

## **Appendix C-2**

### **Proportional Stock Density Indices for Weakfish**

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Amendment 4 requires that descriptors of age or size structure be reported to the Management Board as part of each stock assessment. Proportional stock densities (PSDs) are standardized methods for analyzing length-frequency data that quantify size structure of a fish population (typically gamefish) into categories of sizes that are of interest to recreational anglers (Gablehouse 1984). These techniques allow comparisons of size quality across species. Used commonly for freshwater stock assessment, they have been applied on a limited basis in marine management; Maryland DNR uses them routinely to assess size quality of several species of estuarine and marine gamefish (J. Uphoff, MD DNR, personal observation). Length-frequency data, indexed by PSDs, contains much of the information contained in age-frequency data and even cursory examination of a length-frequency can give useful insights into population dynamics of a stock (Powell 1979; Hoenig et al. 1987). A population's length-frequency distribution results from its recent history of recruitment and mortality, integrated with growth (Barry and Tegner 1989).

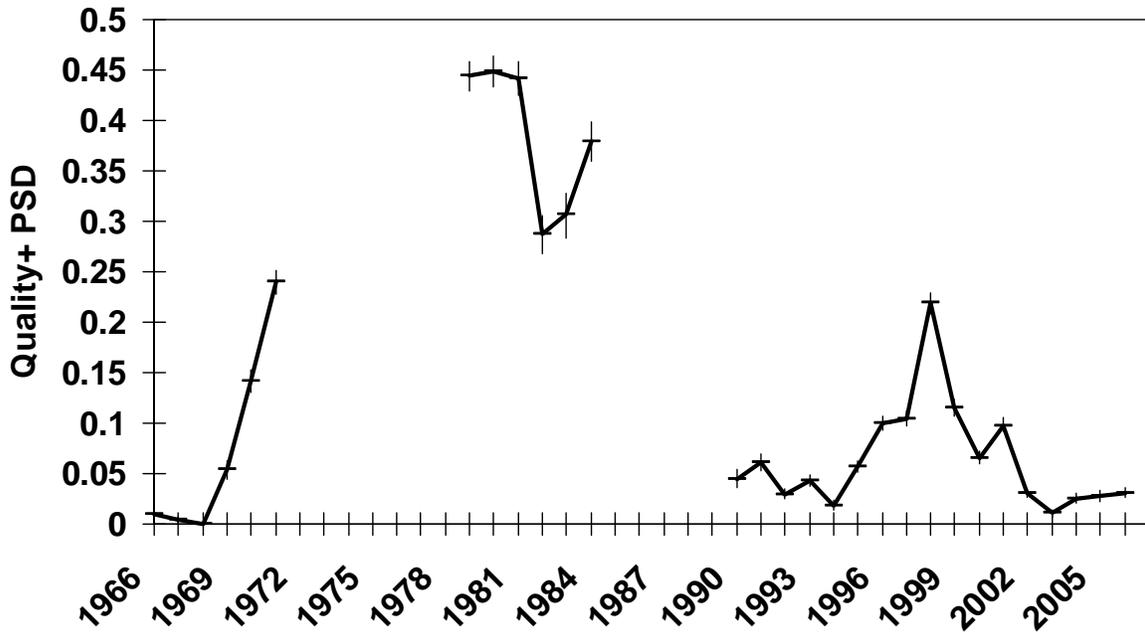
The Quality+ PSD (PSD Q+) equaled the proportion of weakfish greater than or equal to 210 mm (8.3 inches) that were 340 mm (13.4 inches) or larger (Kahn et al. 2006). Sample sizes in the DE and NJ surveys were large enough for precise estimates of PSD Q (Kahn et al. 2006). The normal distribution approximation of the binomial distribution was used to calculate the SD (Ott 1977). The DE Quality+ PSD represents the longest fishery-independent data set available for weakfish. The DE PSD Q+ index was significantly ( $P < 0.05$ ) and positively associated with recreational fishing quality (trophy citations) over a broad (DE, MD, VA) area, commercial and recreational yield along the Atlantic Coast, recreational harvest per trip in the mid-Atlantic (VA-NY), and the proportion of recreational harvest outside of 3 miles (Uphoff 2004). Proportion of recreational harvest in bays and sounds was negatively associated with DE PSD Q+ (Uphoff 2004).

The PSD Q+ size quality indices for DE (1966-1971, 1979-1984, and 1990-2006; Appendix 1, Figure 1) and NJ (1989-2006; August and October; Appendix 1, Figure 2) indicated that size quality of weakfish in recent years was truncated at smaller lengths. A recovery in size quality after Amendment 3 (1996) faltered after 1998. Weakfish PSD Q+ has the potential to be a good bit higher than the peak observed in 1998 (Appendix 1, Figure 1). Values in the early 1980s were twice as high as this peak. Values were lower during 1966-1968 than current indices (Appendix 1, Figure 1).

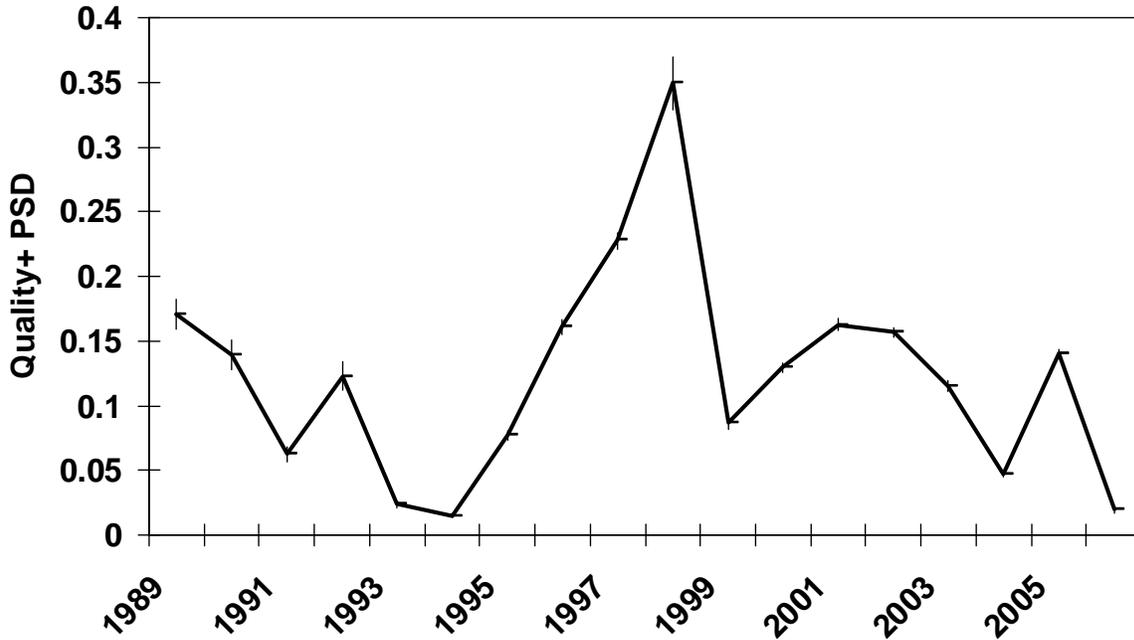
## References

- Barry JP, Tegner MJ. 1989. Inferring demographic processes from size-frequency distributions: simple models indicate specific patterns of growth and mortality. *Fish Bull.* 88: p13-19.
- Gabelshouse DW. 1984. A length-categorization system to assess fish stocks. *N Am J Fish Manage.* 4:273-285.
- Hoenig JM, Heisey DM, Lawing WD, Schupp DH. 1987. An indirect rapid methods approach to assessment. *Can J Fish Aqua Sci.* 44:324-338.
- Kahn DM, Uphoff J, Crecco V, Vaughan D, Murphy B, Brust J, O'Reilly R, Paramore L. 2006. Weakfish Stock Assessment Report for Peer Review (Kahn et al. 2006). Delaware Division of Fish and Wildlife, Dover.
- Ott L. 1977. An introduction to statistical methods and data analysis. Duxbury Press. North Scituate, Massachusetts
- Powell DG. 1979. Estimation of mortality and growth parameters from the length frequency of catch. *Rapp. P.-v. Reun Cons Int Explor Mer.* 175:167-169.

Uphoff JH, Jr. 2004. Indicators of weakfish size quality: proportional and relative stock density indices for weakfish. A report to the Atlantic States Marine Fisheries Commission's Weakfish Technical Committee. Maryland Department of Natural Resources, Stevensville.



Appendix C-2, Figure 1. 95% CI of Delaware survey Quality+ PSD and trend



Appendix C-2, Figure 2. NJ survey Quality+ PSD 95% CI and trend