Estimation of the age-at-length for yellowfin tuna from the EPO based on otolith daily increment counts

Daniel Fuller and Kurt Schaefer

Inter-American Tropical Tuna Commission

Bigeye and Yellowfin Tuna Age and Growth Workshop, La Jolla, California USA, 23-25 January 2019

Introduction

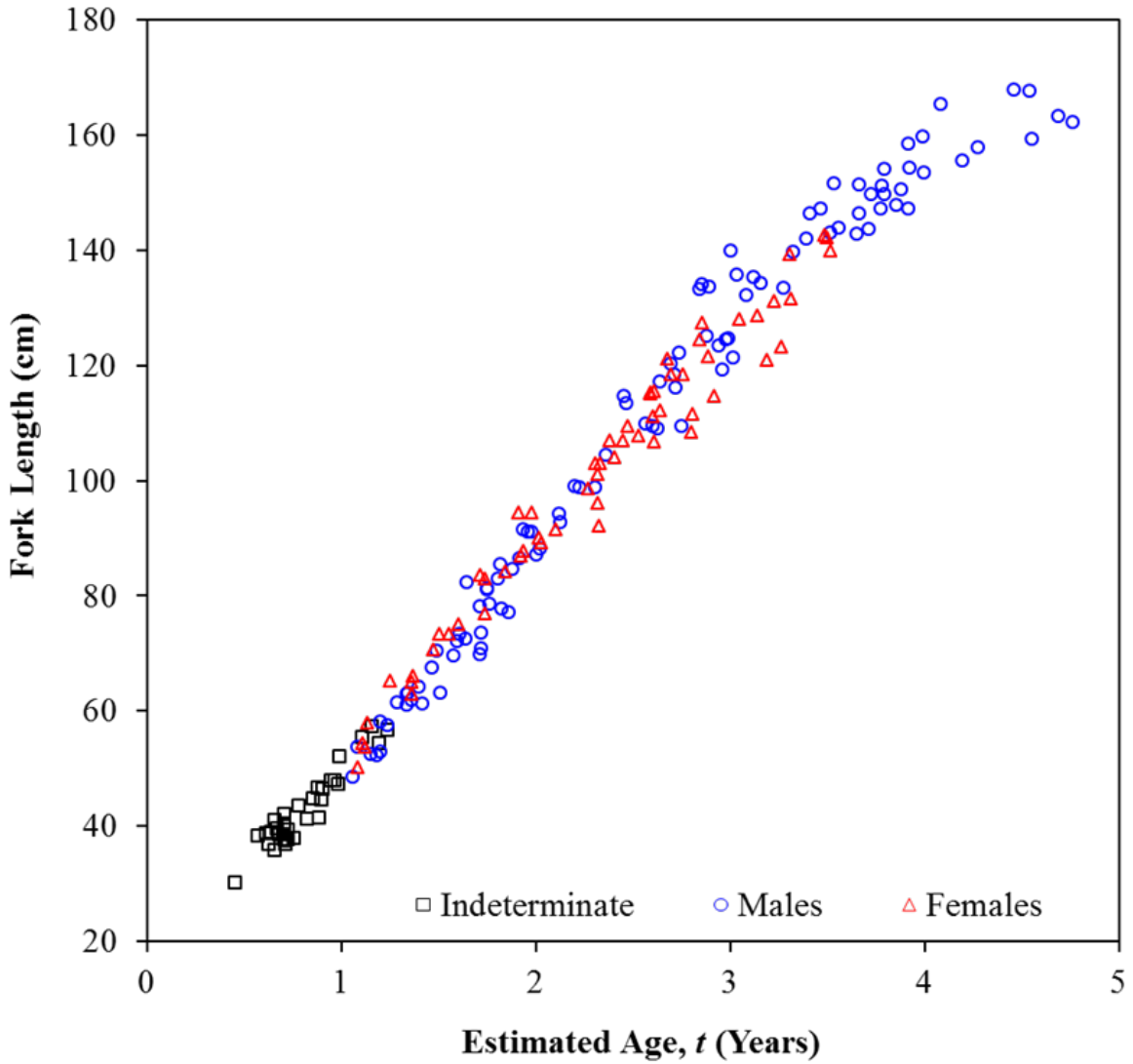
- Deposition rate experiments for yellowfin tuna conducted by Wild and Foreman (1980) indicated that the relationship between increment count and time from the fluorescent mark to the PR tip was 1:1.

- Previous work on age and growth of yellowfin tuna by Wild (1986) was described from a sample of 196 fish, 30-170 cm FL, collected during 1977 through 1979 from purse seiners fishing north of the equator and east of 137°W.

- A replica was created using a cellulose acetate film after an extensive acid etching process. From the replica, the number of increments on a sagittal of each fish was used as a direct estimate of its age in days

Introduction

Estimated age at length from daily increment counts by Wild (1986)



Introduction

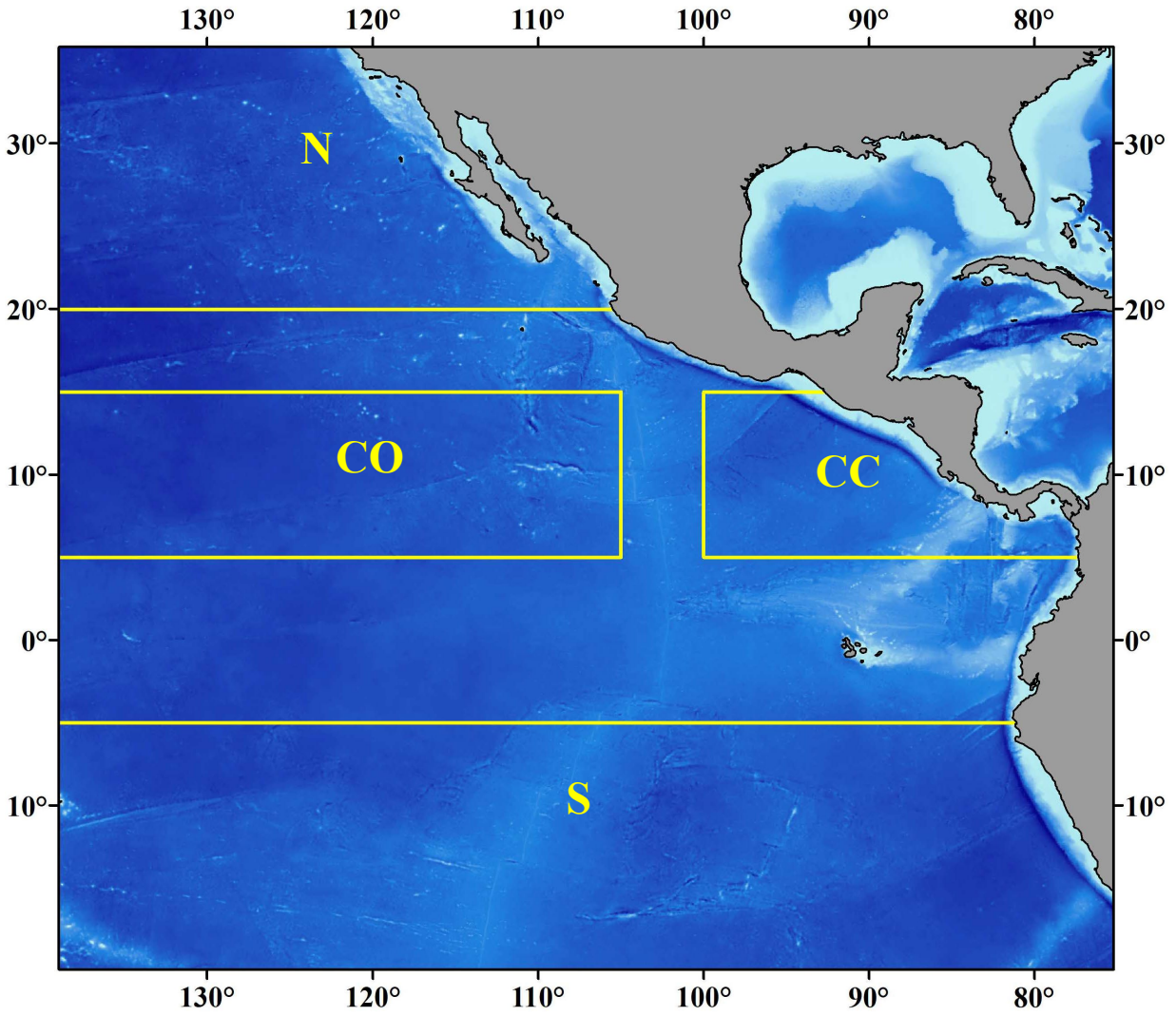
- Deposition rate experiments for yellowfin tuna conducted by Wild and Foreman (1980) indicated that the relationship between increment count and time from the fluorescent mark to the PR tip was 1:1.
- The age and growth of yellowfin tuna was described from a sample of 196 fish, 30-170 cm FL, collected during 1977 through 1979 from purse seiners fishing north of the equator and east of 137°W.
- A replica was created using cellulose acetate after an extensive acid etching process. From the replica, the number of increments on a sagittal of each fish was used as a direct estimate of its age in days
- The creation of acetate replicas of the counting path, from the primordium to the PR tip, is extremely time consuming, so with our experience doing daily counts on frontal sections of BET, we decided to employ similar methods on YFT

Materials and Methods

- Sample across 12 length classes, each of 10 cm range, between 40 and 160 cm
- At-sea sampling aboard purse-seine vessels was conducted by IATTC observers, through cooperation of specific fleets in Mexico and Ecuador. IATTC observers sampled ovaries at sea, shortly after capture, so subsamples could be placed in a fixative within a few hours following capture so as to be suitable for detailed microscopic examination
- Sample only when sea-surface temperatures are > 25°C, when mature yellowfin are expected to be reproductively active
- 20 yellowfin were selected from a single set and their lengths and sexes were recorded
- 40 females sampled for their ovaries and 15 of those for their otoliths, from each length class within each strata. No more than 5 specimens of each length class sampled from a set in the same month within a spatial strata
- Fish from which ovaries were sampled were tagged and placed in well racks, to facilitate locating them during the unloading process, for remeasuring, weighing, and collections of heads for later extraction of otoliths by IATTC field office staff.

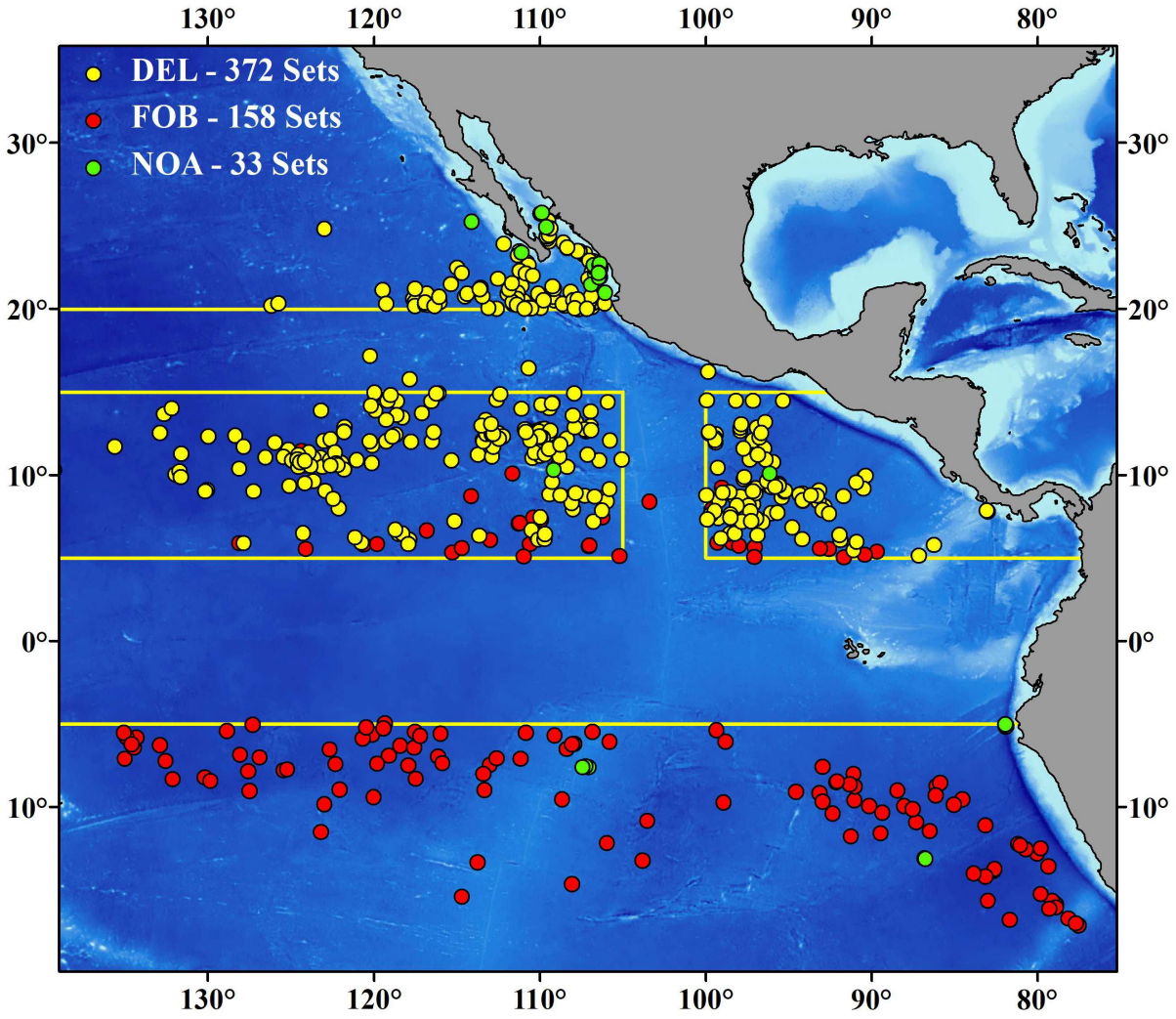
Materials and Methods

Yellowfin tuna otolith sample locations



Materials and Methods

Yellowfin were collected from 563 sets for ovaries and otoliths

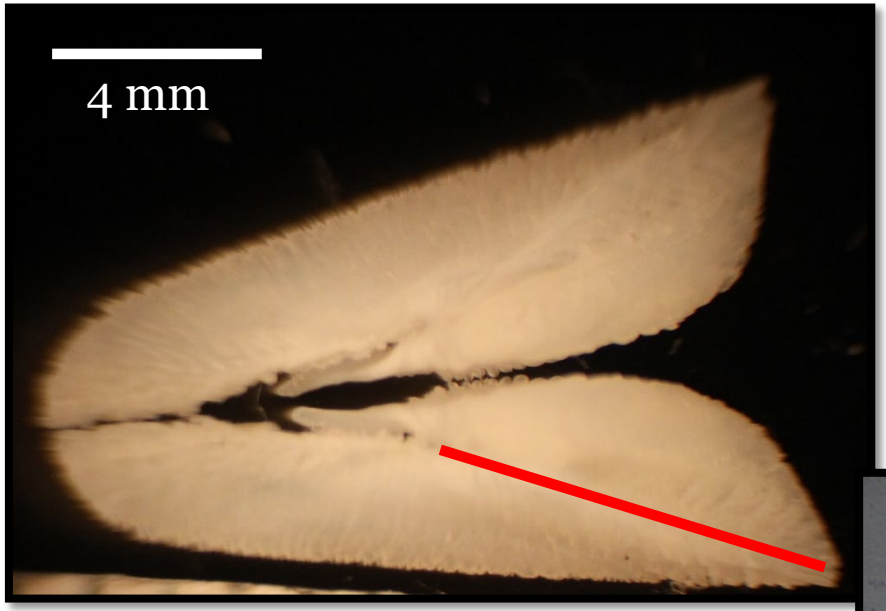


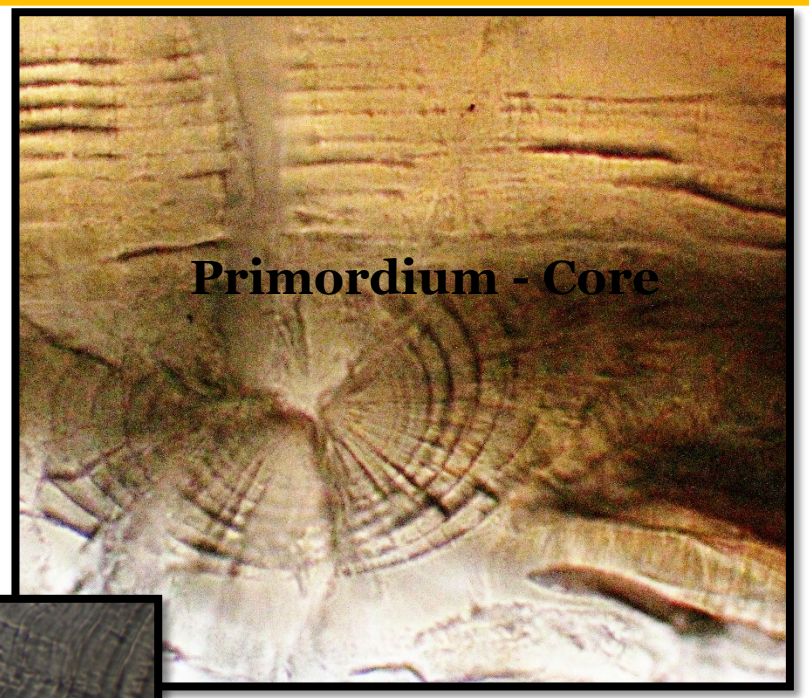
Materials and Methods

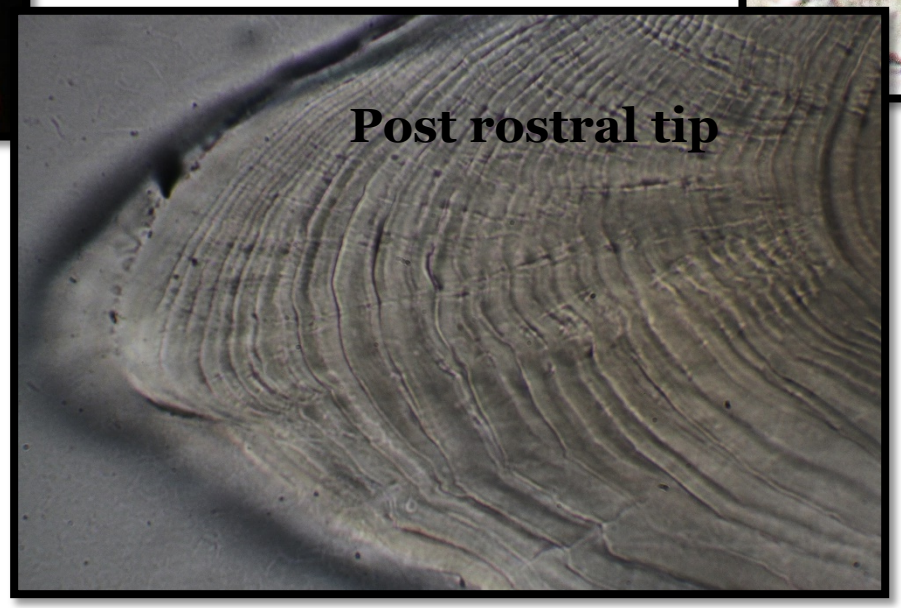
- Selected otoliths were mounted in epoxy resin and allowed to cure
- Sections were cut in the primordium – postrostral axis and hand polished
- Sections were viewed and increments counted at 600 -1000x (oil immersion)
- All otoliths are counted blind, with no knowledge of the fork length of the sample
- Only the discontinuous zone was counted
- Each otolith is counted twice, and those counts averaged to obtain a final age estimate. However, if the sample coefficient of variation (CV) is larger than 5%, the otolith is counted a third time, or more if necessary, until the CV is within the 5% threshold, so a minimum level of precision is maintained

Materials and Methods

Sagittal Otolith of Yellowfin tuna





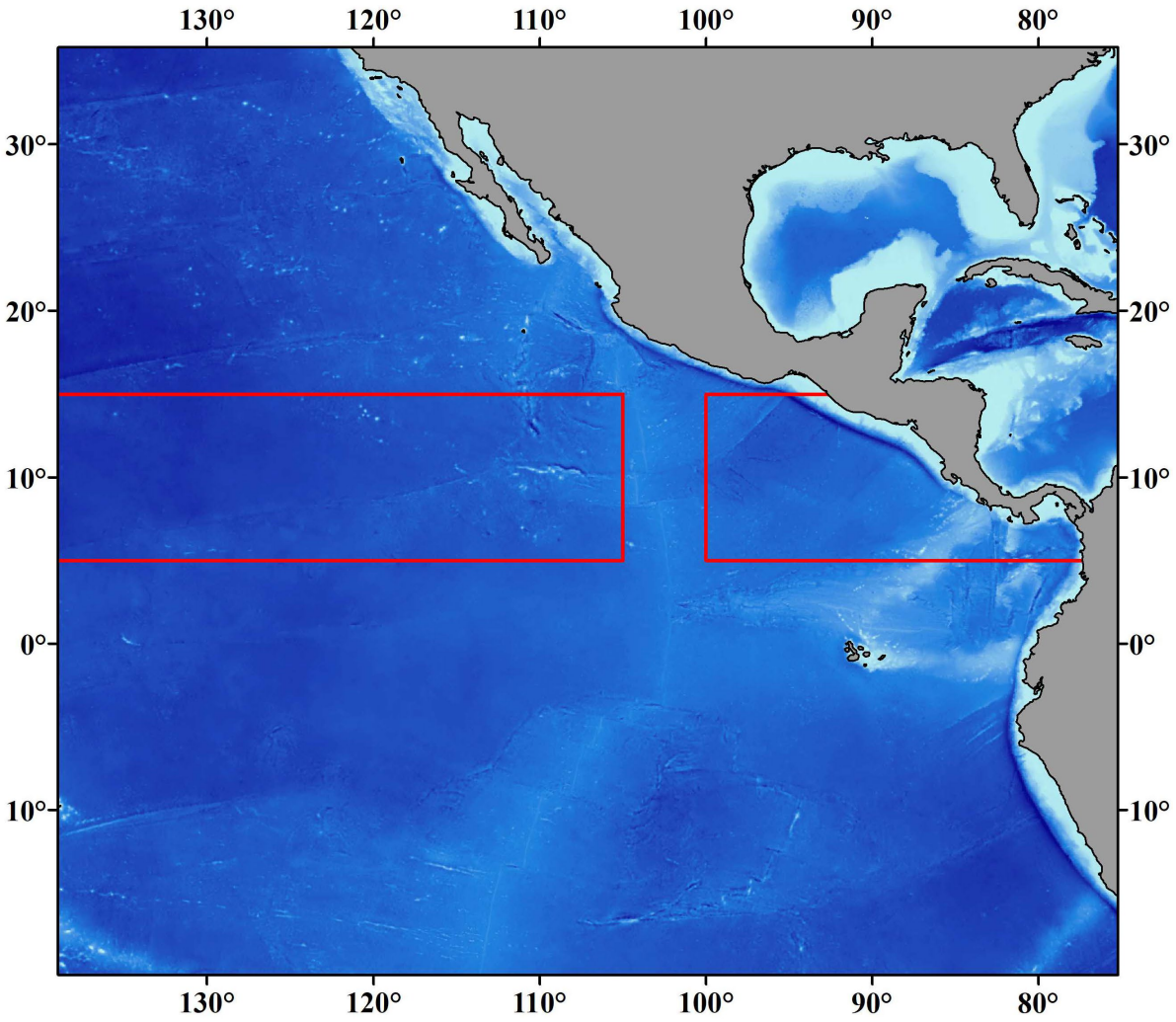


Results

- So far 106 fish from the central coastal area and 128 from the central offshore area have been aged

Results

234 Otoliths Read: 128 Central Offshore and 106 Central Coastal

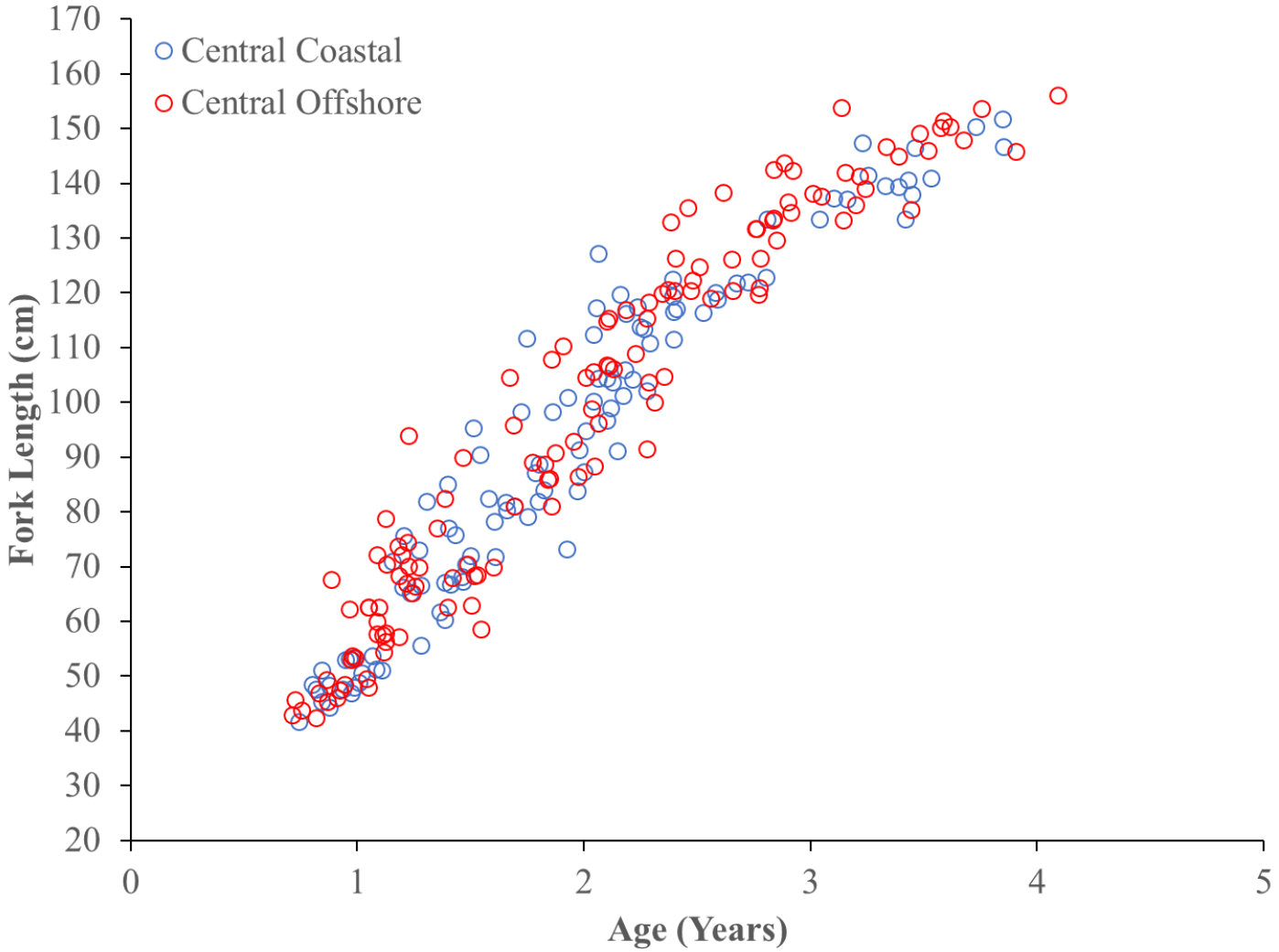


Results

- So far 106 fish from the central coastal area and 128 from the central offshore area have been aged
- Estimated ages for fish from 41.7 to 156.1 cm have ranged from 0.71 to 4.1 years (260 to 1493 d)

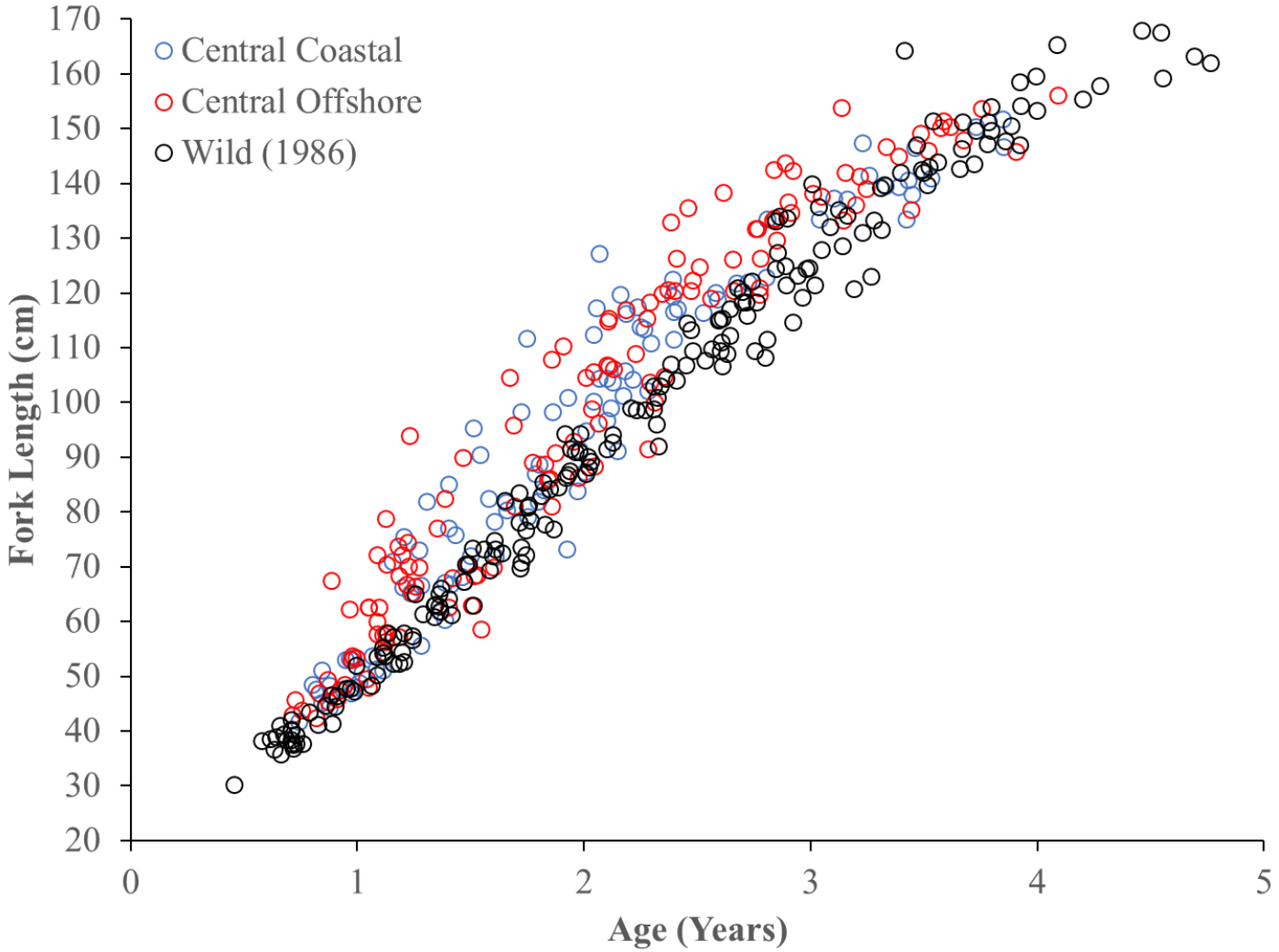
Results

Estimated age at length from daily counts from the CO and CC areas



Results

Estimated age at length from daily counts for the CO and CC areas, and those of Wild (1986)



Results

- So far 106 fish from the central coastal area and 128 from the central offshore area have been aged
- Estimated ages for fish from 41.7 to 156.1 cm have ranged from 0.71 to 4.1 years (260 to 1493 d)
- Although still preliminary, a GAM fit to the age at length data for the CC and CO areas indicated a significant difference between the 2 areas (fl~s(ageyear)+area)
- A GAM fit to the age at length data indicated a significant difference between the combined CO and CC data sets and that from Wild (1986)

What's Next?

- Someday when time permits focus on completing reads for both the CO and CC areas, as well as begin working on otoliths from both the Northern and Southern areas

Questions