Estimation for Japanese catch at length data of North Pacific albacore tuna (*Thunnus alalunga*) [1]

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Abstract

The size composition data given by fishery have not been sampled randomly. For instance, the sample size of the size composition data is not proportional to total catch amount. To consider cumulative catch number effect for size composition data, we estimated catch at length of North Pacific albacore tuna (*Thunnus alalunga*) that was caught by Japanese longline and pole and line fishery. Using estimated catch at length, we summarized time / seasonal change of the area dependent fishery selectivity and we suggested candidate fishery definition for the stock synthesis 3. The estimated catch at length of longline fishery in area 1 and 3 shows seasonal differences between quarter 1-2 and quarter 3-4. Catch at length of the longline fishery in area 2 was changed the middle of the 1990s. Regarding the pole and line fishery, catch at length given by the Northern part of Pacific (>=30N) also showed seasonal differences between quarter 1-2 and quarter 3-4.We could not estimate catch at length of drift net fishery because size composition data of drift net fishery is a little and operational data also is not precise. And it is difficult to define the area / seasonal difference for size composition data of Japanese drift net fishery Thus; we suggested firstly to use seasonal fishery definition for Japanese longline fishery (area 1 and area 3) and pole and line fishery in Northen part. Secondly, to set two selectivity period for Japanese longline fishery in area 2 (1966-1993, 1994-2015) and do not divide area dependent fishery for drift net fishery.

Introduction

Size composition data that was sampled by fishery is one of the most valuable information for the stock assessment. Because selectivity was estimated by size composition data (Methot and Wetzel 2013). However, sometimes size composition data did not represent an actual fish size of fishery. For instance, size data were not observed by random sampling rather than cluster sampled (Pennington et al., 2002). We also need to consider catch amount of sampled population. ISC Albacore working group (ALBWG) defined area based fishery for the next stock assessment (Fig 1, Fig 2). However, Japanese size composition data was not considered catch amount that corresponding to sample data.

Here, we estimated catch at length data for Japanese longline and pole and line fishery and summarize historical or seasonal change of catch at length data. And we attempted to suggest fishery definition for stock synthesis 3.

Material and methods

Catch at length in year y at quarter q of bin j ($\overline{L}_{y,q,j}$) was calculated by

$$\overline{L}_{y,q,j} = \sum_i r_{y,q,i} L_{y,q,i,j}, \tag{1}$$

where $r_{y,q,i}$ is catch rate in year y at quarter q on 5×10 area i, $L_{y,q,i,j}$ is size composition data in year y at quarter q on 5×10 area i of size bin j. $r_{y,q,i}$ is given by estimated catch number in year t at quarter q on area i ($N_{y,q,i}$).

$$r_{y,q,j} = \frac{N_{y,q,i}}{\sum_i N_{y,q,i}}, \sum_i r_{y,q,i} = 1. \tag{2}$$

Using weight based logbook and size composition data, We estimated catch number on 5×10 area i in year y at quarter q as

$$N_{y,q,j} = \frac{H_{y,q,i}}{\overline{w}_{y,q,i}}, \tag{3}$$

where $H_{y,q,i}$ is total catch weight on area i in year y at quarter q, $\overline{w}_{y,q,i}$ is mean body weight on area i in year y at quarter q. Finally, we compared historical or seasonal catch at length data.

Result and discussion

Estimated catch at length data of Japanese longline fishery in area 3 tend to be smaller than original size composition data (Fig3). Catch at length data tends to be smaller than original size composition data (Fig4). The length frequency of drift net fishery is quite similar between Northern area and Southern area that total sample number is 1,125 (Fig5). Estimated catch at length of longline fishery in area 1 and 3 differ between 1-2 quarters and 3-4 quarters (Fig 6). Catch at length of pole and line fishery in Northern area shows different trends between 1-2 quarters and 3-4 quarters (Fig 7). Regarding to the Japanese drift net fishery, there is no data in quarter 3 and 4 and it is difficult to define area / seasonal fishery (Fig 8). Because sampling period is only two years (1990-1991). We summarized historical change of frequency of catch at length that was given by longline fishery (Fig9). The large size albacore was caught between 1980-1990 in area 2 and 4 (Fig9). In the Northern area, catch at length frequency of pole and line shows two mode that associated with seasonal (Fig 10). It is difficult to define historical or seasonal change of driftnet size composition data (Fig 11).

We summarized and suggest to define fleet for SS3 as follows:

- Longline fishery operating area 1 and 3 shows seasonal difference, thus it is better to define seasonal fishery definition for longliner of area 1 and 3.
- Pole and line fishery that operate in Northern area (>=30) shows seasonal difference this feet also needs to define seasonal fishery.
- Longline fishery that operation area2 shows historical change of catch at length data.
- It is difficult to define area based fishery definition for drift net fishery because coverage of size composition data and logbook data is very low.

References

Methot, R. D., and Wetzel, C. R. 2013. Stock synthesis: a biological and statistical framework for fish stock assessment and fishery management. Fisheries Res. 142:86-99
Pennington, M., Burmeister, L-M., and Hjellvik, V. 2002 Assessing the precision of frequency distributions estimated from trawl-survey samples. Fish.Bull. 100:74-80

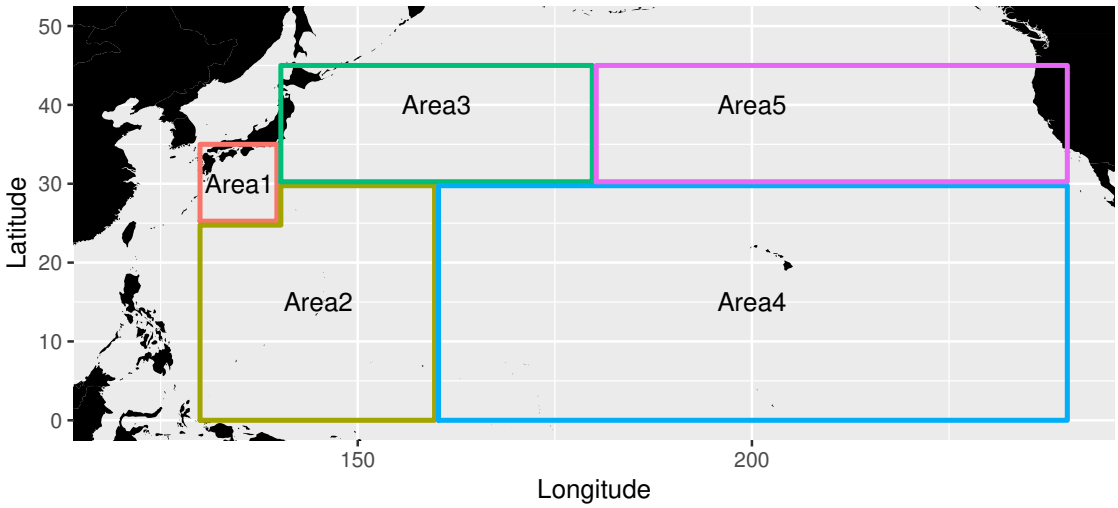

Figure 1: The area dependent fishery definition of Japanese longline fishery.

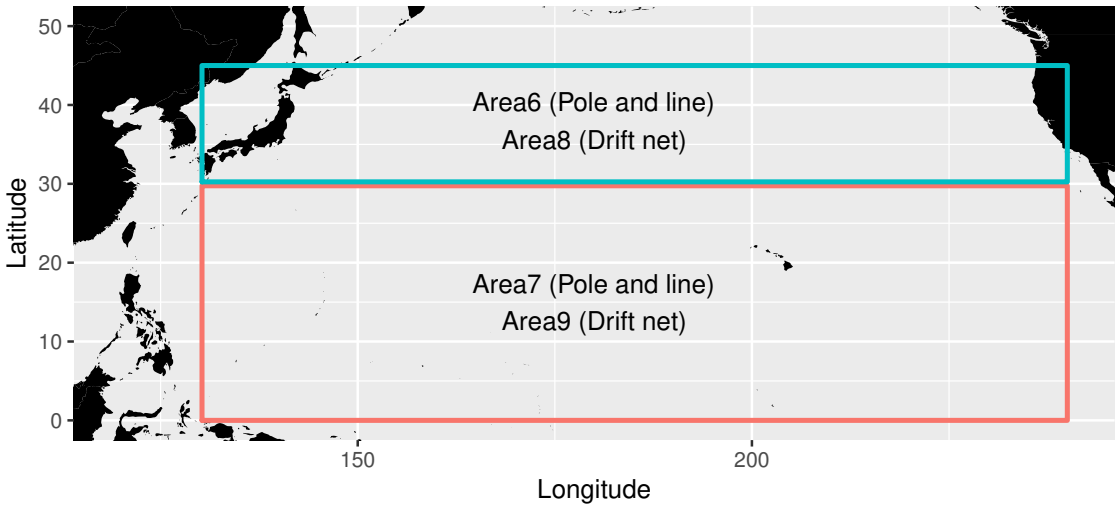

Figure 2: The area dependent fishery definition of Japanese pole and line fishery and drift net fishery.

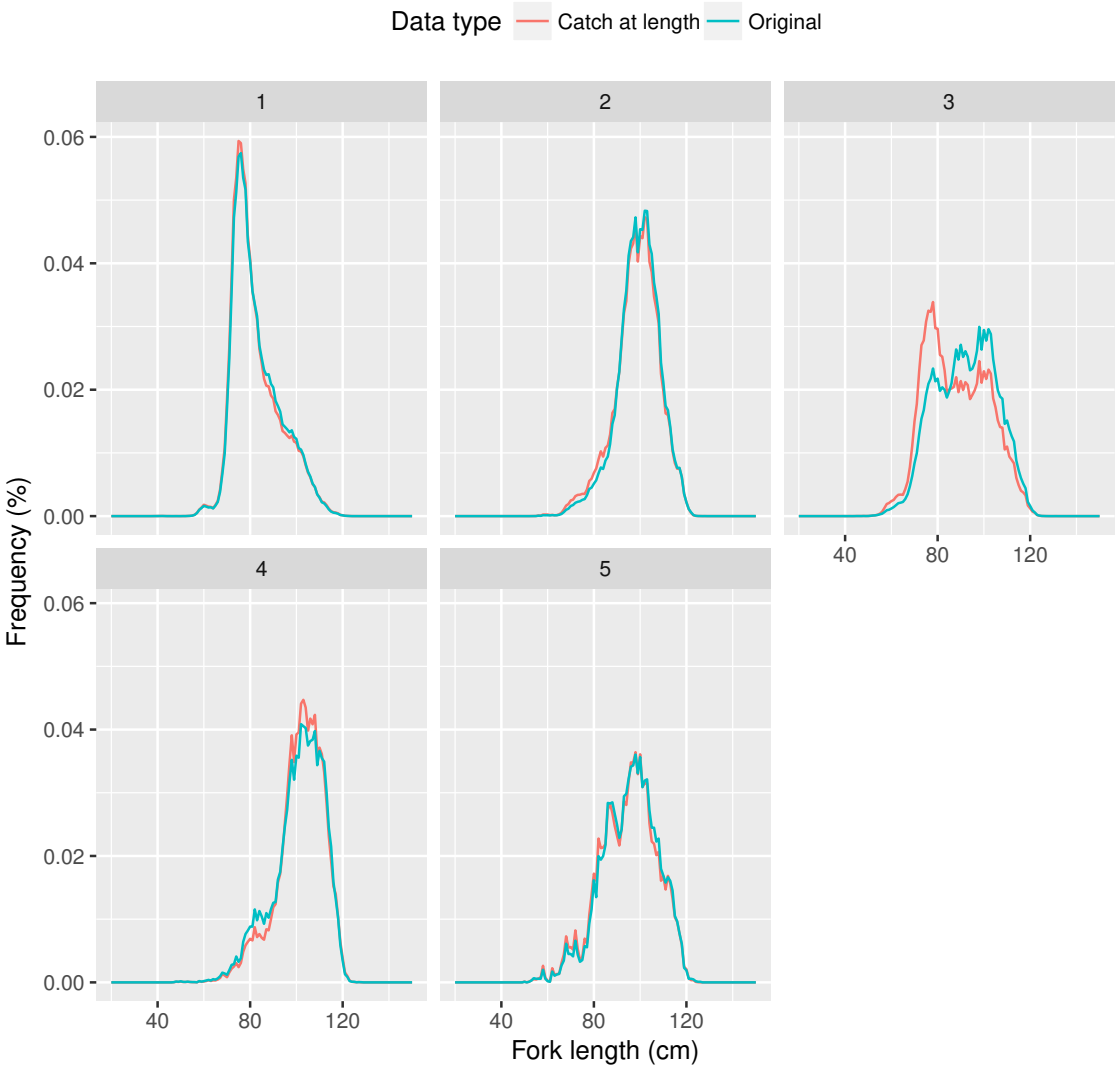

Figure 3: The comparison between estimated catch at length data and original size composition data of Japanese longline fishery.

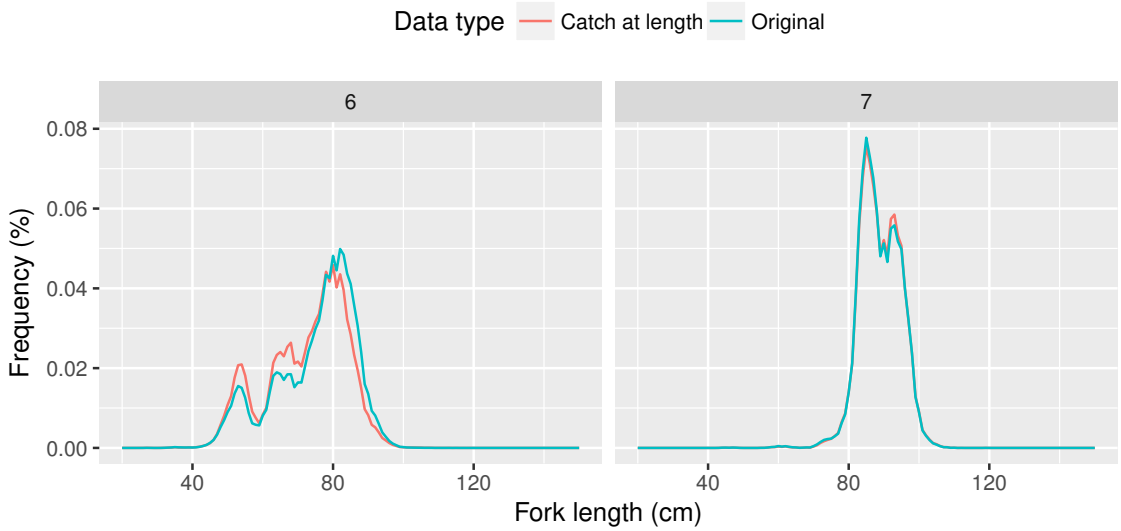

Figure 4: The comparison between estimated catch at length data and original size composition data of Japanese pole and line fishery. 6: Operation area >= 30N. 7: Operation area < 30N.

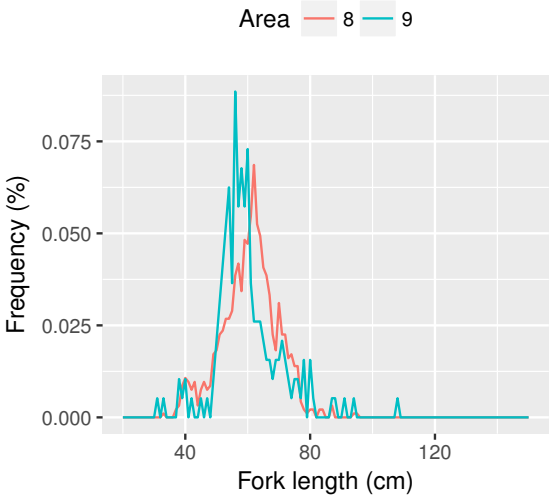

Figure 5: The original size composition data of Japanese driftnet fishery. 8: Operation area >= 30N. 9: Operation area < 30N.

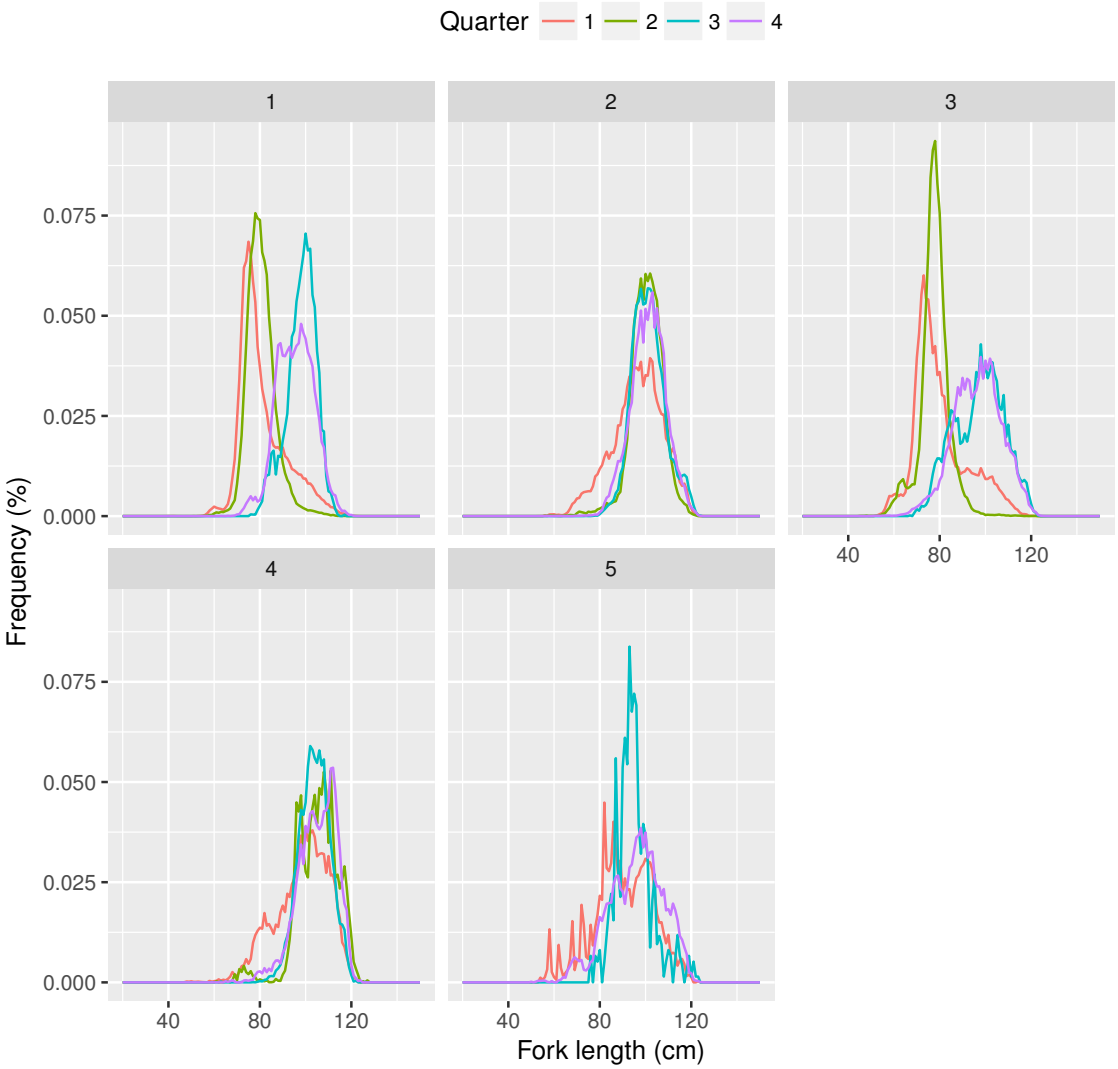

Figure 6: Seasonal difference of catch at length data (Japanese longline fishery).

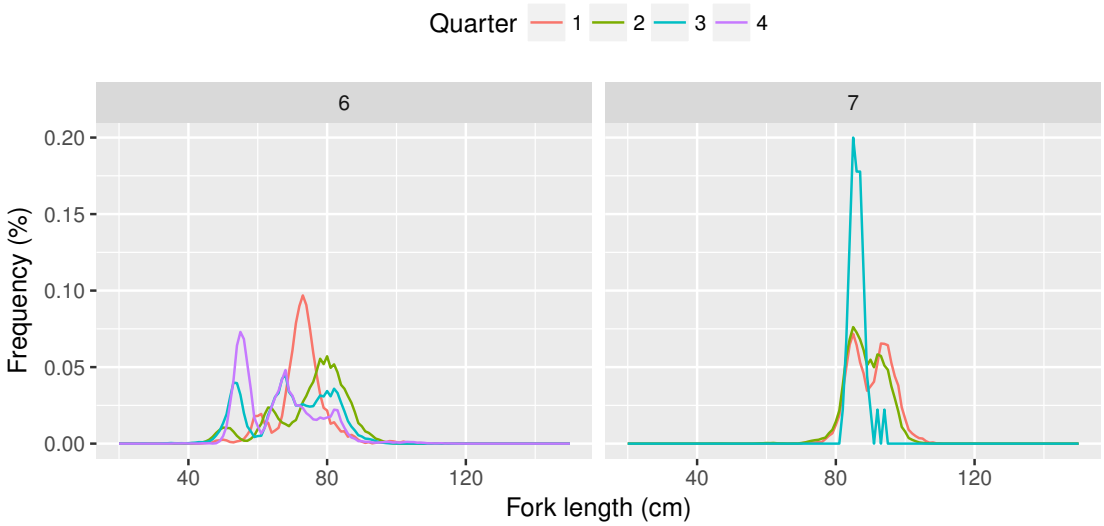

Figure 7: Seasonal difference of catch at length data (Japanese ploe and line fishery). 6: Operation area >= 30N. 7: Operation area < 30N.

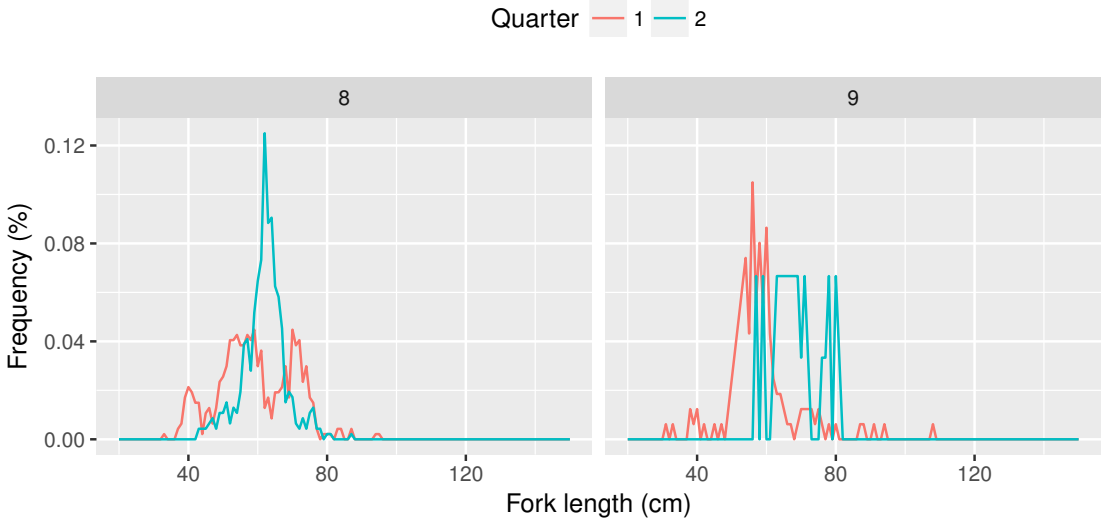

Figure 8: Seasonal difference of original size composition data (Japanese driftnet fishery). 8: Operation area >= 30N. 9: Operation area < 30N.

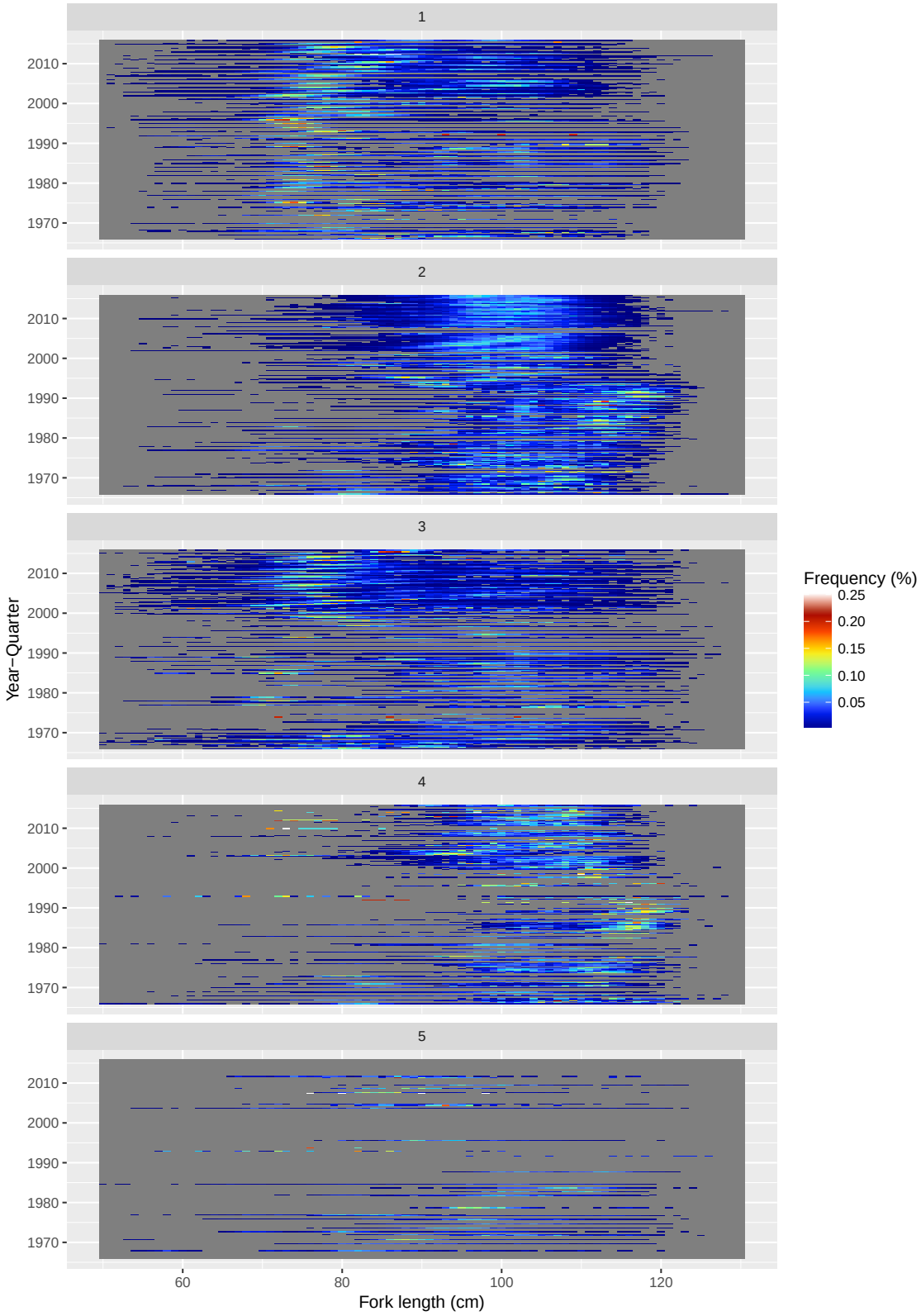

Figure 9: Historical change of catch at length data (Japanese longline fishery).

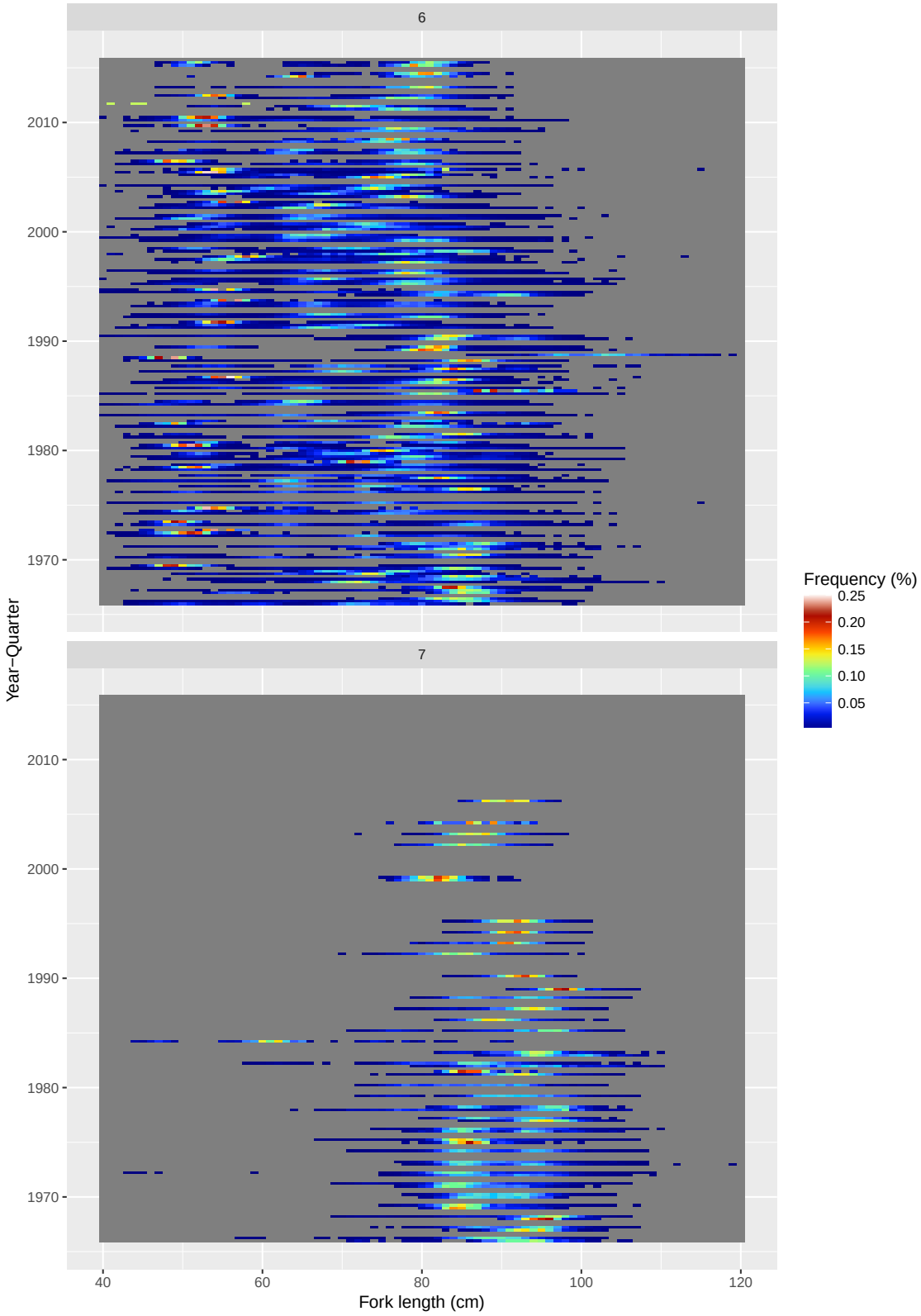

Figure 10: Historical change of catch at length data (Japanese pole and line fishery). 6: Operation area >= 30N. 7: Operation area < 30N.

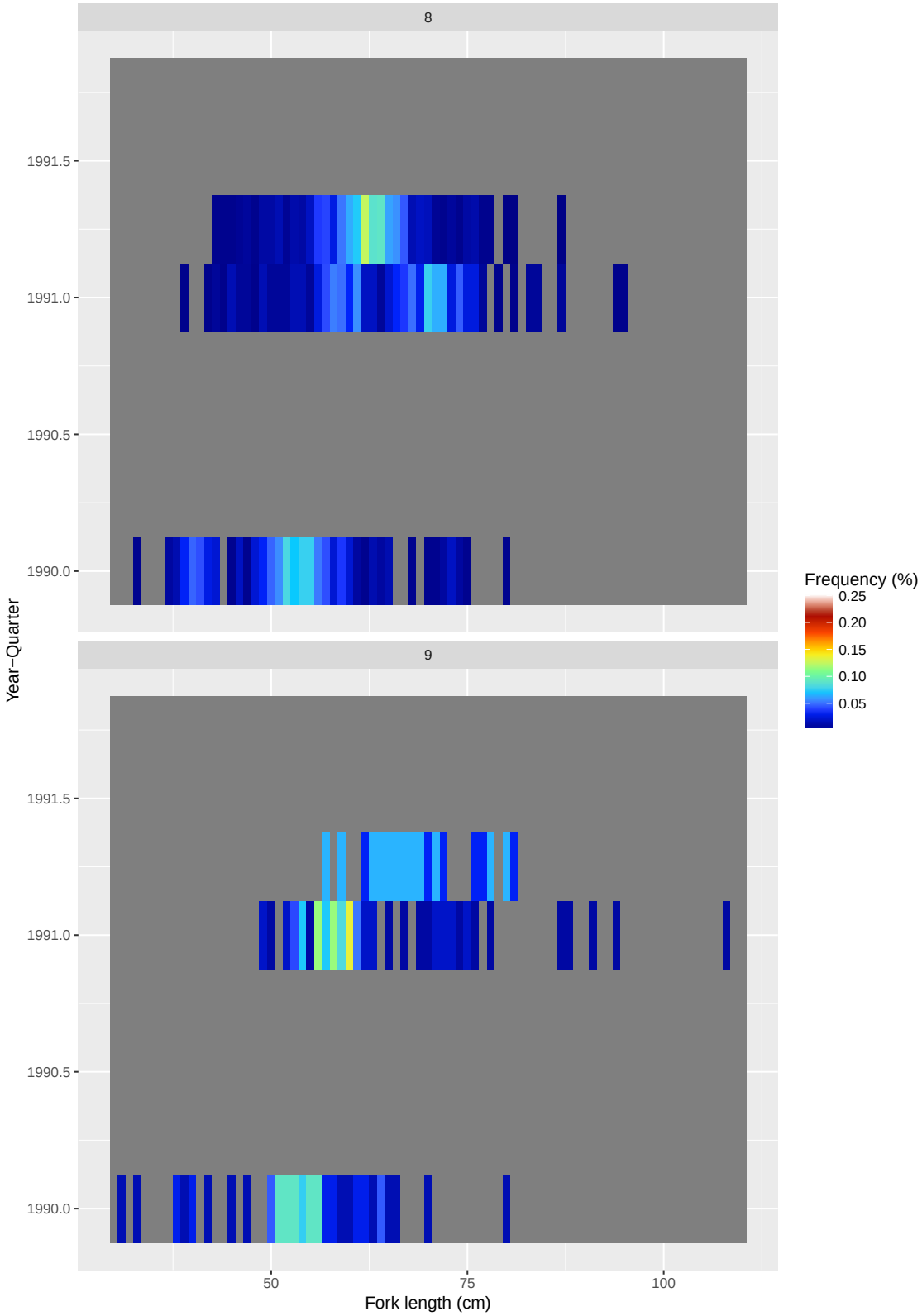

Figure 11: Historical change of original size compositiodata (Japanese driftnet fishery). 8: Operation area >= 30N. 9: Operation area < 30N.