because the 2.5mm exit pupil of binoculars is smaller than the 7mm human pupil, you will perceive images as dark.

#### 7x50 binoculars



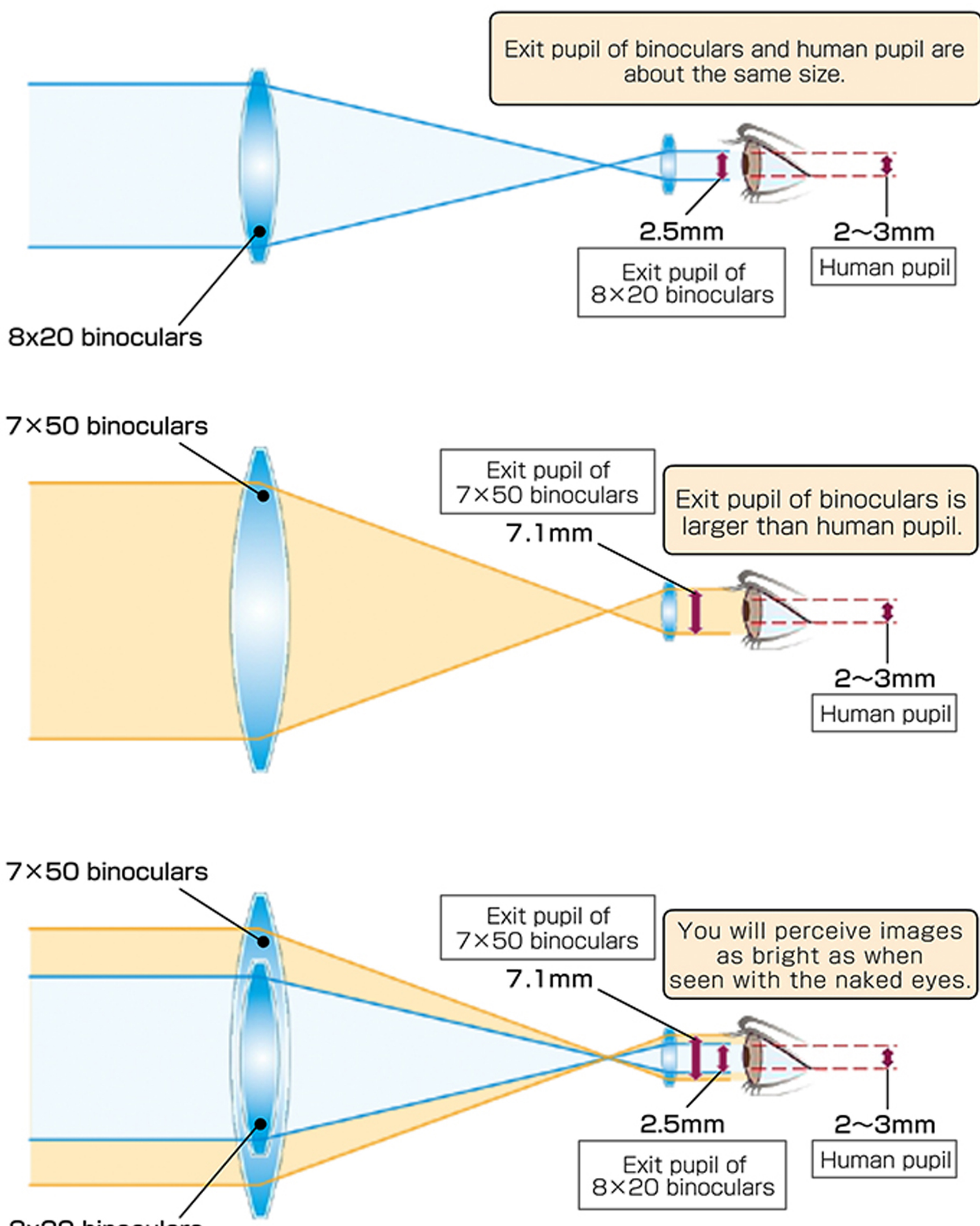
With 7x50 binoculars

Pupil diameter of human eye: 7mm

Exit pupil of binoculars:  $50 \div 7 = 7.1\text{mm}$

Because the human pupil is about the same size as the binoculars' exit pupil, you will perceive images as bright as when seen with the naked eyes.

### In bright conditions (comparing 8x20 and 7x50 binoculars)



With 8x20 binoculars

Pupil diameter of human eye: 2-3mm

Exit pupil of binoculars:  $20 \div 8 = 2.5\text{mm}$

Because the human pupil is about the same size as the binoculars' exit pupil, you will perceive images as bright as when seen with the naked eyes.

With 7x50 binoculars

Pupil diameter of human eye: 2-3mm

Exit pupil of binoculars:  $50 \div 7 = 7.1\text{mm}$

Because the binoculars' exit pupil is larger than the human pupil, you will perceive images as bright as when seen with the naked eyes.

The human pupil becomes smaller in a bright situations, so you won't perceive images as dark with both 8x20 and 7x50 binoculars.

### Why do both large-exit-pupil binoculars and small-exit-pupil binoculars provide the same bright images in bright conditions?

The human pupil normally opens about 2mm in daylight, and 7mm in the dark.

If you use binoculars with an exit pupil of over 2mm in daylight, you won't perceive dark images. Brightness will not vary whether you use binoculars with a 7mm or 2mm exit pupil.

On the other hand, if you use binoculars with a small exit pupil in the dark, the image will not appear as bright as when seen with the naked eyes.

## Related Links

[Sport Optics Guide -Fiedscopes-](#) >

## Basic Information about Binoculars >

<a href="#">What are binoculars?</a> >	<a href="#">Types of binoculars</a> >	<a href="#">Magnification</a> >	<a href="#">Effective diameter of the objective lens</a> >
<a href="#">Exit pupil</a> >	<a href="#">Relative brightness</a> >	<a href="#">Eye relief</a> >	<a href="#">Field of view</a> >