

# **A time spatial analysis of Japanese size composition data of North Pacific striped marlin (*Kajikia Audax*)**

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## **Abstract**

Spatial and temporal distribution of size composition of North Pacific striped marlin caught by Japanese distant-water and offshore longline fishery was reviewed in provisionally. The size composition data showed quarterly, spatial and temporal difference. However, ~~BILLWG did not consider this phenomenon to define fisheries definition in the stock assessment. Hence, fishery definition which used in previous stock assessment did not reflect quarterly and spatial size difference completely. Hence,~~ BILLWG needs to reconsider fishery definition of North Pacific striped marlin.

## **Introduction**

Using stock synthesis 3 (SS3), ISC Billfish working group (BILLWG) addressed stock assessment for Pacific striped marlin (ISC 2015). In this assessment, Japanese size composition data was given by distant-water and offshore longline fishery. However, changes in recent size composition data in comparison to the previous assessment resulted in changes in fishery selectivity estimates and also affected recruitment estimates. This, in turn, affected the scaling of biomass and fishing mortality to reference levels. (ISC 2015). In this document, spatial and temporal size composition of striped marlin caught by Japanese distant-water and offshore longline fishery was reviewed in provisionally to help to consider appropriate fleet definition in stock assessment using SS3.

## **Materials and methods**

Japanese longline size composition data was collected by port sampling and onboard measurement for Japanese distant-water and offshore longline fishery, and training vessel. This data sets are the same as that used in the last stock assessment of North Pacific striped marlin (Yokawa et al., 2015). Using this data sets, spatial and temporal distribution pattern of size data and size frequency were observed.

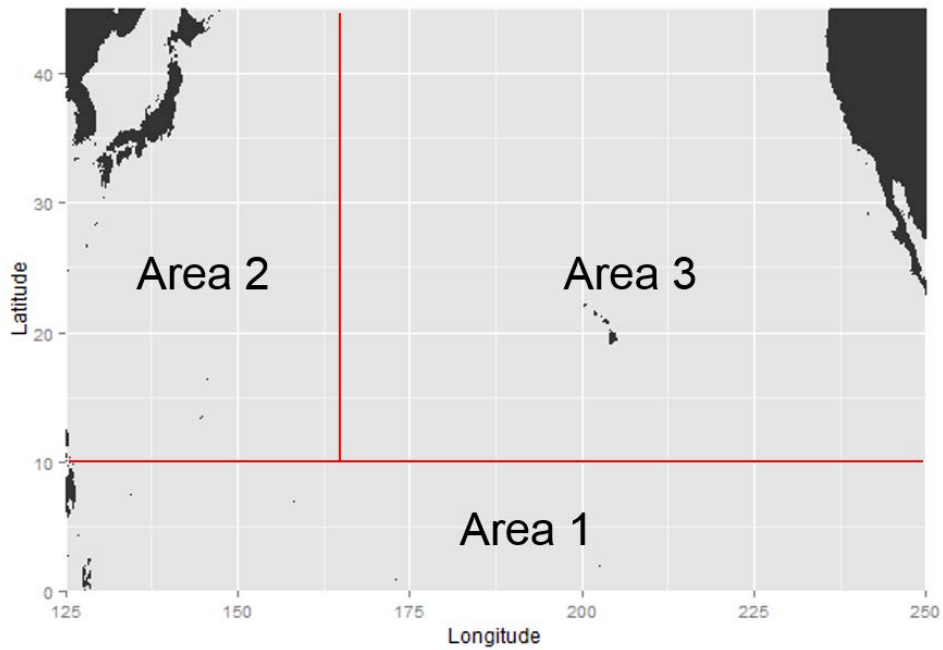
## **Result and discussion**

In the last stock assessment of striped marlin conducted by ISC BILLWG, distant-water and offshore longline fishery were defined as three types of fishery by area, that is area 1: from 0 to 10°N and 115°W to 110°E, area 2: from 10°N to 50°N and 115°W to 165°W, area 3: from 10°N to 50°N and 165°W to 110°E (Fig 1). In the area 1 and 2, clear bimodal distribution was observed (Fig 24). These two modes can be detected clearly until middle 1990s and in 1 and 2 quarter (Fig 32, Fig 43). Difference of size distribution by sex was not clear (Fig 54). Geographic distribution of size data have changed historically, for instance area coverage have decreased in area 1 (Fig 65). In area 1 (< 10°N), Middle-large size fish (> 150cm) was caught mainly, however before 1990s, small fish was caught in quarter 2 (Fig 75). Therefore, if fishery definition is determined without considering these spatial and temporal difference in size frequency and historical change in sampling distribution, age composition in catch and stock should not be estimated correctly.

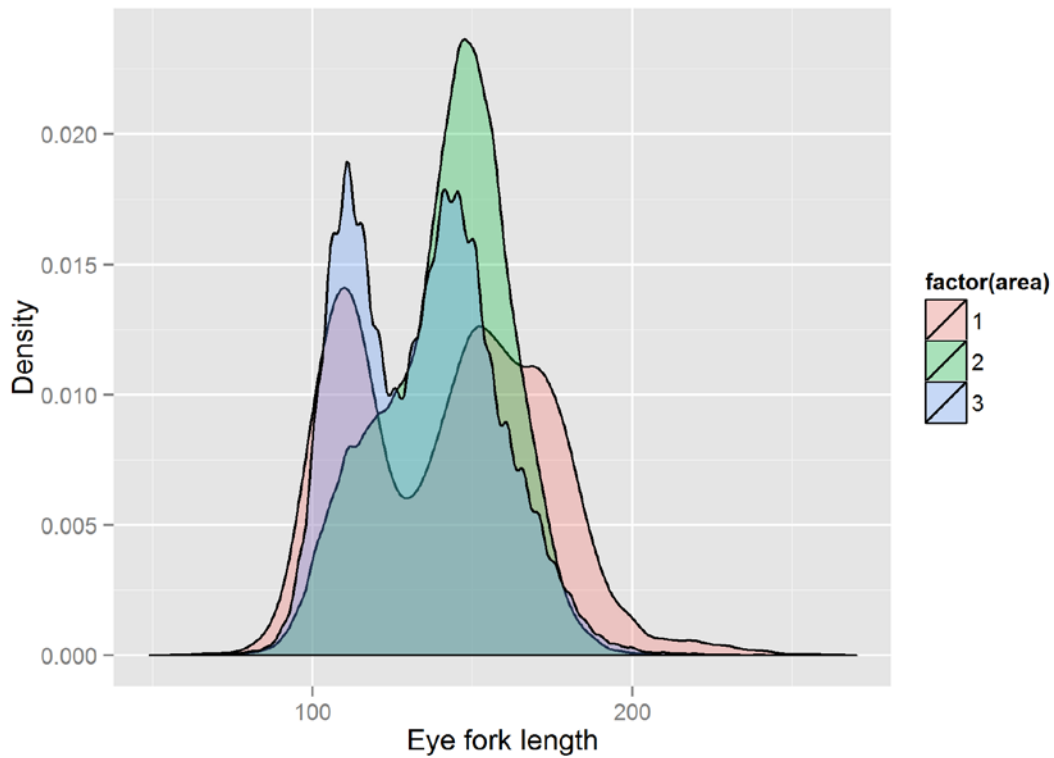
In the last stock assessment, ISC BILLWG did not consider quarterly ~~change and historical change~~ of size selectivity. ~~However,~~ Japanese size composition data shows quarterly, spatial and temporal difference (Fig 43, Fig 65). However, defined fishery did not reflect spatial difference completely (Fig 2). ~~Hence,~~ BILLWG needs to reconsider fishery definitions of Japanese offshore and distant-water longline fishery. To decide new fishery definition, some statistical analysis might be effective because spatial ~~and temporal~~ boundaries are not obvious.

## References

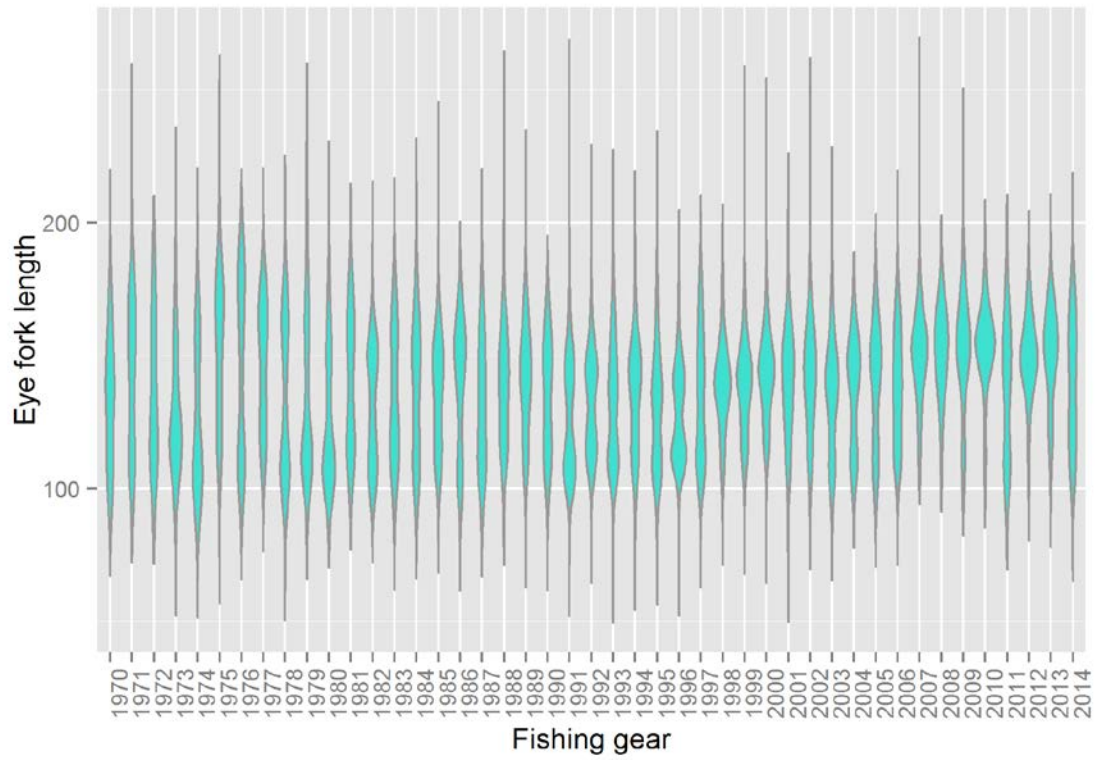
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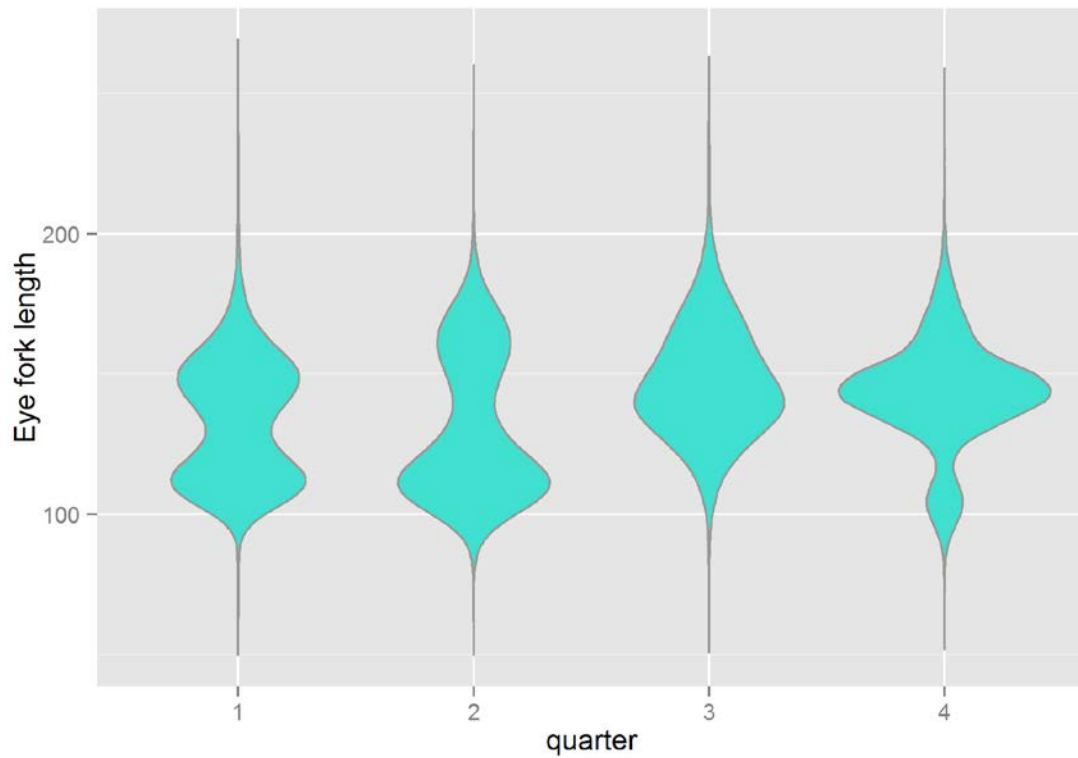
**Fig 1.** Area definition of Japanese distant-water and offshore longline fishery.



**Fig 24.** Eye fork length distribution of the North Pacific striped marlin given by Japanese distant-water and offshore longline fishery. BILLWG defined Japanese distant-water and offshore longline fishery as three fisheries by area (area 1: from 0 to 10°N and 115°W to 110°E, area 2: from 10°N to 50°N and 115°W to 165°W, area 3: from 10°N to 50°N and 165°W to 110°E).



| Fig 32. Annual trend of eye fork length of the North Pacific striped marlin caught by Japanese distant-water and offshore longline fishery.



| Fig 43. Quarterly eye fork length of the North Pacific striped marlin caught by Japanese distant-water and offshore longline fishery.

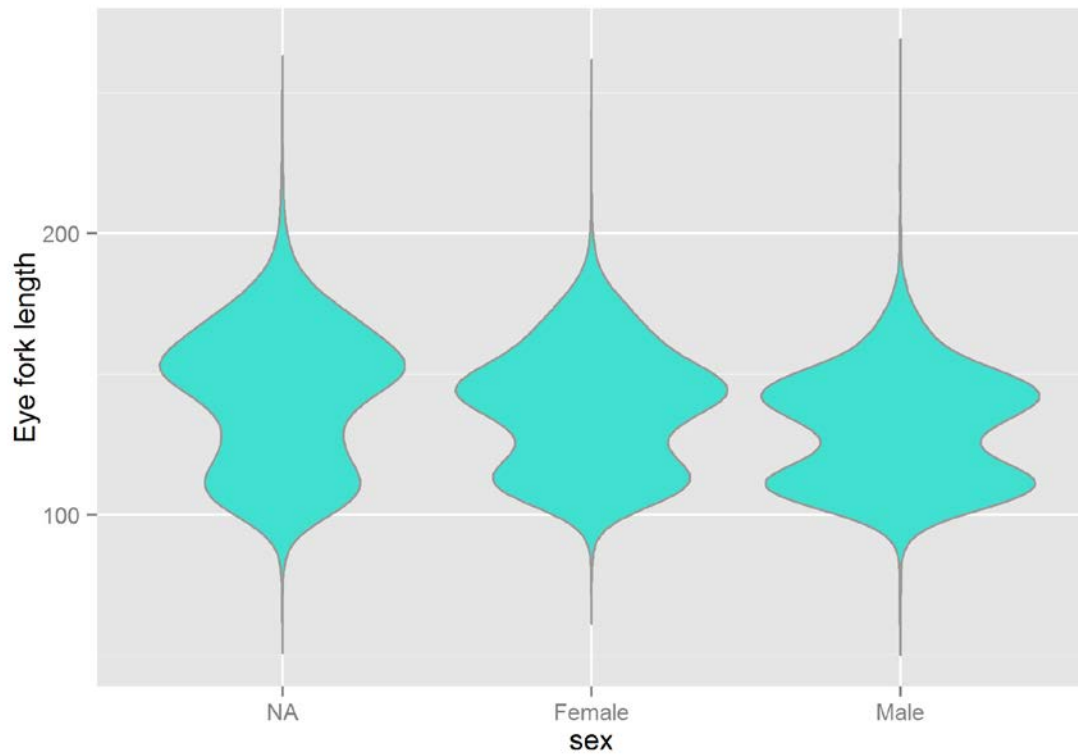


Fig 54. Eye fork length of the North Pacific striped marlin caught by Japanese distant-water and offshore longline fishery aggregated by sex.

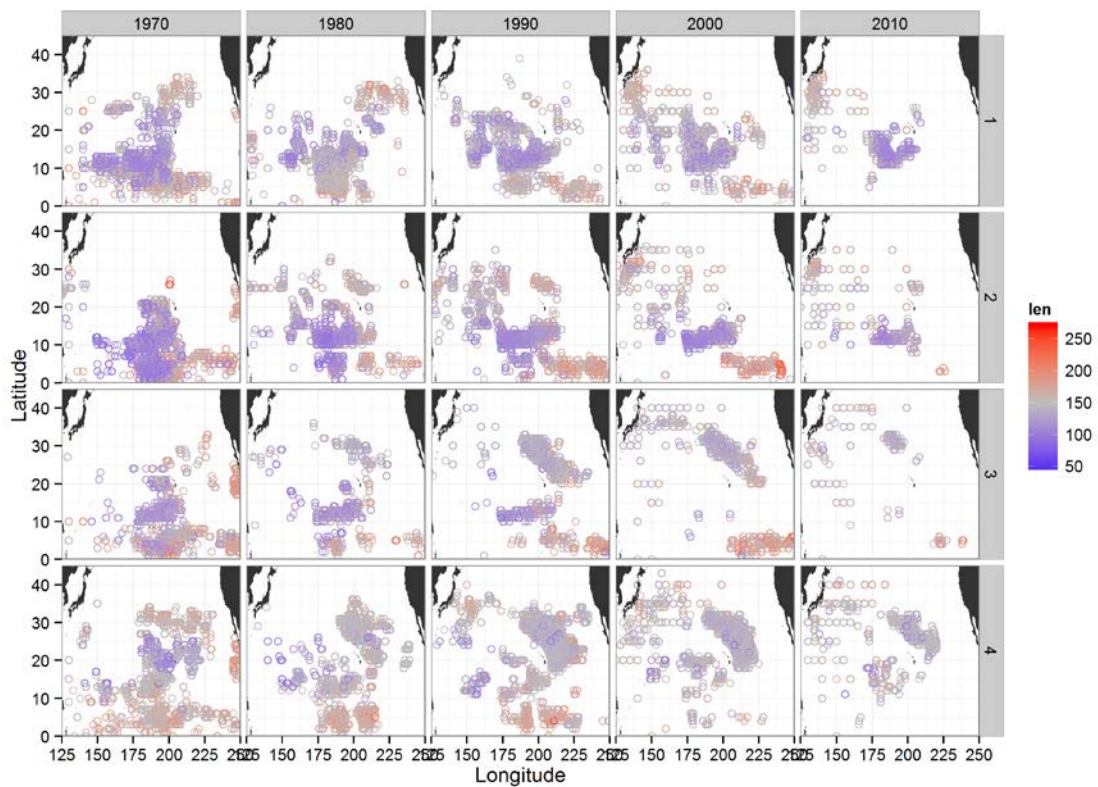


Fig 65. Time-spatial catch size distribution of the North Pacific striped marlin given by Japanese commercial distant-water and offshore longline vessel.