



General overview on Japanese flying squid (JFS)

Comments from presenter

- *The stock assessment conducted to JFS is one of the traditional stock assessments of Japan, which had been started in late 1990s.*
- *It might seem to be old fashioned, for example, in terms of insufficient consideration of uncertainty in estimation of abundance.*
- *Through review made by Steve and EJ, we'll address future improvement and development of the JFS stock assessment methods.*

Contents

Question

Please provide more details on the evidence for having two main stocks (winter and autumn spawning) instead of a single stock spawning throughout the year. Also, it would be important to have evidence that the young from the winter spawners come back to spawn again in winter, and same for the autumn stock.

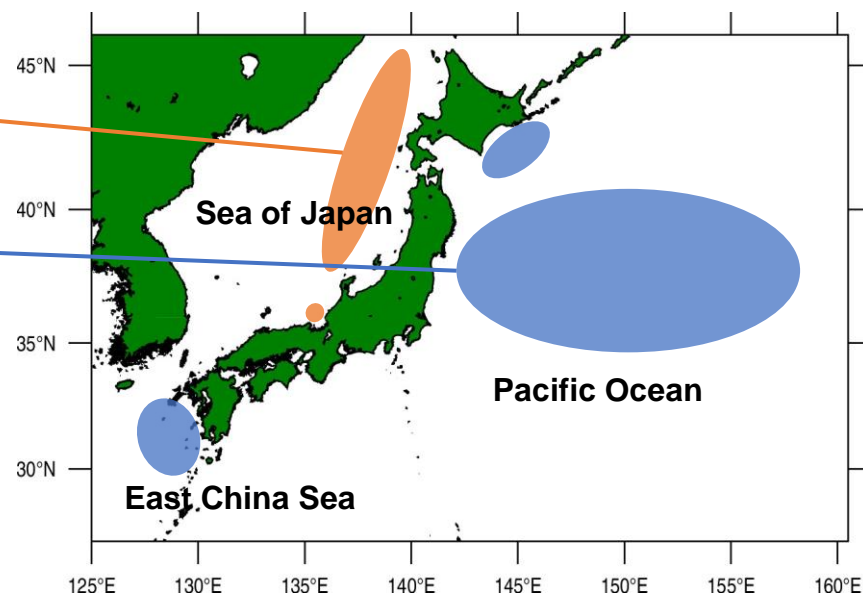
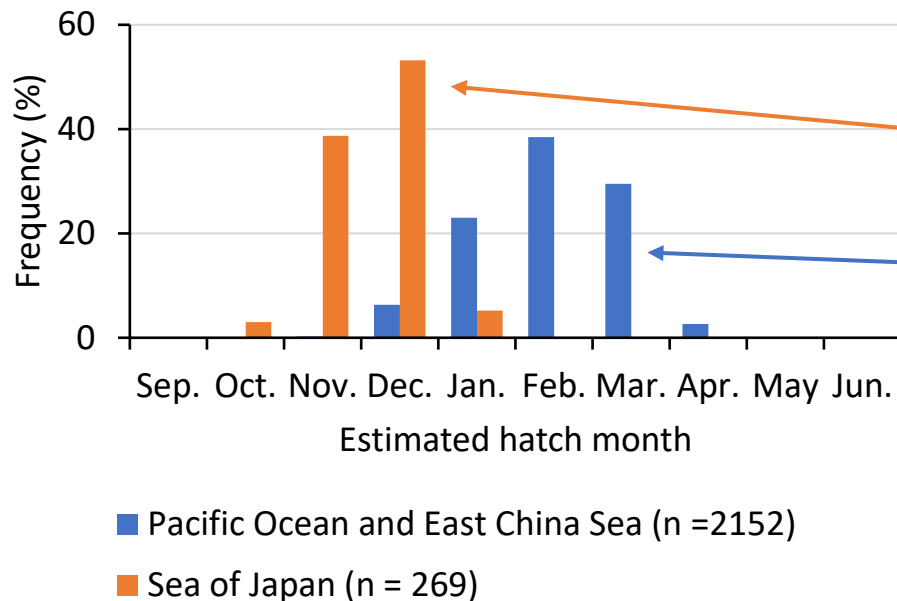
1. Spawning season
2. Distribution
3. Seasonal migration
4. Points of separation of stocks
5. How to allocate catch into two stocks

1. Spawning seasons

Apr May Jun Jul Aug Sep Oct Nov Dec Jan Feb Mar

Autumn-
spawning
stock

Winter-
spawning
stock



- Sea of Japan: squid caught between March and August 1996 (Kidokoro *et al.* 1999)
- Pacific Ocean and East China Sea: squid caught between February 2000 and January 2011 (Sugawara *et al.* 2013)

Reviewers' questions

Question

Also why is the summer stock added to the autumn stock? Any why not the spring stock?

Response

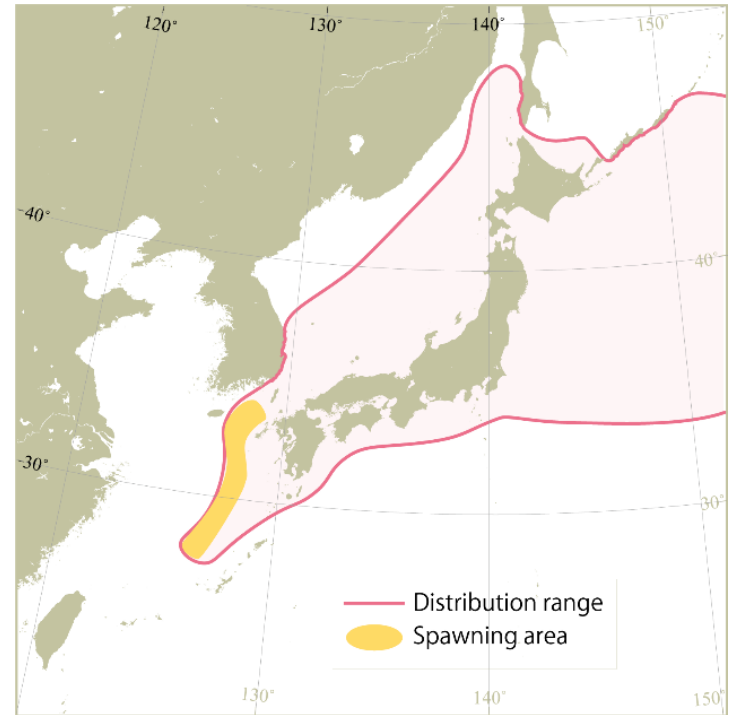
- Although spawning of JFS occurred through the year, magnitudes of spawning in autumn and winter are dominant.
- As conventional treatments, the cohorts hatched in spring and summer have been included into the winter- and autumn-spawning stocks, respectively.

2. Distribution

Autumn-spawning stock



Winter-spawning stock



Reviewers' questions

Question

Are the Japanese flying squid caught throughout the Pacific mostly from one of these two stocks (even the ones caught near the US and Canada)?



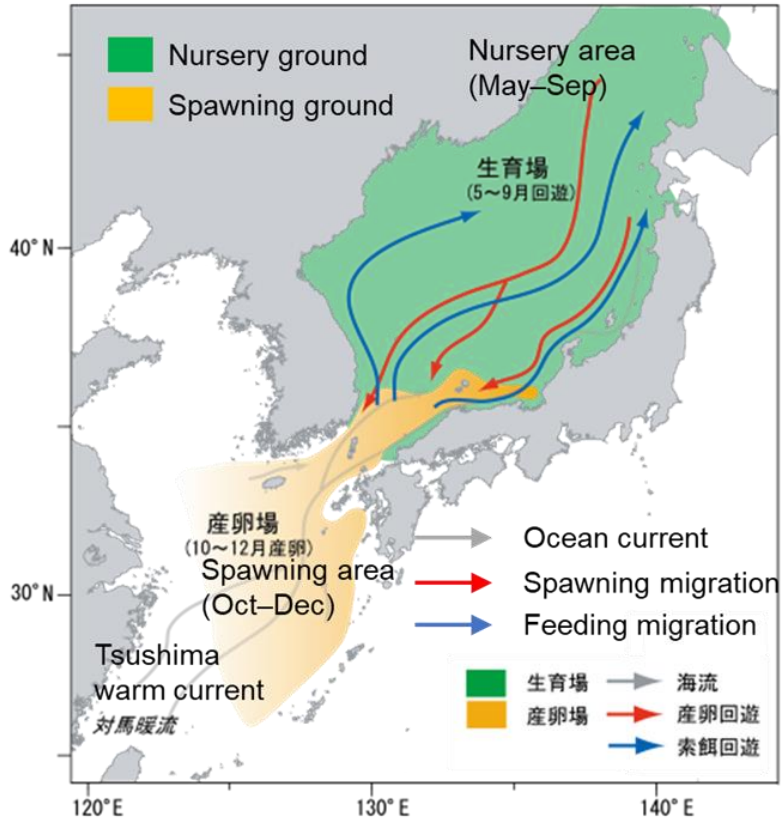
Response

- JFS are distributed dominantly in the WNPO.
- There are some records of capture of JFS in ENPO.
- Those captures highly likely to be derived from the winter-spawning stock.

3. Seasonal migration

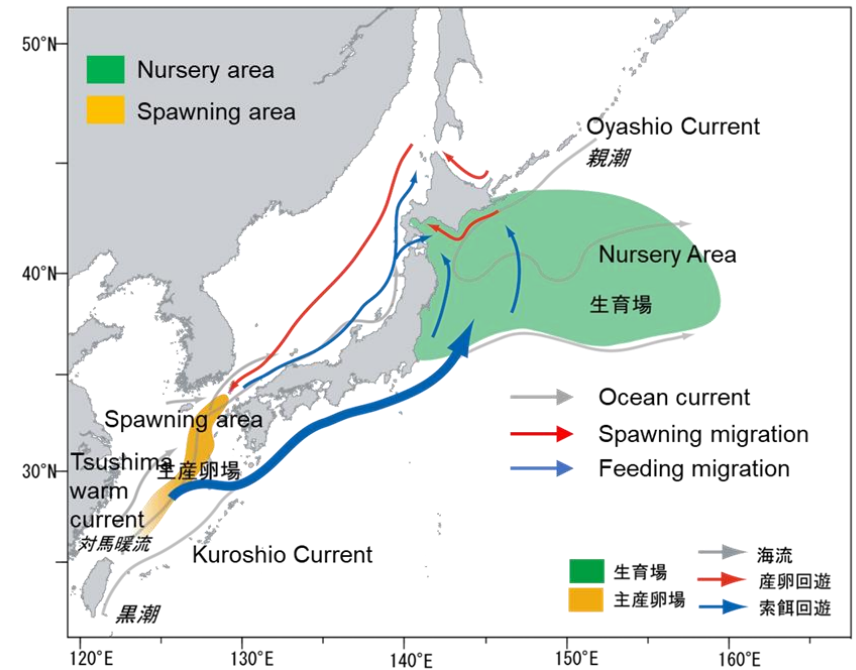
Autumn-spawning stock

スルメイカ秋季発生系群の生活史と漁場形成模式図



Winter-spawning stock

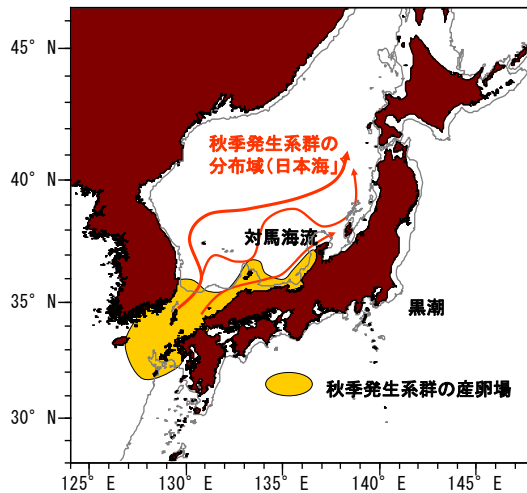
スルメイカ冬季発生系群の生活史と漁場形成模式図



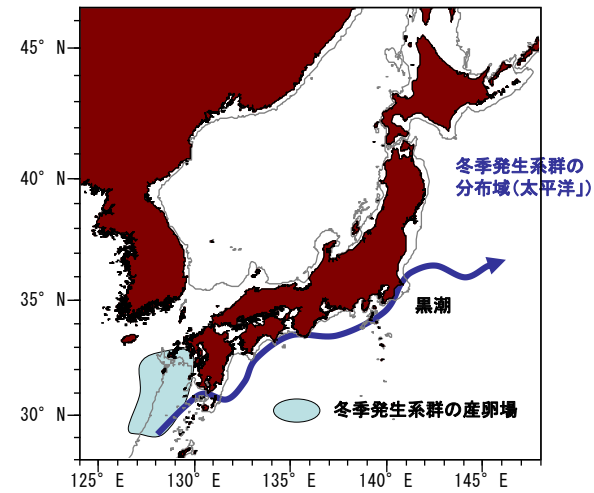
4. Points of separation of stocks

- Difference in spawning months
- Difference in spawning grounds
- Difference in distribution derived from northward migration routes

Autumn-spawning stock



Winter-spawning stock



4. Points of separation of stocks

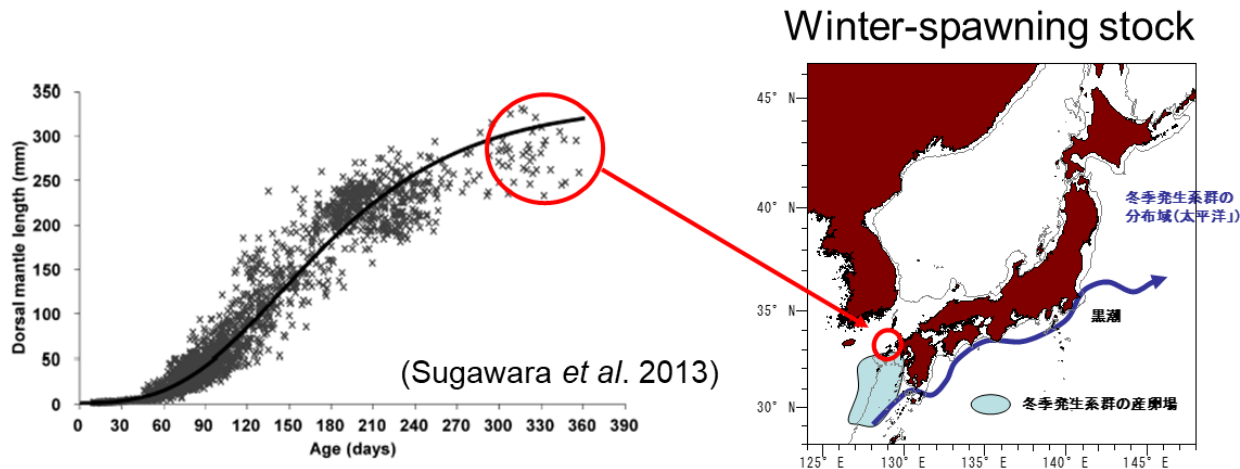
Reviewers' questions

Question

Please provide more details on the evidence for having two main stocks (winter and autumn spawning) instead of a single stock spawning throughout the year. Also, it would be important to have evidence that the young from the winter spawners come back to spawn again in winter, and same for the autumn stock.

Response

- JFS was separated into two stocks taking in consideration of differences in spawning period, spawning ground and migration routes and distributions.



Squid from the winter spawners were caught near the spawning grounds in winter.

Reviewers' questions

Question

Is it common for squid stocks to share spawning grounds but at different periods?

Response

- No information obtained.

4. How to allocate catch into two stocks

Question

How do you distinguish between the catches of the two stocks, especially in the Sea of Japan?

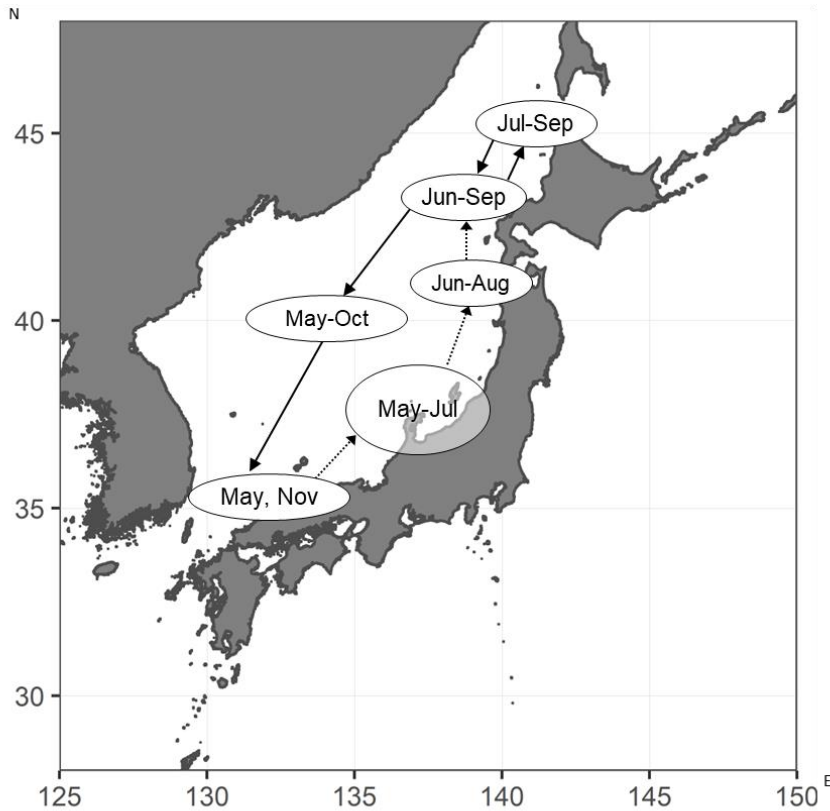
Response

- Catch compositions by stock depend on JFS migration by stock.
- Length measurement and statolith observation provided the stock-classification rules of JFS catch by fishery and by landing site.

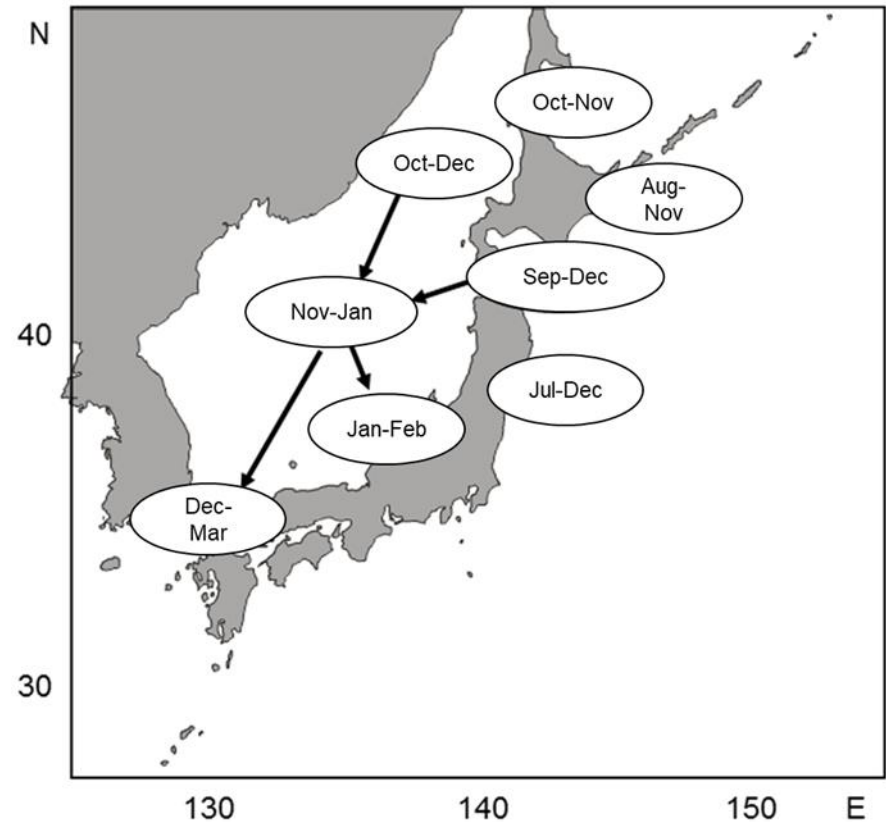
4. How to allocate catch into two stocks

Seasonal change of fishing grounds

Autumn-spawning stock

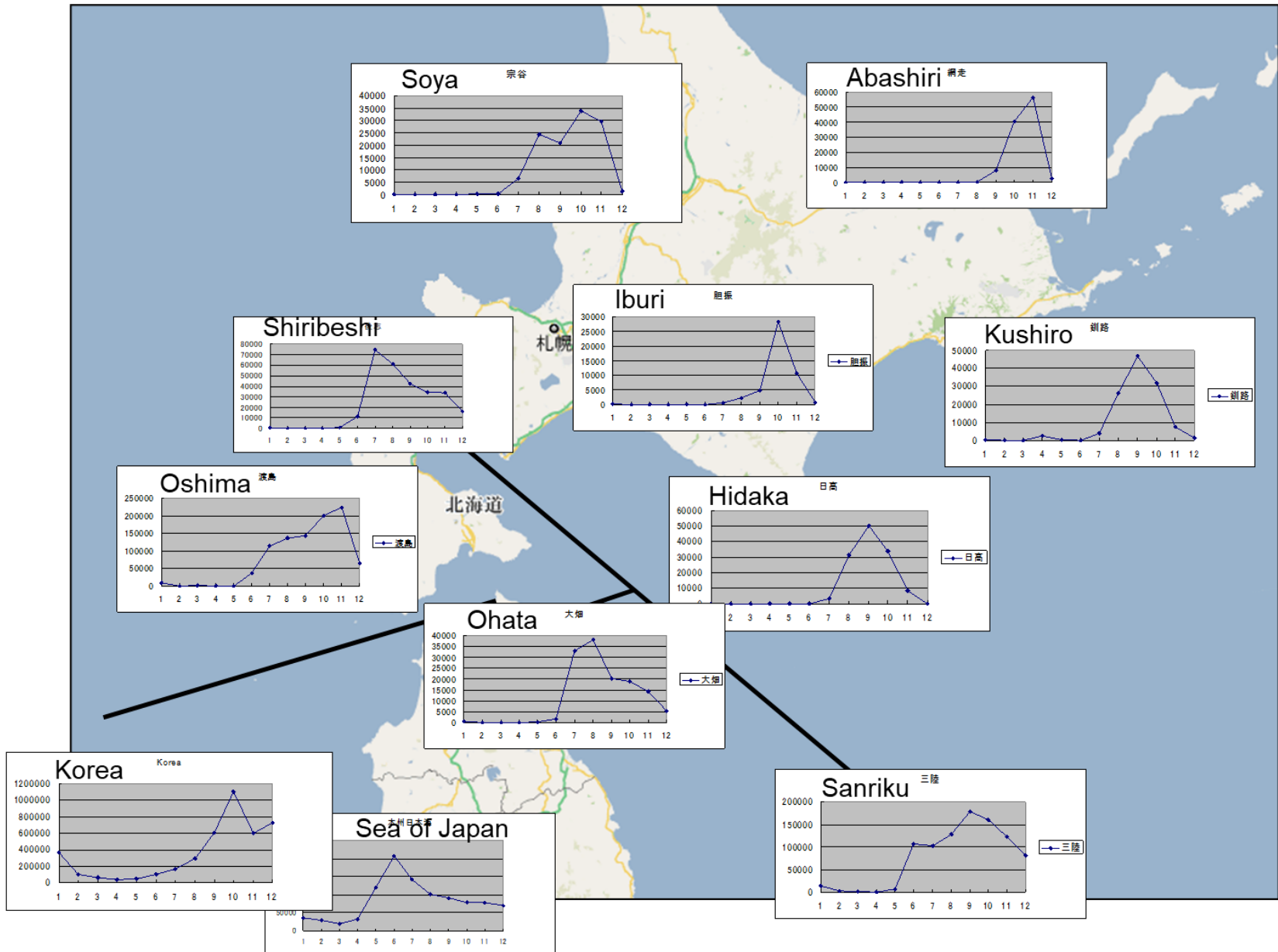


Winter-spawning stock



4. How to allocate catch into two stocks

Monthly catch by region



4. How to allocate catch into two stocks

Stock-classification table of catch

Region		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Coastal fisheries (squid-jigging, set net, etc.)													
Hokkaido	Ishikari	W	W	W	A	A	A	A	A	Mixture	W	W	W
	Shiribeshi	W	W	W	A	A	A	A	A	Mixture	W	W	W
	Hiyama	W	W	W	A	A	A	A	A	Mixture	W	W	W
	Soya	W	W	W	A	A	A	A	A	Mixture	W	W	W
	Rumoi	W	W	W	A	A	A	A	A	Mixture	W	W	W
	Oshima	W	W	W	A	A	A	A	A	Mixture	W	W	W
	Iburi	W	W	W	W	W	W	W	W	W	W	W	W
	Hidaka	W	W	W	W	W	W	W	W	W	W	W	W
	Tokachi	W	W	W	W	W	W	W	W	W	W	W	W
	Kushiro	W	W	W	W	W	W	W	W	W	W	W	W
	Nemuro	W	W	W	W	W	W	W	W	W	W	W	W
Okhotsk	W	W	W	W	W	W	W	W	W	W	W	W	
Pacific	Ohata	W	W	W	A	A	A	A	A	Mixture	W	W	W
	Pacific	W	W	W	A	A	A	Mixture	W	W	W	W	W
Sea of Japan	Main Island	W	W	W	A	A	A	A	A	A	A	Mixture	W
	Kyushu	W	W	W	A	A	A	A	A	A	A	Mixture	W
Offshore squid-jigging													
Okhotsk Sea (Pacific)		W	W	Ban	Ban	W	W	W	W	W	W	W	W
Sea of Japan		W	W	Ban	Ban	A	A	A	A	A	A	W	W
East China Sea		W	W	Ban	Ban	A	A	A	A	A	A	A	W
Korean fisheries													
Korea		W	W	W	A	A	A	A	A	A	A	Mixture	W

4. How to allocate catch into two stocks

Reviewers' question

Question

It appears that some of the catch cannot be distinguished and a 1:1 split between the 2 stocks is assumed. What is the support for this split? How much of the catch falls under this assumption?

Response

The 50:50 split assumption does not matter. The stock-classification has 240 cells over months and regions, where there are 11 cells assigned to mixture (approx. 5%). We can see many cells of mixture in September, when the monthly catch are not dominant.