



## North Pacific Fisheries Commission

NPFC-2022-SC07-WP11 (Rev. 1)

# Catch per unit effort calculations Japanese Sardine

*NPFC Japanese Sardine Small Working Group*

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## Objective

The objectives of this document are to

- calculate a monthly CPUE from commercial fishery catch of Japanese sardine using two methods
- calculate an annual CPUE from commercial fishery catch of Japanese sardine

## Data

Annual catch and effort statistics are provided by Members for Japanese sardine inside and outside the NPFC Convention Area. Three members (China, Japan and Russia) provide annual statistics. Annual catch is expressed in metric tons landed. Annual effort is expressed in number of days fished.

Four Members (China, Chinese Taipei, Japan and Russia) also submitted monthly catch and effort data for their fisheries. The catch from China was all taken in the convention area by either pelagic trawl or purse seine. Catches in tons are reported monthly since 2019 and effort was reported as both operational days and number of hauls or purse seine sets. The CT catch was taken in the convention area by stick-held dipnet, catches were reported since July 2020 in tons and effort was reported as both days fished and *number of hauls*. Russia reported monthly catch and effort data for both seine vessels and midwater trawl vessels since 2016. The Russian effort measures were the number of hauls or net sets for trawlers and seiners respectively. Russia also reported effort as the number of days in which fishers were active during each month (slightly different than the number of fishing days for each month, e.g. the number of days for most months was equal to the number of days in the month, rather than the sum of the number of days fished by all vessels during that month). Russia reported the amount of fishing effort and catch both inside National Waters and in the Convention Area. Japan reported monthly catch and effort data from National Waters (they had no catch in the NPFC Convention Area) since 2015. Japan's monthly catch was also in tons and effort was reported as operational fishing days (since 2015) and number of purse seine sets (in 2021).

## Analysis

### Annual index

Catch per unit of effort was calculated for each year ( $i$ ) by gear type ( $j$ ) for each Member in each using:

$$CPUE = \frac{Catch_{i,j}}{Effort_{i,j}}$$

### Monthly index

Catch per unit of effort was calculated for each month ( $m$ ) by gear type ( $j$ ) for each member using

$$CPUE = \frac{Catch_{m,j}}{Effort_{m,j}}$$

where *Effort* was either the number of operational days or the number of sets of gear type *j*.

## Results

### Annual index

The annual index of CPUE calculated from statistics reported to the NPFC has generally increased across all gear types and Members in both National Waters and the Convention area (Figure 1). Where gears and areas overlapped, such as for Japan and Russia in National Waters, the trends were similar.

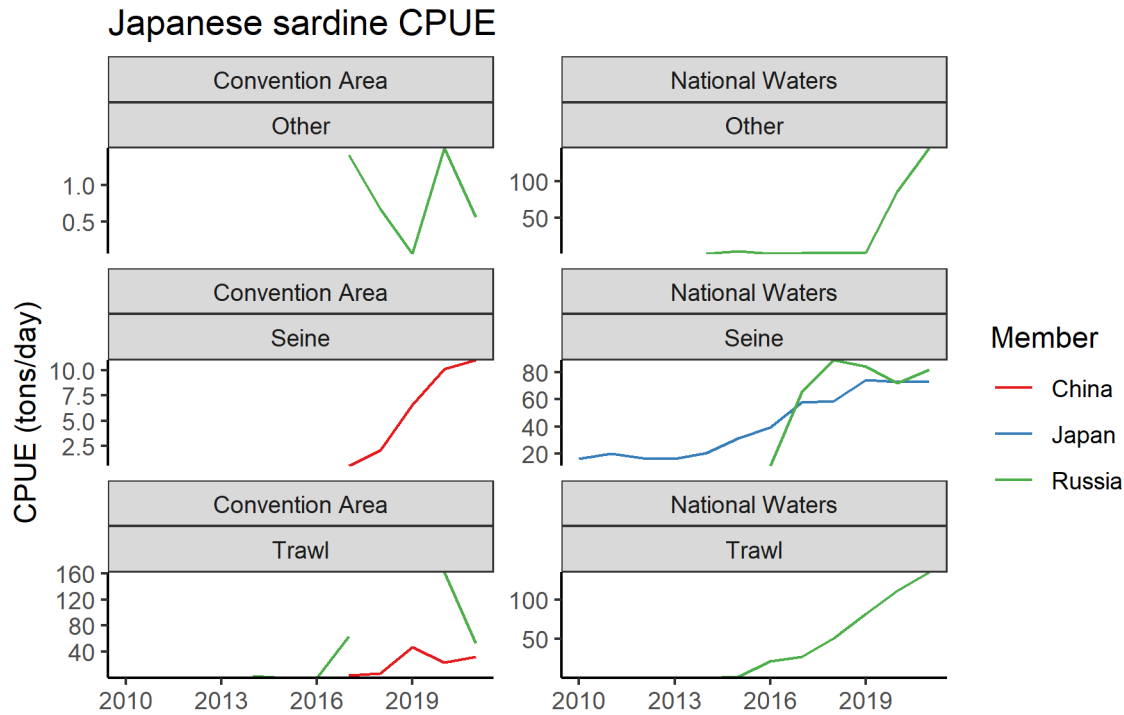


Figure 1: Catch per unit of effort for Japanese Sardine calculated annually from the total catch by gear and area and the effort by gear and area.

### Monthly index

Monthly CPUE calculated using sets as the unit of effort showed a seasonal pattern with catches increasing in the summer and through the early fall (June) and declining in late fall (November). For the limited number of years available, there were no compelling trends in CPUE, although CPUE did appear to be lower in the earlier part of the time series for Russia's trawl fleet (Figure 2).

Monthly CPUE calculated using number of operational days as the unit of effort showed an earlier increase in CPUE around April, but the same decreasing pattern in CPUE decline after November (Figure 3). The CPUE calculated using the number of days was more consistent within each year, but again there were similar patterns over years, with the early years having uniformly lower catch than the later years across each month. There is a noticeable decline in Sardine CPUE in August in Japan's catch data. Also note the differences in scale for the trawl versus seine comparisons, these are the result of the somewhat different method in which

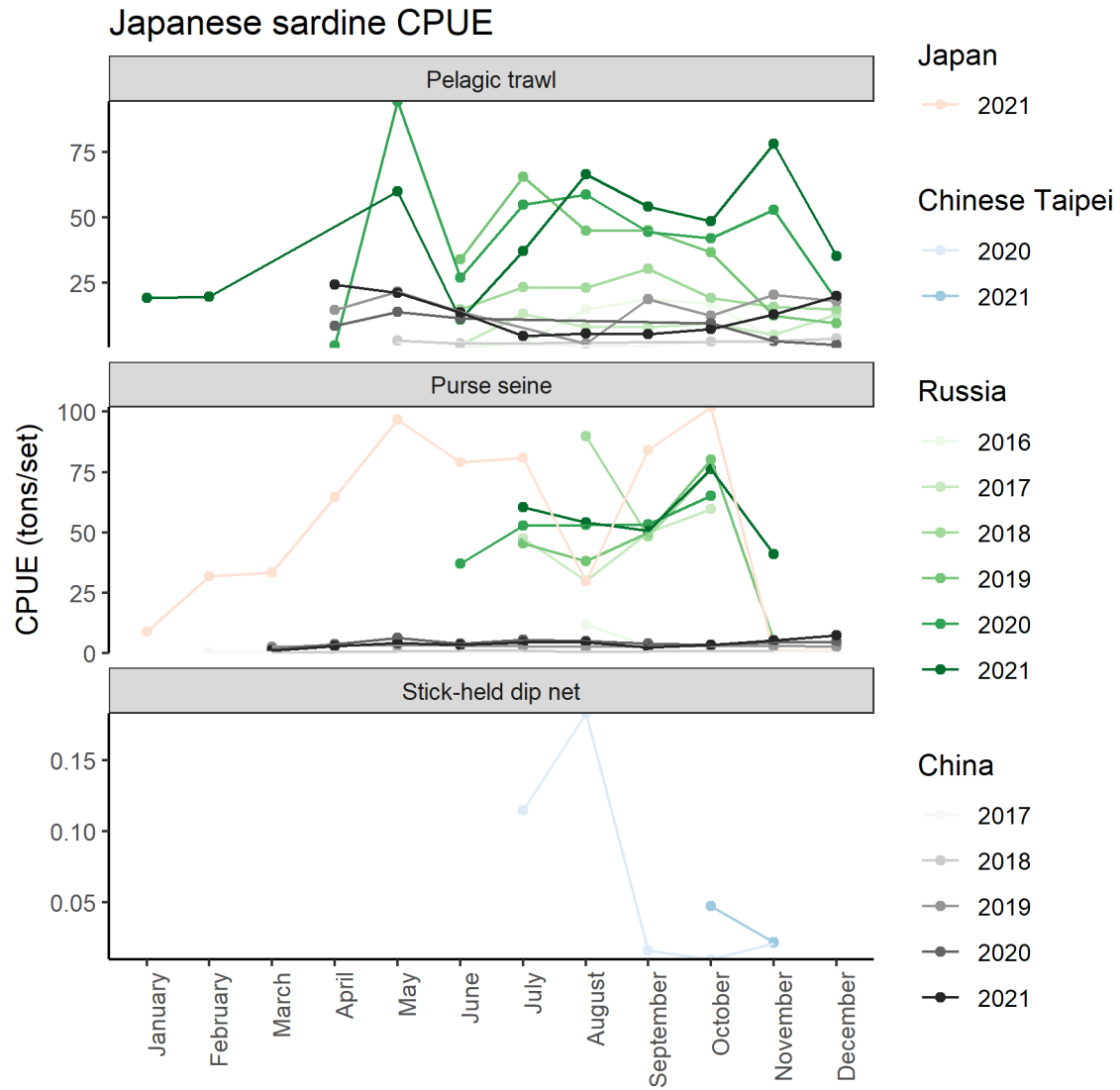


Figure 2: Catch per unit of effort for Japanese Sardine calculated monthly from the total catch by gear and area and the effort measured by the number of sets or hauls.

the three members captured days fished, as either vessel operational days or days during the month when vessels were operating.

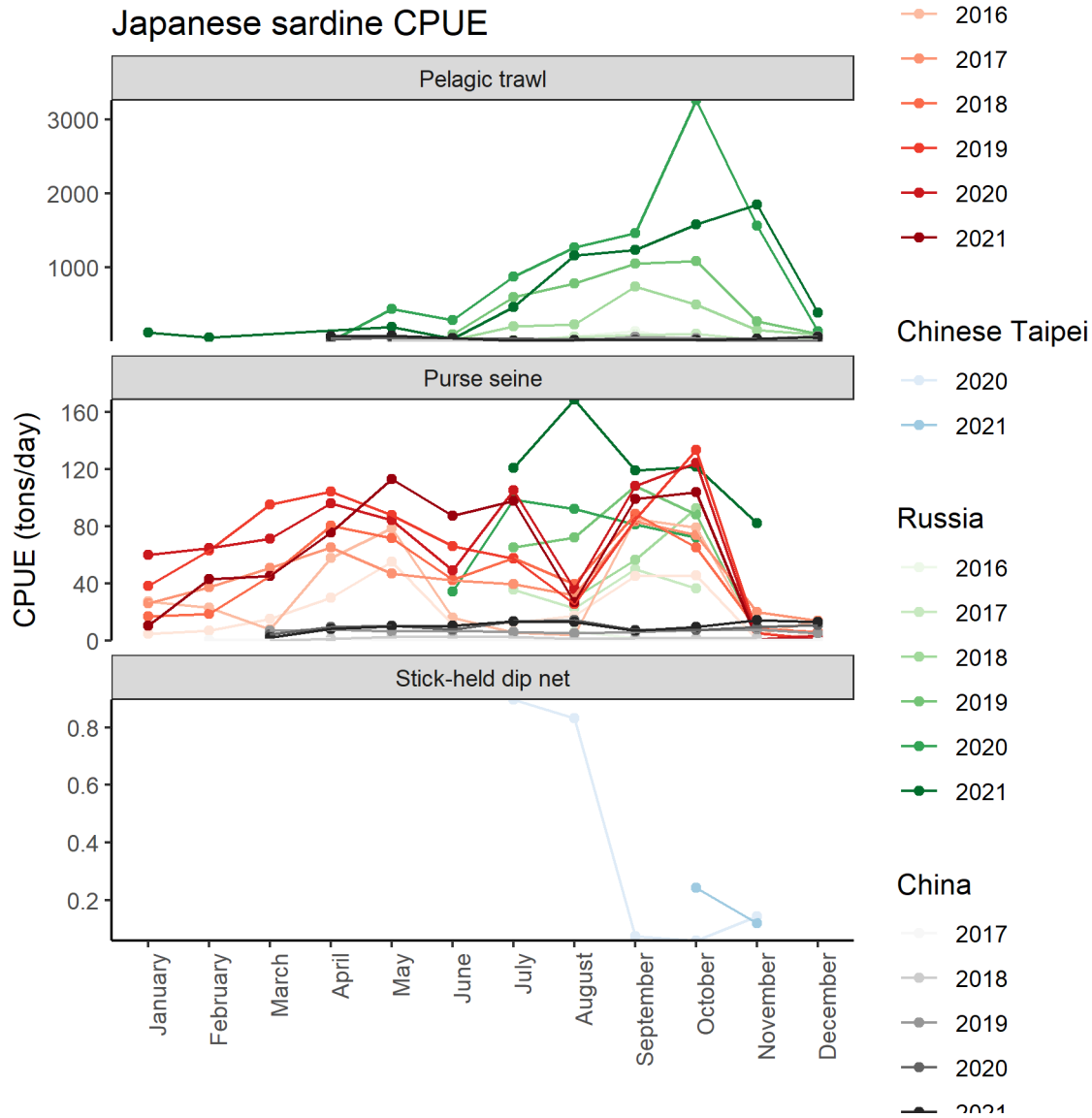


Figure 3: Catch per unit of effort for Japanese Sardine calculated monthly from the total catch by gear and area and the effort measured by the number of days.

A plot of the two methods of calculating CPUE showed that in most cases they were correlated, but perhaps biased (Figure 3). With the exception of the Pelagic trawl data, the CPUE calculated using days as the measure of effort was well correlated to the CPUE calculated using sets as the measure of effort. However, the CPUE calculated using the number of sets as the unit of effort was uniformly lower than when calculated using the number of days. In some cases, such as for Pelagic trawl, this is due to the use of days when vessels were operating, rather than operational days. In the case of Chinese Taipei's data, since Japanese Sardine is a bycatch species in the Pacific Saury fishery (this is my assumption), the CPUE's are quite low. The CPUE's measured by the different gear types did not have a similar magnitude when calculated either by day or by set.

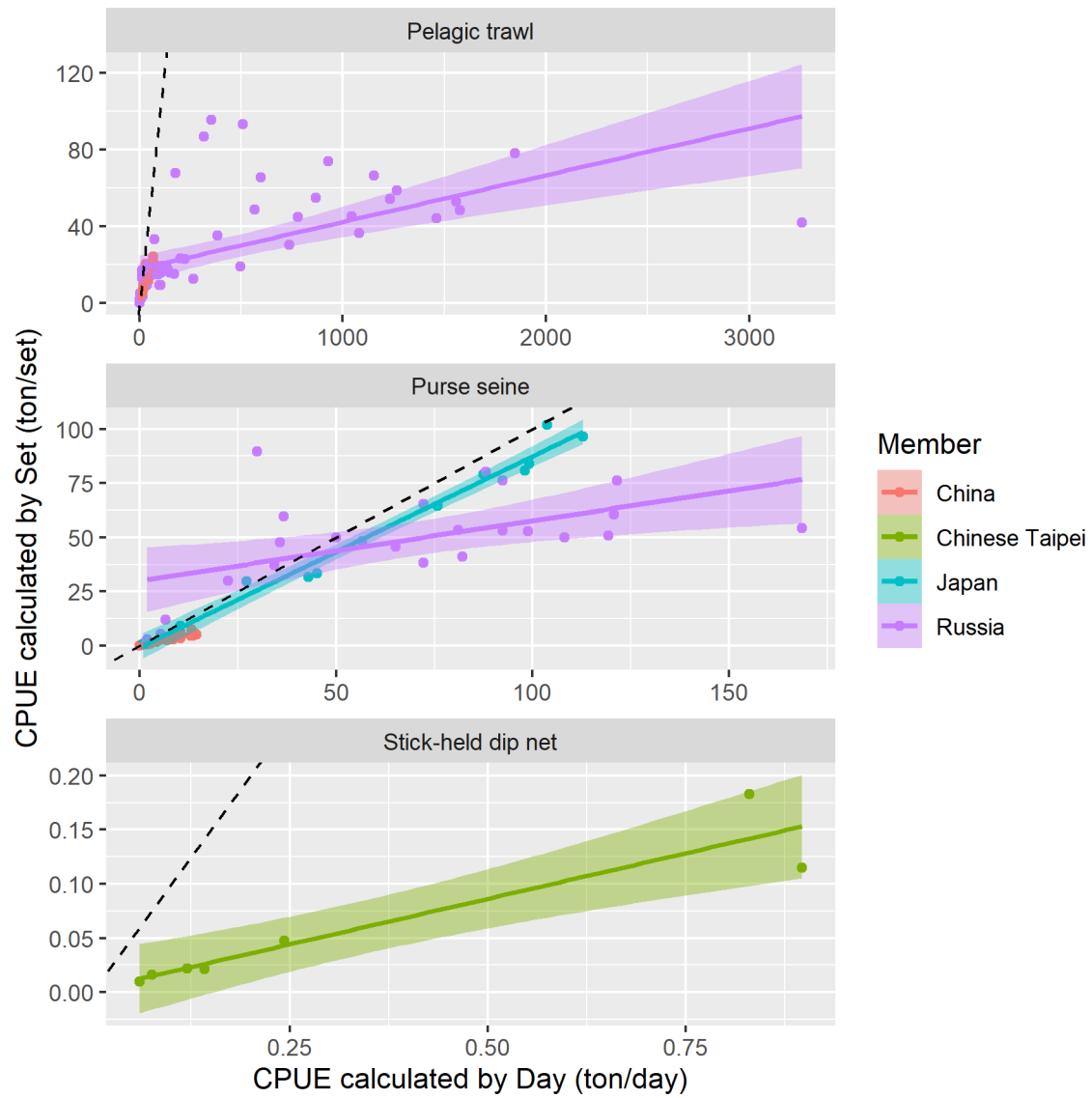


Figure 4: Comparison of the two methods for calculating CPUE using either operational days or number of sets.

## Conclusions and future directions

- Calculate CPUE for each gear type separately (and likely for each member separately)
- If possible use the number of sets rather than the number of days as the measure of fishing effort and if the number of days is used as the measure calculate this as the number of operational days
- Perhaps it is not worth calculating CPUE from the “Other” gear types, since it is difficult to derive effort in these cases.