

A-573 Tomonori KANETA

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Accuracy of estimating wave height based on the wave transform application with angular spreading method

A Windows PC application that estimates wave height transformation with the angular spreading method and can read values from existing cumulated energy curve graphs and the distances between wave rays from a refraction diagram was developed. The application automatically calculates the values, searching for energy cut areas by land boundary, executes the calculations of multiple data sets (i. e., wave height, wave period, and wave direction), and saves the results, which makes estimating operations easy to perform. Estimating wave height transformation of actual measured wave heights at an offshore observation point with the application showed that there is a correlation between the estimated wave heights and actual measured wave heights from a shore observation point. According to the results, setting the wave ray intervals to 5 times greater than the width of the designing facility, but shorter than the distance between the calculation point and land boundary, is appropriate.

A-574 KIYOSHI KASUGAI

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Seasonal changes in age and maturity of chum salmon *Oncorhynchus keta* landed on fishermen' s cooperative associations in Hokkaido

The age and maturity of chum salmon *Oncorhynchus keta*, which landed on 17 fishermen' s cooperative associations in Hokkaido were surveyed between 2004 and 2014. Sexual maturity based on body color of each fish was recorded, and the scales were removed from 50 females and 50 males from each survey site once a month between September and November each year. Age and proportion of mature fish were analyzed for all specimens grouped by sex, catch date (ten days interval), and survey site throughout the duration of the survey. With the change of seasons, the mean ages of the fish decreased in eastern Hokkaido, and the number of mature fish increased at the many survey sites in the Nemuro region and

the Pacific Ocean coast, for both sexes..

A-575 Kazutaka SHIMODA, Tomoharu WATANABE and Daisei ANDO

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Differences in early squamation of chum salmon *Oncorhynchus keta* juveniles among river populations in seasonally spawning stocks

Body size and period of early squamation in chum salmon juveniles *Oncorhynchus keta* were examined. The difference in squamation process between early- and late-run stocks (fertilized from late September to early October and from middle November to early December, respectively) were compared with juvenile fish from six rivers (Abashiri R., Shibetsu R., Tokachi R., Chitose R., Shizunai R. and Torisaki R.) in Hokkaido, Japan. The delay of early squamation was observed in the rivers where emerging juveniles were shown to have short fork length. The early squamation of late-run stocks was faster than that of early-run stocks in three rivers based on results comparing the period of fertilization. The fork length of juveniles at the first squamation day were observed to be significantly by the analysis of two-way ANOVA depending on the period of fertilization and populations in the rivers. These results suggest that the period of early squamation in chum salmon juveniles could be determined based on the body size at emergence and at the first squamation day. Body sizes can explain the differences in early squamation period between juveniles from the six rivers and during the fertilization period.

A-576 Osamu SHIDA, Ryotaro ISHIDA, Koichi ISHIDA and Kenji SAKAGUCHI

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Inter-annual fluctuation in distribution of age-0 walleye pollock *Gadus chalcogrammus* in the southeastern Pacific coast of Hokkaido

Inter-annual fluctuation in the distribution of age-0 walleye pollock *Gadus chalcogrammus* in the southeastern Pacific coast of Hokkaido was examined by acoustic surveys conducted in autumn from 1997 to 2013. As a result, age-0 juveniles were widely distributed through the continental shelf to the continental slope region, where, inter-annual changes in the distribution of age-0 fish were found. A major change observed was that their distribution shifted from the continental shelf to the slope

region in 1999, 2000, 2003 and 2005. It seems that age-0 pollock distribution is regulated by the size of the fish and environmental factors such as food availability and water temperature, but not by the distribution of adult pollock that are a major predator of the juveniles.

A-577 Takuya MIZUKAMI, Kazuhiko ITAYA, Tohru MUKAI and Kohji IIDA

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Vertical distributions of walleye pollock *Gadus chalcogrammus* and euphausiids on the continental shelf of southern Okhotsk Sea, off the coast of Hokkaido, by using a quantitative echosounder

To understand spring distribution patterns of walleye pollock *Gadus chalcogrammus* and euphausiids, we conducted an echo integration survey on the continental shelf region of the southern Okhotsk Sea at night in late April and June of 2012 and 2013. Walleye pollock aggregations were mainly distributed in the Soya warm current layer (SWC,  $>0$  °C,  $>33.5$ ), that has a subsurface current of intermediate cold water (ICW,  $<0$  °C). In contrast, euphausiids were distributed at the surface layer of the ICW. In addition, we conducted a drift observation to observe diel vertical migration of euphausiids. Euphausiids were noted to descend to the lower layer of the SWC via the ICW before and after sunrise. Stomach contents of walleye pollock that were caught by bottom trawl consisted mainly of euphausiids, indicating that feeding occurs during euphausiids migration between the two current layers.