Barrier Removal Monitoring Guide; and 2) development and nascent implementation of the Open Rivers Initiative *Stream Barrier Removal Performance Measures and Project Monitoring*. These efforts built upon an earlier improvement of salt marsh restoration monitoring through the development, publication, and implementation of the *Gulf of Maine Salt Marsh Monitoring Protocol*. Similar to the experience with salt marsh monitoring, improved stream barrier removal monitoring at the site-scale does not necessarily translate to information that facilitates regional-scale analyses suitable for program planning. To have restoration project monitoring that produces usable, planning-level feedback requires a network of sites carefully chosen to illuminate broad-scale questions. Also needed are: systematic data capture, storage and management; project- and regional-level data analyses by project type; and mechanisms for adaptive management that allow information learned from project monitoring to affect program priorities, project selection, and/or technique selection. We report on our recent experience in the northeast United States to develop a network of stream barrier removal monitoring sites explicitly selected to facilitate regional analyses and program planning by representing the range of habitat types and scales typically used by NOAA trust resources in the region. We also describe our efforts to generalize this experience to inform restoration monitoring of all project types and to develop systematic data handling, analyses, and feedbacks for program planning and project implementation.

Estimating total spawning abundance from index area counts using a GIS-based habitat intrinsic potential model

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Counts in selected stream sections (index reaches) have been used to monitor trends in steelhead (*Oncorhynchus mykiss*) abundance in several mid-Columbia River tributaries. Index reaches are visited one or more times during the spawning season to generate an estimate of the number of steelhead redds (spawning nests). Index areas were selected based on a number of criteria including accessibility and the relative potential to observe spawning under a range of relative abundance levels. As a result, while index area counts may reflect year to year patterns in abundance, expansions based on the ratio of habitat area within index reaches to the total available for spawning are likely biased. We applied a geographic information system (GIS) based habitat intrinsic potential model that uses empirically derived relationships to assign a spawning potential rating to stream reaches based on physical characteristics. The model was used to expand from annual index redd counts to total population spawning abundance estimates for several mid-Columbia steelhead populations. Comparisons to abundance estimates based on alternative methods (e.g. weir counts or randomized sampling) indicate that expansions from index counts to total abundance based on habitat intrinsic potential outperformed expansions based on linear stream miles.

Multifrequency biplanar interferometric imaging for ultra high resolution three-dimensional imaging of seabed habitat

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The resolution of 3-D seabed imaging is greatly improved using a new multifrequency biplanar interferometry (MBI) technique. Using data from a multifrequency acoustic pulse-echo system (e.g. Simrad EK60 or ME70), ranges to coherent targets, estimated from propagation delays, and the phase differences between echoes received with four quadrants of a split-aperture array are converted to Cartesian distances, and transformed into Earth coordinates. The collective data set is interpolated to create a surface closely approximating the target's image. The resolution of the resulting image is improved orders of magnitude relative to those created with measures based on echo intensity or single frequency uniplanar interferometry. The MBI method allows estimation of seabed slope and surface scattering as a function of incidence angle for seabed characterization on a sub-beam basis. We present results from MBI applied to data from split single (EK60) and multibeam (ME70) echosounders.

Proceedings

11th National Stock Assessment Workshop

Characterization of Scientific Uncertainty in Assessments to Improve Determination of Acceptable Biological Catches (ABCs)

Joint Session of the National Stock and Habitat Assessment Workshops

Incorporating Habitat Information in Stock Assessments

1st National Habitat Assessment Workshop

Moving Towards a National Habitat Science Program

Hosted by the Southeast Fisheries Science Center, Southeast Regional Office, and Office of Science and Technology
St. Petersburg, FL
May 17–20, 2010

Edited by Kristan Blackhart

November 2010
NOAA Technical Memorandum NMFS-F/SPO-112

U.S. Department of Commerce
Gary Locke
Secretary of Commerce

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This publication may be cited as:

Blackhart, K. (ed.) 2010. Proceedings. 11th National Stock Assessment Workshop: Characterization of scientific uncertainty in assessments to improve determination of acceptable biological catches (ABCs); Joint Session of the National Stock and Habitat Assessment Workshops: Incorporating habitat information in stock assessments; and 1st National Habitat Assessment Workshop: Moving towards a national habitat science program. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-F/SPO-112, 153 p.