WKGIC2 – Workshop on Growth-increment Chronologies in Marine Fish: climate-ecosystem interactions in the North Atlantic

2015/2/SSGIEOM12

A **Workshop on Growth-increment Chronologies in Marine Fish: climate-ecosystem interactions in the North Atlantic** (WKGIC2) chaired by Bryan Black, USA, Christoph Stransky, Germany and Beatriz Morales-Nin, Spain, will meet in Palma de Mallorca, Spain in 18–22 April 2016

This will be a hands-on training exercise in which participants will work as a group to develop an otolith growth-increment chronology, including all phases of data collection, analysis, and interpretation. The chronology will be developed from one of the North Atlantic collections identified during WKGIC in December 2014. The 2016 workshop will involve learning:

a) Fundamental dendrochronology (tree-ring analysis) technique, with particular emphasis on visual cross dating followed by statistical verification using programs such as COFECHA.

b) How to prepare and photograph otolith samples, then measure growth-increment widths using image analysis software (i.e. Image Pro Premier).

c) Statistical techniques for generating biochronologies from growth-increment width measurements. Topics will include the removal of age effects, issues of minimum sample size, and maximizing signal-to-noise ratio. Special consideration will be given to datasets for chronologies developed using archival collections of short-lived individuals.

d) Correlation and regression techniques for relating the biochronology to instrumental climate records, principally through the use of the KNMI Climate Explorer.

A new otolith chronology based on candidate species and collections and their relationships to climate will be established over the course of the workshop.

WKGIC2 will report by 1 June 2016 for the attention of WGBIOP, SCICOM, ACOM and SSGEPD.

Supporting Information

Priority:	Over the past several decades, thousands of otoliths, bivalve shells, and scales have been collected for the purposes of age determination and remain archived in European and North American fisheries laboratories. Advances in digital imaging and computer software combined with techniques developed by tree-ring scientists provide a mean to extract additional levels of information in these calcified structures and generate annually-resolved (one value per year), multidecadal time series of population-level growth anomalies. Given that they are exactly placed in time, chronologies can be directly compared to instrumental climate records, chronologies from other regions or species, or time series of other biological phenomena. In this way, chronologies may be used to reconstruct historical ranges of environmental variability, identify climatic drivers of growth, establish linkages within and among species, and generate ecosystem-level indicators. The first workshop on Growth-increment Chronologies in Marine Fish: climate-ecosystem interactions in the North Atlantic (WKGIC) met in2014. WKGIC identified that the greatest limitation to developing biochronologies in the North Atlantic is lack of training in the specialized crossdating and statistical apporoaches involved. WKGIC2 will be a longer training workshop in which participants will learn these techniques (i.e. Crossdating and detrending, including common dendrochronology programs ARSTAN and COFECHA.) by developing a biochronology using otoliths from the North Atlantic region.

Scientific justification and relation to action plan:	A large and growing network of chronology datasets has been developed from annual growth-increment widths in marine fish and bivalves in the North Pacific. These chronologies have been integrated across species, marine regions, and other biological time series to develop indicators and identify climate drivers of productivity and functioning at the ecosystem level. For example, chronologies of rockfish (*Sebastes* spp.) and salmon (*Oncorhynchus* spp.) have been integrated with indices of seabird reproductive success to demonstrate that winter upwelling is critical to ecosystem functioning in the California Current. This winter upwelling pattern is driven by broad-scale atmospheric pressure systems that facilitate or block onshore flows of precipitation. Due to their drought sensitivity, tree-ring chronologies can be used to hind-cast this biologically important winter pattern over the past six centuries, documenting that variance in the system has risen to unusually high levels over the past 100 years driven by a series of winters with anomalously low upwelling. Moreover, these California Current chronologies have been compared to those developed in the Gulf of Alaska, showing that the two ocean domains co-vary out of phase. Robust growth in the north is associated with poor growth in the south and vice versa, a pattern largely driven by winter El Niño Southern Oscillation activity. Such approaches have also been applied in fish chronologies off New Zealand and along the Australia west coast. A number of exactly dated chronologies have also been developed for the extremely long-lived bivalve species *Arctica islandica* and *Glycymeris glycymeris* in the North Sea and North Atlantic for the purposes of reconstructing ocean circulation and climate. However, the "tree-ring" approach for chronology development has not yet been applied to fish or to address ecological or management issues. The first workshop on Growth-increment Chronologies in Marine Fish: climate-ecosystem interactions in the North Atlantic (WKGIC) met at the Johann Heinrich von Thünen Institute in Hamburg, Germany, from 2–3 December 2014, chaired by Bryan Black (USA) and Christoph Stransky (Germany). During this meeting, we identified several pilot studies have generated strong preliminary chronologies for Atlantic cod, plaice, and the greater Argentine. However, the greatest impediment to expanding this work remains a lack of knowledge as to suitable species and collections available for chronology development in the Atlantic, North Sea, and Baltic region. To this end, we propose a training workshop (WKGIC2) in which participants will learn these techniques and foster new collaborations by developing an otolith biochronology.
Resource requirements:	All necessary samples, images, and meeting space will be provided by the chairs and other members.
Participants:	We anticipate 10-20 participants from leading age labs and universities.
Secretariat facilities:	None.
Financial:	No financial implications.
Linkages to advisory committees:	ACOM
Linkages to other committees or groups:	SCICOM , WGBIOP
Linkages to other organisations:	None.