Appendix 3 to Agenda item B10

Age and maturity estimations of whelks, *Buccinnum undatum,* around the Kent and Essex coast.

Introduction

A common problem facing fisheries scientists studying whelks is an inability to accurately estimate the age of an individual animal. If the age and size of a range of individuals from a population are known, estimates about the structure of the population, such as the number of young and old individuals and their growth rates can be made. These estimates can help understand several things about the populations including how fast individuals grow, the age at maturity, and how populations change over time in response to influences such as fishing pressure. Previous attempts to age whelks using the operculum (crust) rings showed this method to be very difficult to routinely use as the rings are frequently unreadable. In the Isle of Man whelk fishery only 16%, from a total of 10,975 operculae examined were classed as 'clear and readable' (Kideys, 1996); similar success rates were found in populations around the coast of the UK (Lawler, 2013). For this reason, our research has focussed on developing a robust and alternative method of whelk age determination using a structure called the statolith. The statolith is a small round (<0.5 mm diameter) ball of calcium carbonate in the whelk's foot that is connected to its nervous system that allows the whelk to sense gravity. We have shown that rings observed in the statoliths, similar to those in a tree trunk or a fish scale/otolith are annually deposited. Validation of an annual periodicity of the statolith rings using laboratory experiments determined that a ring was formed during the winter (Hollyman *et al*., 2017). We have also undertaken chemical analyses of the statolith rings and observed seasonal cycles in magnesium concentrations that match the visible statolith rings, further validating the annual periodicity of the rings (Hollyman *et al*., *in prep*). We propose to use the annually-resolved growth rings to determine the age structure of whelk populations around Kent and Essex. Whilst the whelks are processed for age determination, the size at maturity will also be assessed for each population. These data will be used to construct length at age curves, as well as age at maturity estimations for each population, which will feed into current stock assessments with a view to

improving understanding and monitoring of whelk stocks within the Kent and Essex IFCA region.

Materials and Methods

Sample collection

Samples of 250 whelks will be collected from one site within each of the four main fishing regions within the Kent and Essex IFCA district in June 2017. The samples collected from each site will not be riddled to retain all juvenile whelks which are below the minimum landing size. It is imperative that the sample is representative of the wild population, with both small juvenile size classes (i.e. < 45mm) and large adult size classes (i.e. > 80 mm) collected wherever possible. The collection of these small and large individuals is necessary to construct accurate growth curves. Collected specimens will be stored in a -20^{o}C freezer as a means of dispatch and sample preservation. The frozen samples will them be shipped to Bangor University where the processing will take place between July and August, 2017.

Maturity estimations

Frozen samples will be thawed and measured for several key metrics (size measurements such as shell length and minimum shell width and weight measurements such as total weight, body weight and gonad weight). The maturity of each specimen will then be estimated using techniques outlined in Haig *et al*. (2015) and Hollyman (2017). These data will be used to calculate the size at maturity for males and females individually for each population. The length measurements will also allow the calculation of riddle spacing widths, by calculating the relationship between total shell length and minimum shell width (the narrowest part of whelk morphology which is what controls riddle spacing size). The plastic nature of whelk shell morphology means that this relationship can differ between populations (Hollyman, 2017), therefore it is important to quantify this relationship to introduce effective management measures.

Age determination

Following maturity estimation, the statoliths from each specimen will be extracted and mounted following the methods outlined in Hollyman et al.

(2017). The mounted statoliths will then be analysed, counting the number of annual growth rings to estimate the age of each animal. These data will be compiled along with the total shell length measurements and analysed using FISHPARM (Prager *et al*., 1994) to calculate the Gompertz growth curves for each population. As a contingency in the case of missing juvenile specimens, the relationship between statolith width and total shell length will be calculated and the size at age of a subset of animals will be retrospectively calculated from the width of the statolith rings representing juvenile age classes (i.e. years 1 & 2).

Dissemination

Upon completion of the work, an important part of the project will be dissemination of findings to fishermen who have helped in sample collection. This will be achieved through face to face meetings with these fishermen by the research team (Phil Hollyman, Will Wright), along with a final report written in accessible language.

References:

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