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The application of new acoustic observations and techniques to stock assessment of walleye pollock in the eastern Bering Sea

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Extended abstract
Better information on the abundance and distribution of fish stocks and their prey can improve stock assessment. Acoustic-trawl survey techniques are a proven means of providing this information and have the potential to offer further help to the stock assessment process (Trenkel et al., 2011). However, such new observations are costly and benefits to stock assessment and fisheries management decisions are sometimes unclear. We outline two examples of how new cost-effective sources of information on the semi-pelagic gadid walleye pollock (*Theragra chalcogramma*) in the eastern Bering Sea are being used in stock and ecosystem assessments.

An acoustic index of pelagic walleye pollock biomass and distribution:
Opportunistically collected acoustic backscatter data from bottom-trawl survey vessels were processed to provide an additional assessment index of the pelagic portion of walleye pollock biomass, which can be used to "fill in" years when funds are unavailable to conduct a full acoustic-trawl survey (Honkalehto et al., 2011). Even though this backscatter index is not scaled to number of fish at age, it can be incorporated into the age-structured population dynamics model used for Bering Sea pollock in the same way as any other survey time series, if some reasonable assumptions about the catchability, age-selectivity, and CV of the index are made using the regular acoustic-trawl survey results as a guide (Ianelli et al., 2011). A five-year time series of this index affected recent stock assessment model results and quota recommendations for 2012 (Ianelli et al., 2011, Ressler et al., 2012b; Figure 1). The general idea of estimating an unknown function that links acoustic observations and model results could also be a helpful way of using acoustic data in ecosystem models (Handegard et al., 2012).

An acoustic survey of euphausiid biomass on the Bering Sea shelf:
Euphausiids ("krill") of the genus *Thysanoessa* are important prey for pollock and many other species in the Bering Sea (Aydin et al., 2007). Multifrequency classification of acoustic backscatter data collected during acoustic-trawl surveys of pollock and additional net sampling were used to develop an index of euphausiid biomass and distribution (Ressler et al., 2012a; Figure 2). Although not an explicit input to the walleye pollock stock assessment model, this new euphausiid time series has been used as one measure of food availability to inform stock assessment of pollock (Ianelli et al., 2011) and to inform a broader assessment of Bering Sea ecosystem status (Zador and Gaichas, 2010). These data may also be useful in evaluating the results of "end-to-end" ecosystem modeling of the Bering Sea ecosystem currently underway (in preparation, http://bsierp.nprb.org/).

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Figures

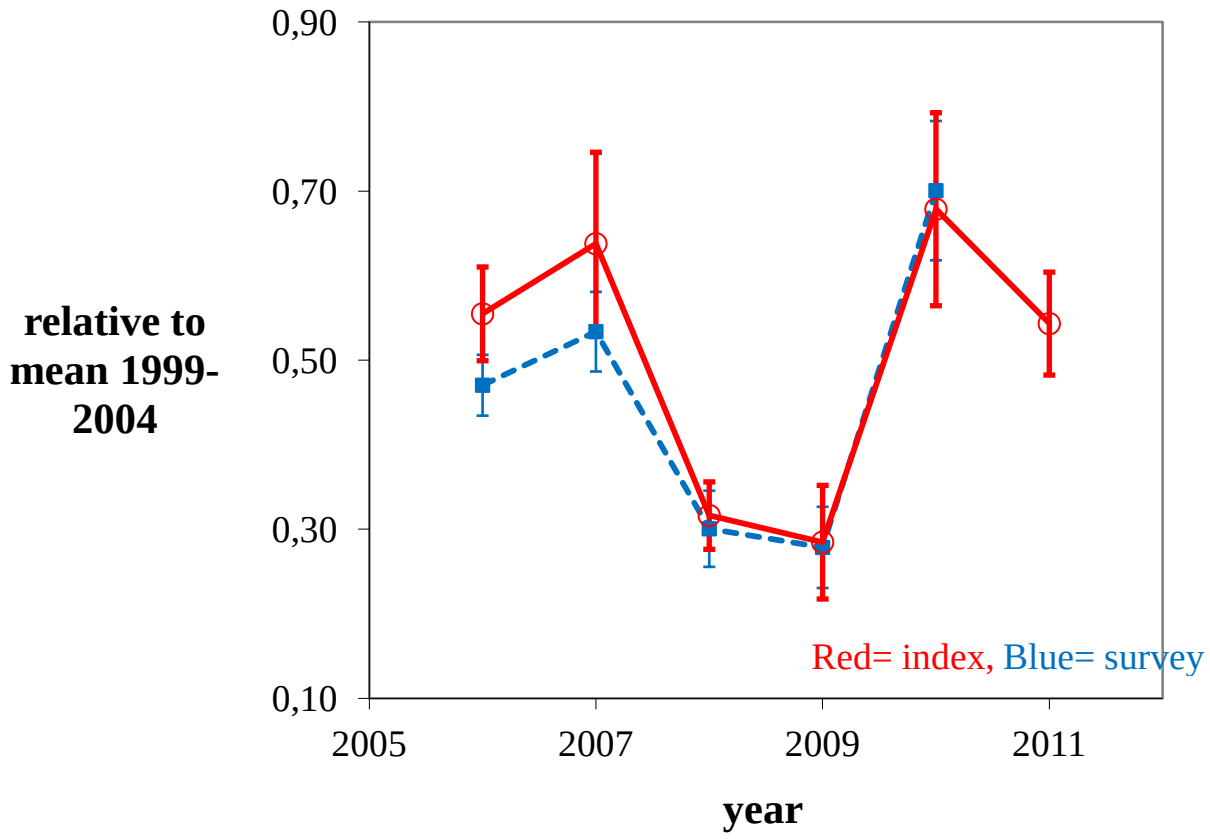

Figure 1.The opportunistic acoustic index of pelagic pollock is well correlated with the regular acoustic-trawl survey estimates, and in 2011 the index indicated a reduction in pelagic pollock biomass when no regular survey results were available. Each time series has been normalized to the results of a retrospective analysis of data collected between 1999 and 2004 (see Honkalehto et al., 2011 for details). Error bars indicate approximate 95% confidence intervals.

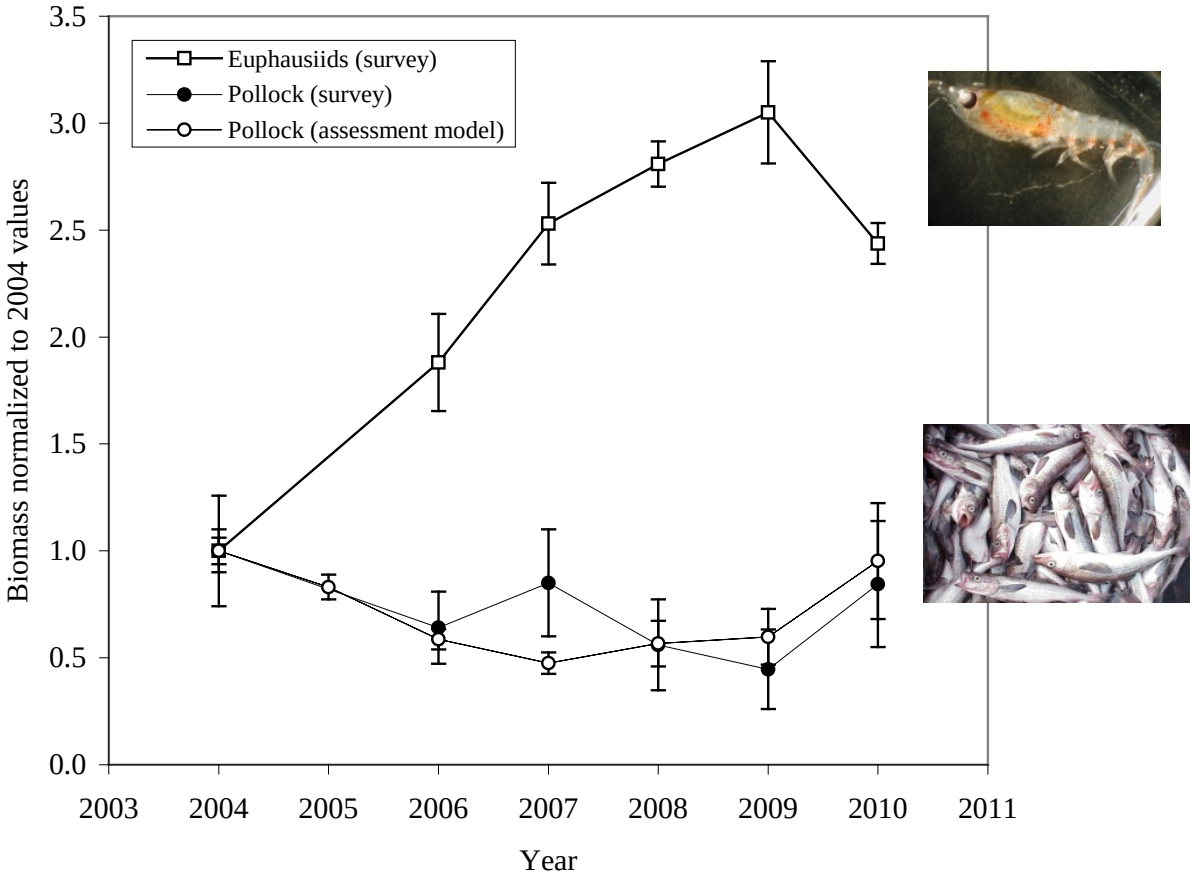

Figure 2. Euphausiid biomass calculated using data from acoustic-trawl surveys of pelagic pollock, combined acoustic-trawl and bottom-trawl survey estimates of pollock biomass, and pollock biomass estimated by the stock assessment model. Each series is normalized to its value in 2004; error bars indicate approximate 95% confidence intervals. An increase in euphausiid biomass is indicated between 2004 and 2009.