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# Revisiting the spatial and seasonal distribution of tropical tuna larvae and their potential spawning area in the western central Pacific Ocean

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**Abstract**
Clarifying the seasonality of tropical tuna larvae distribution would be very important to understand spawning habitat and recruitment process of these species in the WCPO. In this document, collected tropical tuna (skipjack, bigeye and yellowfin) larvae data were reexamined to characterize spatial distribution of these tuna in the WCPO. Survey was conducted in wide range of Pacific Ocean and all data were compiled into quarterly basis. Significant occurrences of skipjack larvae were identified in quarter 2 (Apr.-Jun.) especially in western area (0°N-20°N, 120°E-170°E) and quarter 4 (Oct.-Dec.) between 20°S and 20°N, mainly around PNG and Solomon Islands.

## INTRODUCTION

Clarifying the seasonality of tropical tuna larvae distribution would be very important to understand spawning habitat and recruitment process of these species in the WCPO. In this document, we intended to revisit the spatial distribution of skipjack in the western central Pacific (WCPO) with sea surface temperature for updating our knowledge and re-establish a shared awareness of early life history of skipjack tuna in the WCPO since spawning habitat or survival of skipjack and influence of oceanographic factors has not been improved since Ueyanagi et al (1969) and Matsumoto et al (1984).

## DATA

In addition to previously published tuna and skipjack larvae datasets caught by the research vessel in Japan between 1956 and 1989 (Nishikawa et al., 1985), we employ sea surface temperature estimated by the Hadley Centre Sea Ice and Sea Surface Temperature data set (HadISST; http://rda.ucar.edu) were employed in the correspond time period with the larvae data for considering influence of oceanographic factors. HadISST is a unique combination of monthly globally-complete fields of SST and sea ice concentration on a 1 degree latitude-longitude grid from 1870 to date.

## RESULTS AND DISCUSSION

*Spatial distribution of tropical tuna larvae in the WCPO*

**Figure 1** shows quarterly and spatial distribution of tropical tuna larvae from Nishikawa et al (1985). Significant occurrences of skipjack larvae (blue) were identified in quarter 2 (Apr.-Jun.) especially in western area (0°N-20°N, 120°E-170°E) and quarter 4 (Oct.-Dec.) between 20°S and 20°N, mainly around PNG and Solomon Islands. Overall skipjack larvae distribution tends to be distributed in the western Pacific Ocean. Taking growth of skipjack into account (Tanabe et al., 2003), larvae in quarter 2 in subtropical area would contribute to recruit to near Japanese water.

**Figure 2** shows sea surface temperature by HadISST at the area where skipjack larval distributions were identified. Most of skipjack larvae (5 – 95%) were found temperature between 24℃ and 28.8℃. This result indicates that tropical area may not be suitable for skipjack larvae survival while adult fish are caught here. It is now pointed out that increase of skipjack catch in tropical areas decrease the range or abundance in subtropical area, which will lead to increase larvae mortality due to spawning in unsuitable area.

*Importance of cooperation among CCMs*

Pacific water around Palau, Indonesia and Philippine would be important for tropical tuna spawning area and larval survival, especially skipjack tuna. Consideration of joint research among these CCMs is an important role.

*Others (Further research)*

In this February, NRIFSF started a trawl survey, same as implemented in the past, in subtropical area in order to collect data on tropical tuna larvae. New *in situ* research is now planning to conduct from November to December 2015 in subtropical and tropical area.

***Summary and Recommendation***

1. Historical tropical tuna larvae data (1954 – 1989) were used to examine to characterize their spatial distribution in the WCPO. Overall skipjack larvae distribution tends to be distributed in the western Pacific Ocean. Taking growth of skipjack into account (Tanabe et al., 2003), larvae in quarter 2 in subtropical area would contribute to migrate to water around Japanese coast.
2. Higher sea surface temperature by HadISST indicates that tropical area may not be suitable for skipjack larvae survival while adult fish are caught here. Currently it is pointed out that increase of skipjack catch in tropical areas may decrease the range or abundance in subtropical area, which will lead to increase larvae mortality due to spawning in unsuitable area.
3. Pacific water around Palau, Indonesia and Philippine would be an important area for tropical tuna spawning area and larval survival, especially skipjack tuna. Consideration of joint research among these CCMs is an important role.

**Reference**

Nishikawa, Y., Honma, M., Ueyanagi, S. and Kikawa, S. (1985) Average distribution of larvae of oceanic species of Scombroid fishes, 1956-1981. *Far Seas Fish. Res. Lab. S Ser.* 12:1-99.

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Ueyanagi, S. (1969) Observations on the distribution of tuna larvae in the Indo-Pacific Ocean with emphasis on the delineation of spawning areas of albacore, Thunnus alalunga. *Bull. Far Seas Fish. Res. Lab.*, 2:177-256 (in Japanese with English abstract).

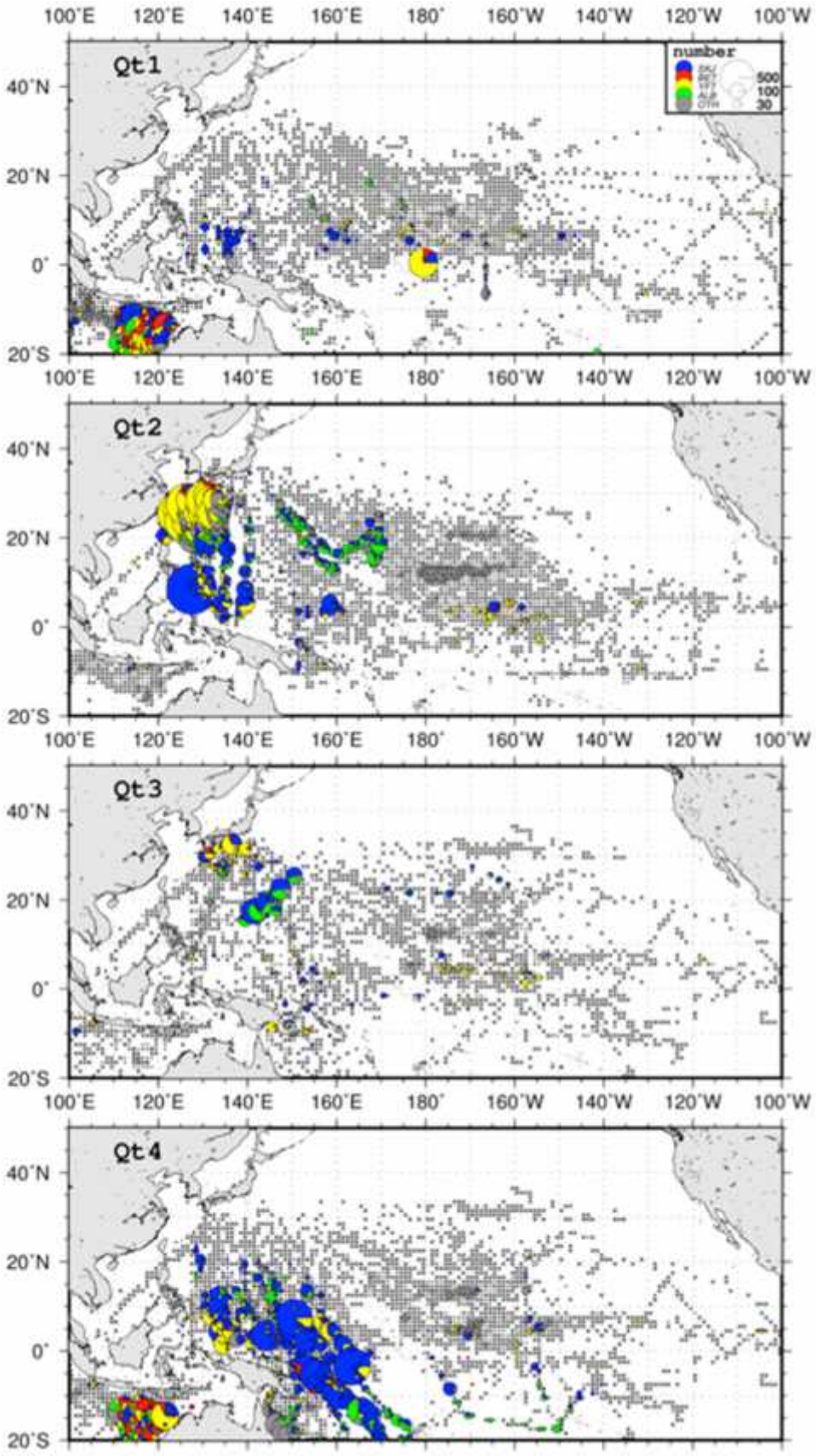


**Figure 1.** Quarterly and spatial distribution of tropical tuna larvae from Nishikawa et al (1985). (a) quarter1 (Jan.-Mar.), (b) quarter2 (Apr.-Jun.), (c) quarter3 (Jul.-Sep.) and (d) quater4 (Oct.-Dec.). Blue: Skipjack, Red: Bigeyfe, Yellow: Yellowfin, Green: Albacore and Gray: Others.

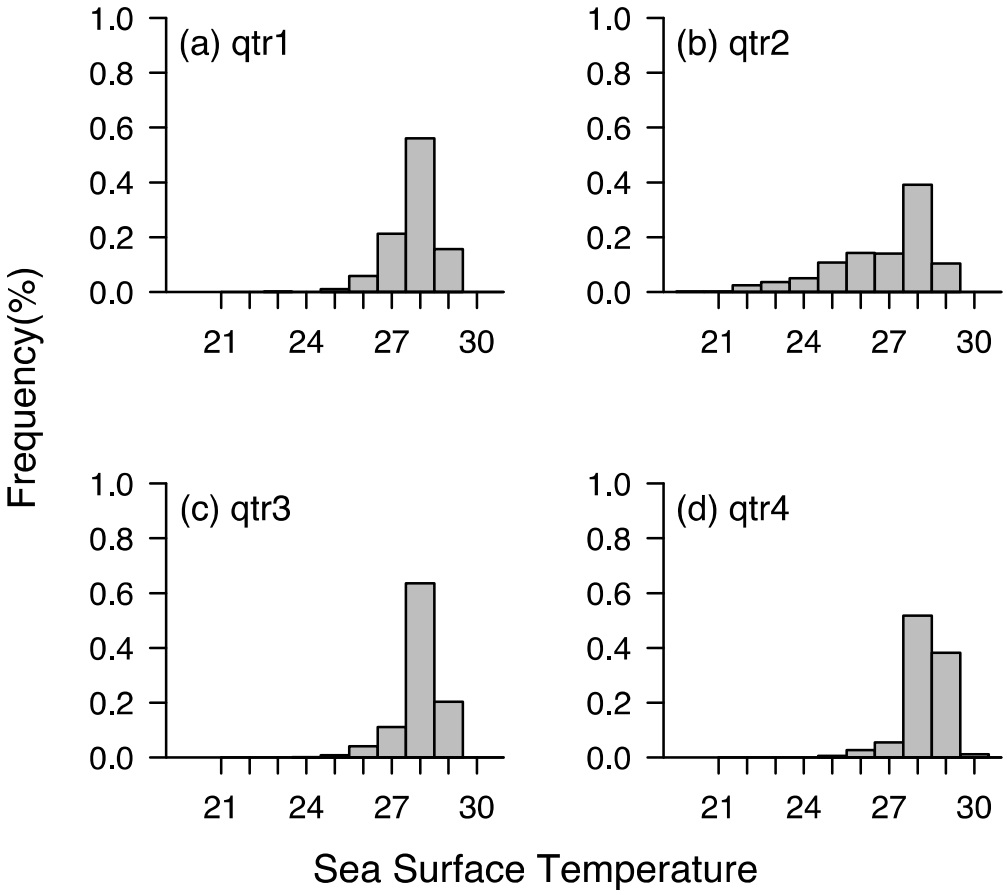


**Figure 2.** Sea surface temperature at the area that skipjack larval distributions. Note that most of skipjack larvae (5 – 95%) were found temperature between 24℃ and 28.8℃.