

Application of Chemical Tags to Obtain Life History Information of Sharks

Aplicación de Etiquetas de Productos Químicos Para Obtener Información de la Historia de Vida de los Tiburones

Application des Marqueurs Chimiques pour Obtenir la Vie Informations d'Historique des Requins

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ABSTRACT

Accurate age and growth models are some of the most important biological parameters needed for stock assessment and fishery management. However, assumptions regarding band pair deposition rates used for age and growth models are often being made without direct validation studies. As such, the purpose of this study is to validate vertebral band counts of three pelagic shark species tagged and recaptured in the eastern Pacific Ocean. Oxytetracycline (OTC) labeled vertebrae from each species was obtained from tag-recapture activities and is being processed to determine timing of centrum growth band deposition. Results from band counts of vertebrae distal to OTC marks indicate species-specific annual and biannual band pair deposition rates for sharks of the size range examined.

KEY WORDS: Sharks, oxytetracycline, age & growth

INTRODUCTION

Accurate size-at-age determinations are necessary for both stock assessment and management of sharks because they form the basis for calculations of growth and mortality rates, age-at-maturity, age-at-recruitment, and estimates of longevity. A suite of band enhancement techniques have been used in elasmobranch vertebrae studies including digital images of vertebral sections (Skomal and Natanson 2003), x-ray radiography (Cailliet et al. 1983), and staining of vertebrae (Stevens 1975). The primary objective of this study was to validate the periodicity of band pair deposition in shark vertebrae of three species (shortfin mako [*Isurus oxyrinchus*], blue [*Prionace glauca*], common thresher [*Alopias vulpinus*]) collected in the eastern Pacific Ocean. Chemical marking methods are some of the most robust age validation techniques available (Campana 2001). Consequently, sharks were injected with oxytetracycline (OTC) and recovered vertebrae were examined to determine the banding pattern deposited distal to the OTC mark during the known time at liberty.

MATERIALS AND METHODS

Sharks for tagging and OTC injection were captured in the Southern California Bight (SCB) using baited pelagic longlines. The cradle was then raised to facilitate tagging, measuring, and OTC injection, while the eyes of the shark were covered with a wet chamois cloth, and a saltwater ventilation hose continuously pumped water over the shark's gills. Once injected, each shark was tagged on the dorsal fin with a plastic rototag labeled with contact and reward information in English and Spanish, with instructions to measure the fish and save the vertebrae. At tagging, each shark was sexed and measured (straight line fork length [FL] or total length [TL]) to the nearest centimeter using a stationary measuring device fitted to the shark tagging cradle. Oxytetracycline-marked vertebrae were obtained from sharks recaptured on research cruises and commercial and recreational fishing vessels and samples were stored frozen until processed, and kept from light and excessive UV exposure to preserve the OTC mark. Widest diameter vertebral centra in a given sample were chosen for processing. Whole centra were separated, cleaned of excess tissue, rinsed and air-dried. To elucidate the vertebral bands, we chose to compare several techniques in order to determine the most suitable method for the OTC-marked vertebrae. These included the high frequency X-radiography technique of Cailliet et al. (1983), whole centrum faces and sectioned vertebrae bow ties viewed under a light microscope (Skomal and Natanson 2003), and Alizarin red staining. Band pairs were counted from digital images of centrum faces on a computer screen. We referred to the original vertebrae under the microscope if more detail was desired. Counts excluded the birth band, which represents age zero and alternating pairs of translucent (bright, broad = fast growth period) and opaque (dark, narrow = slow growth period) bands were assumed to represent one complete 'growth increment' or 'band pair.'

RESULTS AND DISCUSSION

To date, a total of 17,297 sharks have been tagged using conventional tags and 2,763 have been injected with OTC for age validation. Recapture rates of the OTC-injected sharks ranged from 5.4% for shortfin mako, 5.5% for common thresher, and 7.9% for blue sharks. Time-at-large ranged from 24 to 1,594 days for shortfin mako (average 450 days), 1 to 1,389 days for common thresher (average 223 days), and 22 to 701 days for blue shark (average 364 days). Age validation

results were species specific with annual band pair deposition observed for blue sharks and biannual deposition for juvenile shortfin mako. Unfortunately, no common thresher samples have been processed to date; however, previous age and growth studies on this species in the SCB have suggested annual deposition rates (Cailliet et al. 1983, Smith et al. 2008). Future work plans will be to finish processing all OTC returned vertebrae for each species and to use non-OTC vertebrae to provide updated growth models once deposition rates are determined.

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