



INTERNATIONAL PACIFIC
HALIBUT COMMISSION



Biological and Ecosystem Science Program

Oocyte stages and development in female Pacific Halibut (*Hippoglossus stenolepis*)

INTRODUCTION

Each year, the fishery-independent setline survey collects biological data on the maturity of female Pacific halibut that are used in the stock assessment. In particular, the female maturity schedule is used to estimate spawning stock biomass. Currently used estimates of maturity-at-age indicate that the age at which 50% of female Pacific halibut are sexually mature is 11.6 years on average. However, not only is maturity estimated with the use of macroscopic visual criteria, incurring a relative level of uncertainty that is associated with semi-quantitative criteria, but the estimates of maturity-at-age have not been revised in recent years and may be outdated. For this reason, efforts need to be put in place to further understand reproductive maturity in female Pacific halibut. Unfortunately, relatively little is known regarding the changes that take place in the ovary during reproductive development leading to spawning in this species. This study aims to describe oocyte (immature egg) development in female Pacific halibut by comparing oocyte stages and characteristics between the non-spawning season (summer) and the spawning season (winter).



MATERIALS AND METHODS

Ovaries were collected from Pacific halibut females captured in three geographical regions (Fig. 1), two in the central and south Gulf of Alaska (Portlock and Haida Gwaii, respectively) and one in the southeast Bering Sea (Misty Moon), during the winter (Jan-Feb, 2004) and summer (June-July, 2004) periods. Ovaries were fixed in buffered formalin, embedded in paraffin and sections were mounted on glass slides. Two slides for each ovary were stained with Hematoxylin and Eosin. From each slide, the diameters of 10 randomly selected oocytes were measured, yielding a total of 20 measured oocytes per ovary analyzed. Measures were conducted using the Image-Pro Premier 9.1 software.

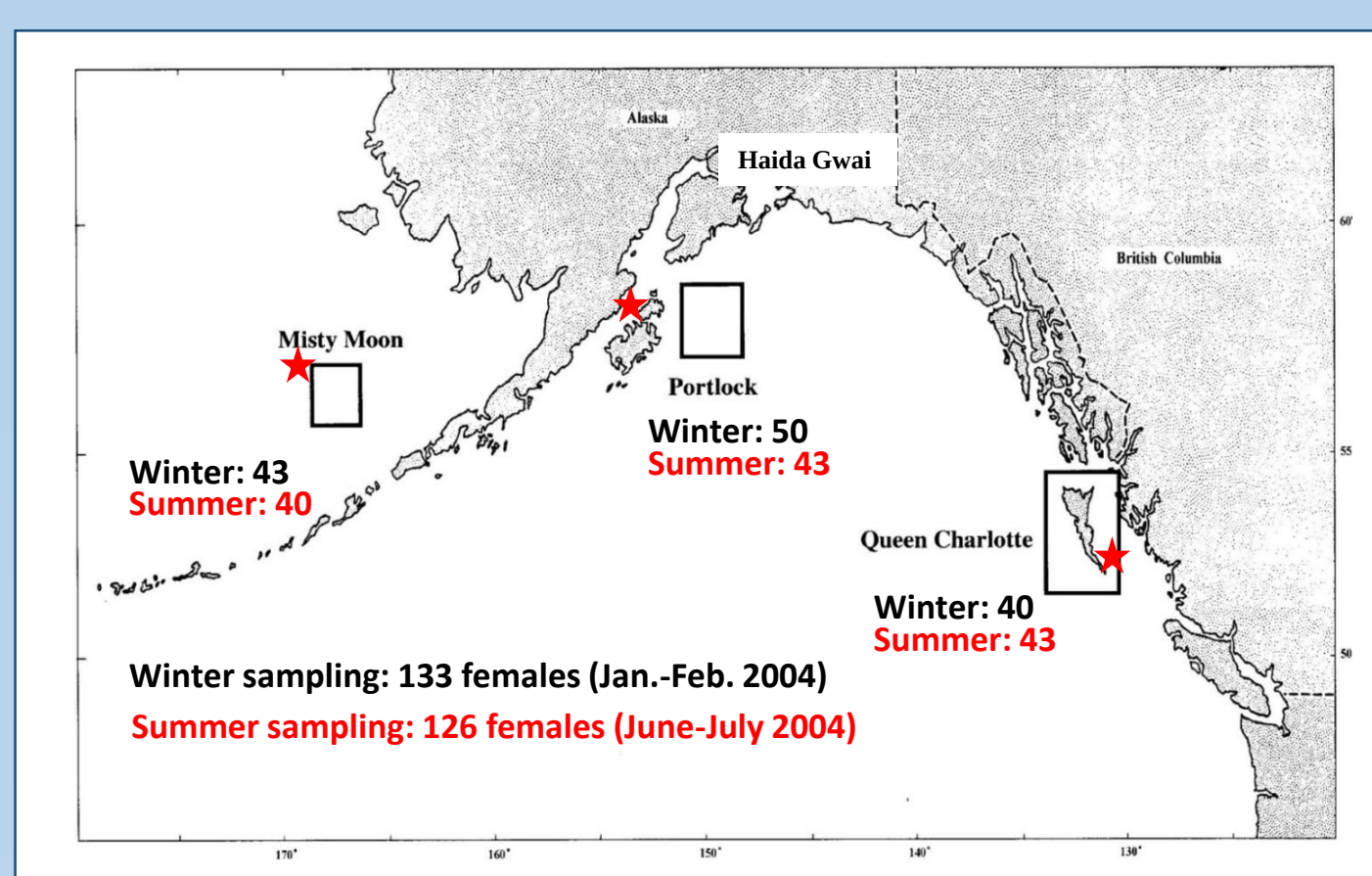


Figure 1. Geographic location of sample collection sites. Summer collection sites (non-spawning season) are indicated by a red star and winter collection sites (spawning season) are indicated by a black box. The number of females collected at each site is indicated.

Oocyte size distribution

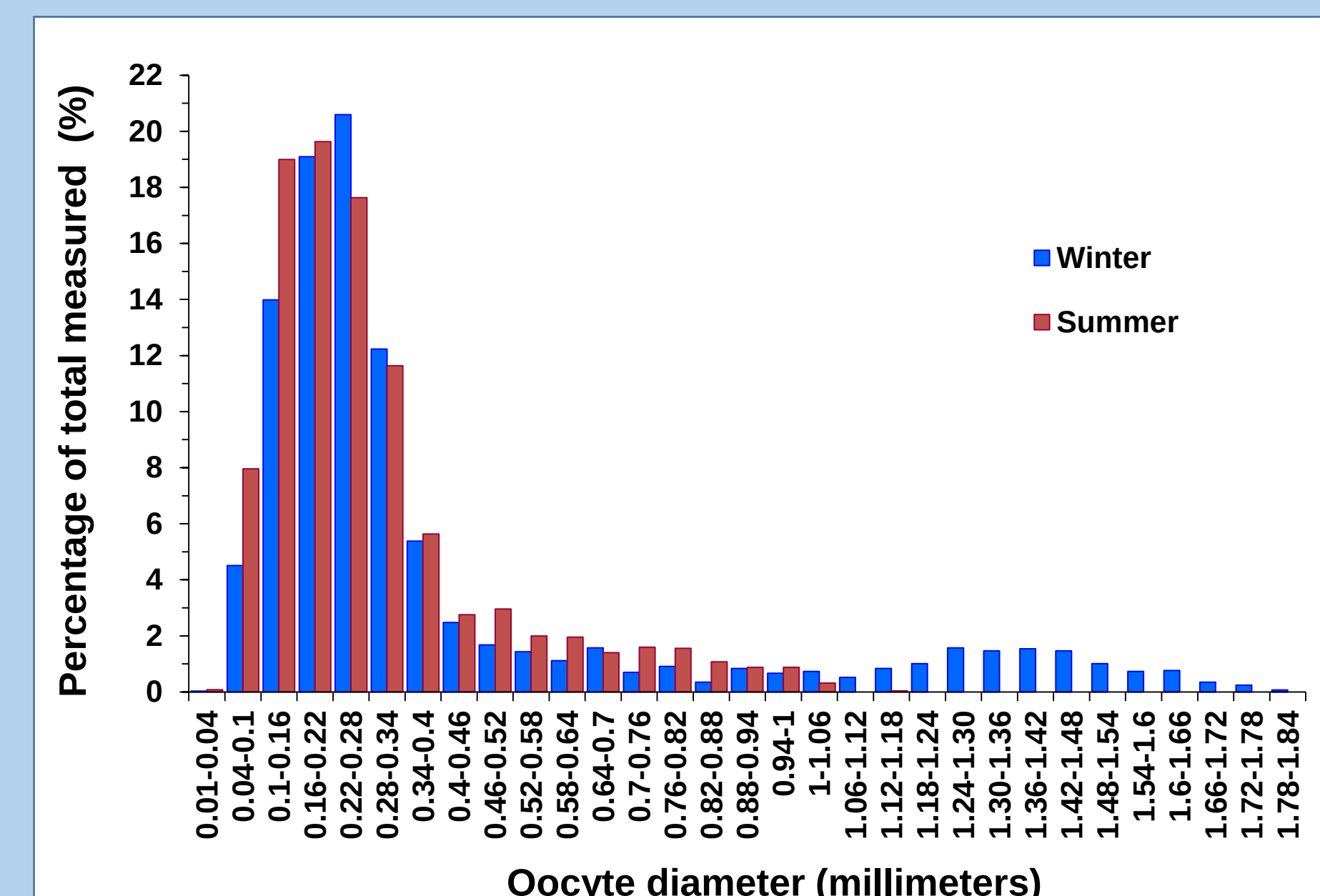


Figure 3. Pacific halibut oocyte distribution in females caught in summer and winter periods. Oocyte size categories are in millimeters and are shown as percentage of the total number of oocytes measured.

Oocyte stage classification: Summer versus Winter

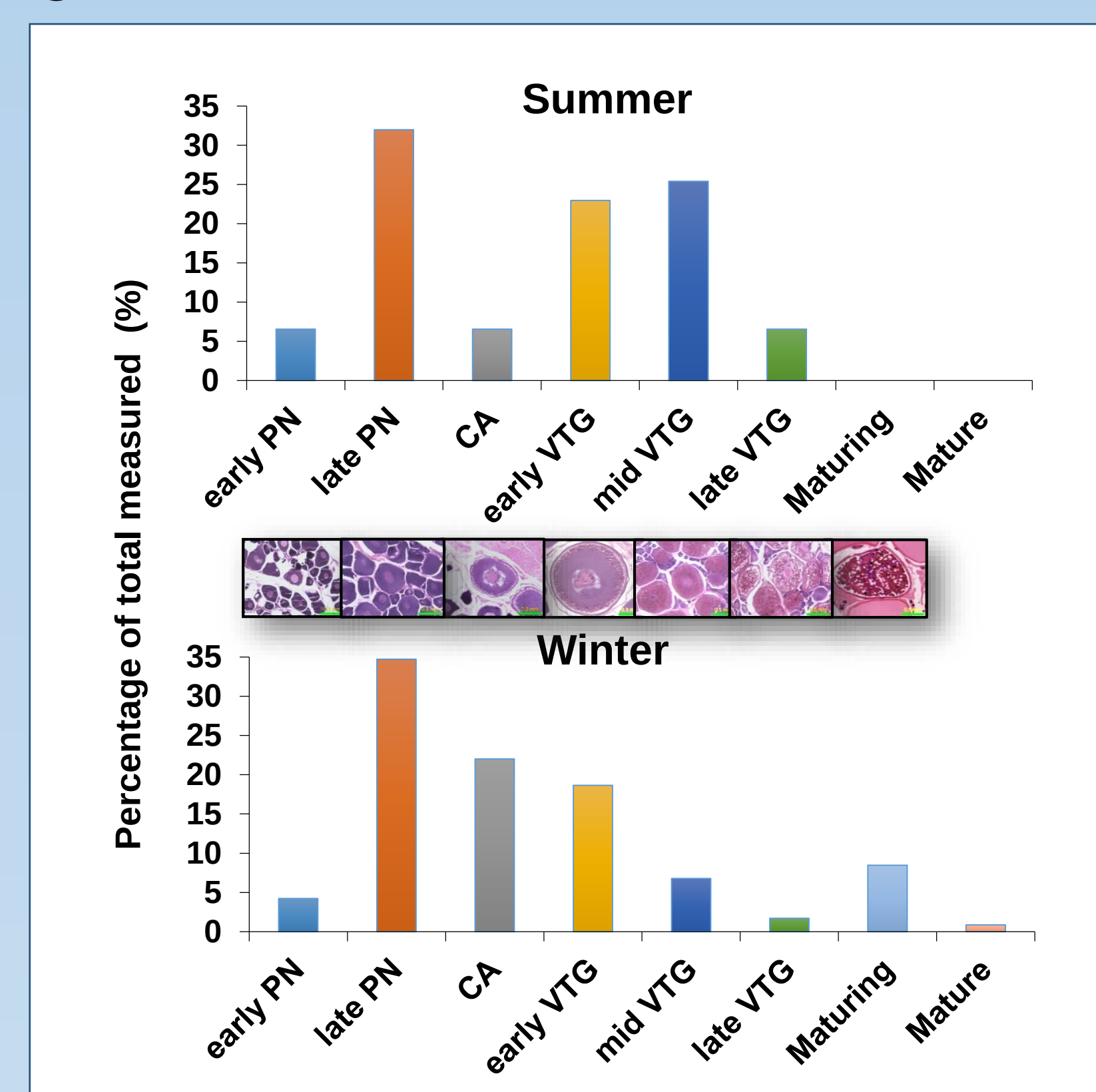


Figure 4. Pacific halibut oocyte stages in females caught in the Summer (A) and Winter (B). Oocyte stage classification included oocytes at the early and late perinucleolar (PN), cortical alveoli (CA), mid and late vitellogenesis (VTG), maturing and mature stages.

RESULTS

Oocyte classification

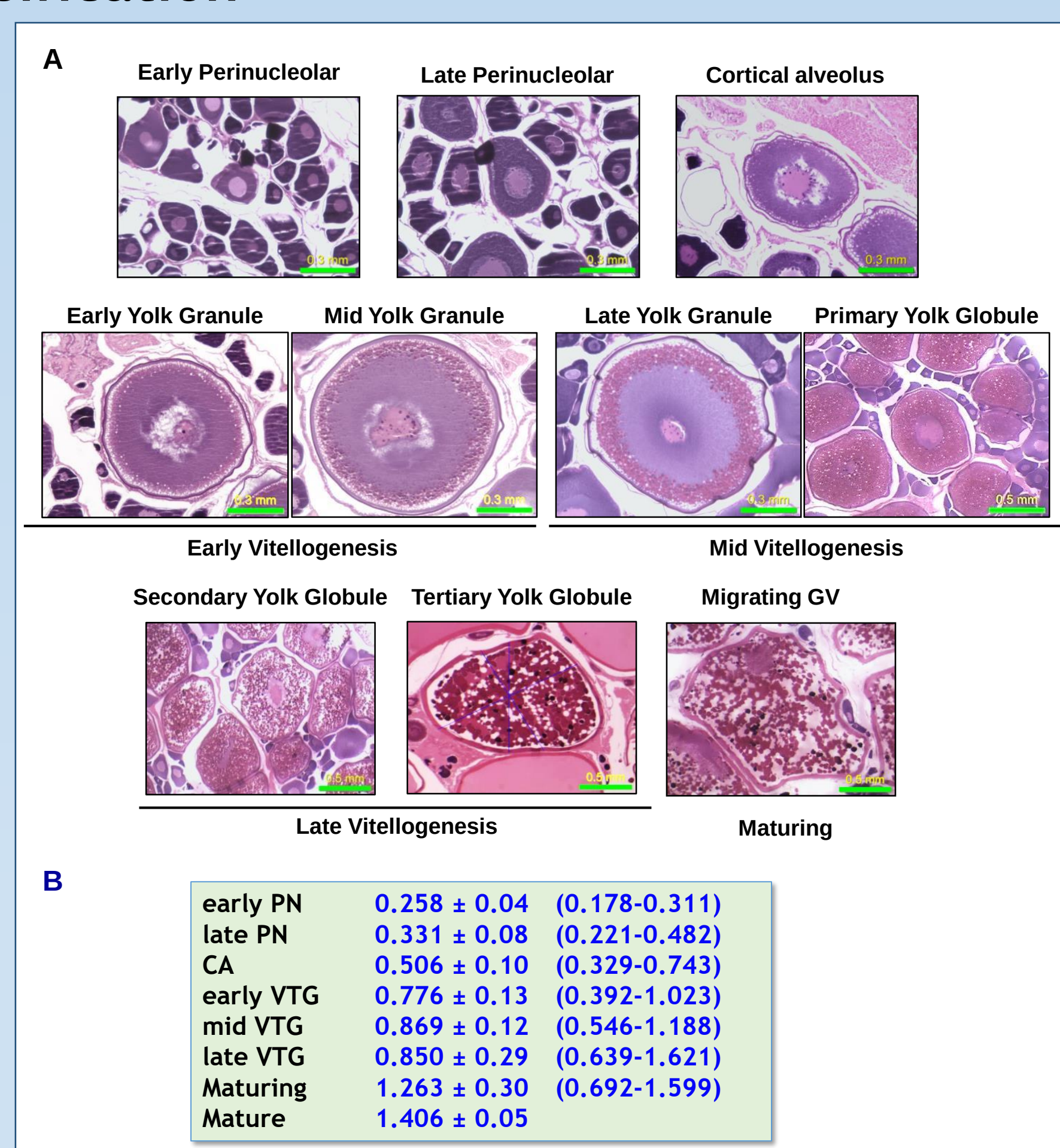


Figure 2. Pacific halibut oocyte stages and diameters. A) Pictures of representative oocytes at the various stages during oocyte development. B) Oocyte diameters (in millimeters) at different stages in oocyte development. Oocyte stage classification included oocytes at the early and late perinucleolar (PN), cortical alveoli (CA), mid and late vitellogenesis (VTG), maturing (migrating germinal vesicle [GV]) and mature stages. The range of oocyte diameters is indicated within parenthesis.

CONCLUSIONS

- This study represents the first attempt at describing ovarian development in Pacific halibut.
- Oocyte stages have been identified and can be used for accurate ovarian staging.
- The ovary of Pacific halibut contains a predominant population of early vitellogenic oocytes that is likely recruited during the Fall for Winter spawning.
- The observed differences in oocyte stages between Summer and Winter are indicative of the seasonal progression of ovarian development.
- Further studies are needed to complete the description of the annual reproductive cycle in this species.

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