Ted Brewer's Motion Comfort ratio - next page.

ures more than 2'6" square on the sole.

In putting all our observations together, we have to be careful not to let personal prejudices cloud our judgment. I think that *Mystery* is a handsome boat with great potential as a coastal or offshore cruiser for someone demanding near-ultimate performance. On the other hand, I believe that the designer has put just a little too much accommodation in the hull, making some features too small and not leaving enough storage space for extended cruising. But that's a personal opinion. However, I approve of the life raft stowage locker at the stern and propane locker built in at the port quarter.

If I were looking for this sort of performance, I think I would try a water-ballast system. *Mystery*'s light displacement and flared topsides, as revealed in the midship section (Figure 2) make her a good candidate for this, but it would further diminish useful interior volume.

By following the steps I have taken in looking at this design, and by using the guidelines in "Looking At The Numbers," you can make some valid evaluations on your own. This is an enjoyable way to develop a more critical eye and a greater appreciation for cruising sailboat design.

Danny Greene, N.A., is a *Cruising World* contributing editor.

Looking At The Numbers

Length/Beam Ratio — The ratio of overall length to beam is an expression of the broadness or beaminess of the hull. In smaller boats, values of 2.8 to 3.2 are common, while in larger boats the norm increases to 3.2 to 3.8 (Figure 3). In general, a beamy boat will have generous interior space, high stability at normal angles of heel but possibly reduced stability at extreme angles. A narrow boat will have less accommodation space and less initial stability, but is usually more easily driven (especially in waves). A beamy boat can sometimes be difficult to steer in strong winds.

Waterline Length/Draft Ratio — This ratio describes the relative depth of the hull. Values are generally between 5.0 and 7.0, with higher values indicating shoal draft and centerboard boats, and the lower numbers representing very deep boats (Figure 4). All other factors being equal, a deep boat will have greater ballast stability (which becomes increasingly significant at high angles of heel) and will very likely be more sea-kindly in rough weather.

Ballast/Displacement Ratio — This figure, expressed as a percentage, usually falls between 30 and 40 on cruising boats, though figures approaching 50 sometimes are found.

Displacement/Length Ratio — This is equal to the displacement (expressed in long tons of 2,240 pounds each), divided by one hundredth of the waterline length (in feet) raised to the third power, or cubed.

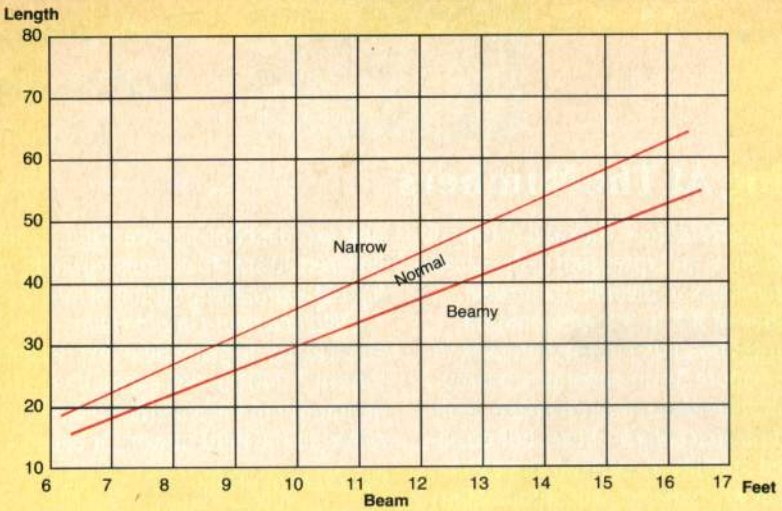
Disp./Length Ratio =

$$\frac{\text{Displacement (in long tons)}}{(.01 \times \text{LWL})^3}$$

Values can range from a low of about 50 to 400 or more and generally can be categorized as follows:

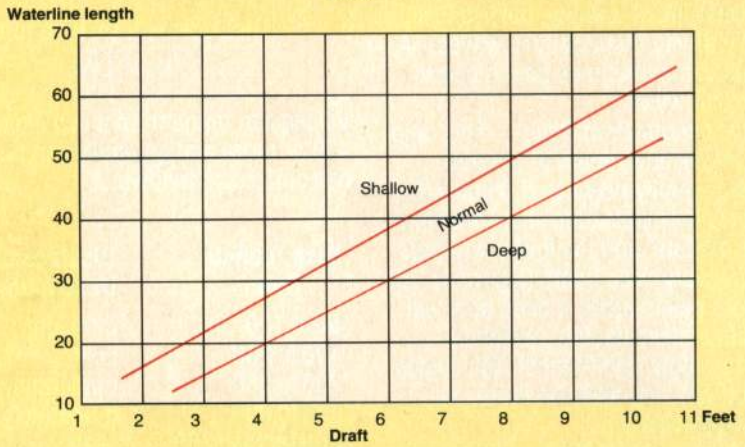
Disp./Length Ratio	Displacement Description
50 to 100	ultralight
100 to 200	light
200 to 250	moderately light
250 to 300	moderately heavy
greater than 300	heavy

(continued)



◀ *Fig. 3 The ratio of overall length to beam indicates the relative broadness of the hull. This graph reveals whether a hull is narrow, beamy or normal.*

Light-displacement boats offer exciting performance, while sacrificing accommodation space and comfort (at least in the smaller sizes). They can be expensive to build and require good engineering to achieve high strength. Heavy-displacement boats deliver comfort, large interior space and load-carrying ability, at the expense of performance. They, too, can be expensive but they can be built massively strong. Moderate-displacement boats have characteristics in between heavy- or light-displacement designs.



◀ *Fig. 4 The ratio of waterline length to draft reveals the relative depth of the hull. This graph shows whether a hull is shallow, deep or normal draft.*

Sail Area/Displacement Ratio — This is essentially a horsepower-per-pound figure indicating the relative size of the sail plan and its potential relative power.

Sail Area/Disp. Ratio =

$$\frac{\text{sail area (sq. ft.)}}{\left(\frac{\text{displacement lbs.}}{64}\right)^{2/3}}$$

Sail Area/Disp. Ratio	Sail Area Classification
under 15.0	low
15.0 to 18.0	moderate
18.0 to 20.0	moderately high
greater than 20.0	high

Obviously, the greater this ratio, the greater the performance potential (especially in light winds) — but the greater the need to reef down in higher winds. Larger sail plans are expensive and impart greater forces on the hull.

Motion Comfort Ratio — Created by Naval Architect Ted Brewer, this ratio relates displacement, length and size to comfort.

▲ *Fig. 5 The Motion Comfort Ratio relates displacement, length and size to comfort.*

Motion Comfort Ratio =

$$\frac{\text{Displacement lbs.}}{.65\ (.7\ \text{LWL} + .3\ \text{LOA}) \times \text{Beam}^{1.33}}$$

Figure 5 shows that comfort tends to increase with size. An interesting way to look at it, however, is that a light displacement 50-footer can have the same level of comfort as a heavy displacement 30-footer.

Cruising sailboat design is an intricate combination of science and art, not to be reduced to ratios and coefficients. These figures can, however, provide many excellent clues to a design's performance and behavior.

Danny Greene