OPINION:
FISHERIES FORUM

New Terminology for Proportional Stock Density (PSD) and Relative Stock Density (RSD): Proportional Size Structure (PSS)

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Proportional stock density (PSD) and relative stock density (RSD) are used to numerically describe length-frequency data (Anderson and Neumann 1996). These length-frequency indices were introduced in the 1970s and their use by state and federal agencies has proliferated for describing and assessing fish populations (Gabelhouse et al. 1992).

Regardless of their widespread use, fisheries professionals continue to be confused regarding the utility and meaning of stock density indices. We believe this confusion is founded mostly on terminology and a lack of understanding why length-frequency indices are useful, particularly by the inclusion of "density" in the nomenclature.

Anderson (1976) first coined the term PSD to assess the state of balance of largemouth populations in small impoundments based on length-frequency distributions. He defined PSD as:

$$PSD = \frac{\text{number of fish} \geq \text{quality length}}{\text{number of fish} \geq \text{stock length}} \times 100$$

where stock length (S) was 8 inches and quality length (Q) was 12 inches. Later, Anderson and Weithman (1978) defined stock and quality lengths as percentages of all-tackle world record lengths, ultimately suggesting stock and quality lengths for 26 species (Anderson 1980).

Relative stock density is calculated as:

$$RSD = \frac{\text{number of fish} \geq \text{specified length}}{\text{number of fish} \geq \text{stock length}} \times 100.$$

Wege and Anderson (1978) introduced RSD to index the proportion of largemouth bass in a stock that were 15 inches or longer, and it was termed RSD-15. Gabelhouse (1984) also suggested the need to move beyond a two-cell model of length categorization and further refined RSD by recommending stock (S), quality (Q), preferred (P), memorable (M), and trophy (T) lengths for 27 species. Today, standard length categories are available for at least 51 species (Anderson and Neumann 1996; Bister et al. 2000).

Gabelhouse (1984) also proposed incremental RSDs to quantify the percentage of stock-length fish that are between the minimum lengths for various length categories. For example, RSD S-Q is the percentage of stock length fish that are stock to quality length. The current convention for reporting stock density indices is listed in Table 1.

Table 1. Old (proportional stock density [PSD]; relative stock density [RSD]) and new (proportional size structure [PSS]) terminology for size-structure indices. Note that PSD=RSD-Q under the current terminology.

Terminology	
Current	New
PSD	PSS_Q
RSD-Q	PSS_Q
RSD-P	PSS_P
RSD-M	PSS_M
RSD-T	PSS_T
RSD S-Q	PSS_{SQ}
RSD Q-P	PSS_{QP}
RSD M-T	PSS_{MT}

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Anderson (1980) stated that individual growth rates and density determine length frequency. Proportional stock density and RSD should reflect density, and hence the term density in the original PSD and RSD nomenclature. Proportional stock density and RSD sometimes have been correlated with density, especially for largemouth bass in small impoundments (see Willis et al. 1993 for correlation data). However, in larger, more complex systems or where habitat is not well-suited to a particular species, PSD and RSD do not always reflect population density (Willis et al. 1993).

Even though PSD and RSD reflect density in some situations, they are not true measures of density and involve only length data in calculations. We believe this is where most of the confusion with the present terminology occurs. Stock density indices have been a useful tool for the past 30 years and we believe they will continue to be useful because they ease communication within the fisheries profession, quantify size structure of fish populations, and in some cases reflect growth, recruitment, and mortality.

To make communication easier and have the name accurately reflect the index, we recommend that PSD and RSD be changed to Proportional Size Structure (PSS). The calculation of PSS will be the same as RSD. Proportional stock density will now be referred to as PSS_Q, RSD-P as PSS_P, and the other length categories will be similarly named (Table 1). Incremental RSDs will also be termed PSS, and the

subscript will define the increment used (Table 1).

The term proportional should be retained because it was used in the original nomenclature and accurately describes the index. However, the term density should be dropped in favor of size to reflect length structure. We also recommend that the term stock density indices that describes the collection of PSS terms now be labeled size structure indices. We realize that this will cause confusion in the short term and requires time to be fully integrated. Nevertheless, removing the term density from the names and combining PSD and RSD into PSS will make these data analysis tools easier to learn and use, and hopefully increase acceptance and use within the profession.

Please provide comments regarding the new terminology to Christopher Guy at cguy@montana.edu. We will summarize the comments in a short follow-up article.

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