North Pacific Fisheries Commission

Species summary for Japanese flying squid

Japanese Flying Squid (*Todarodes pacificus*)

Common names:

太平洋褶柔鱼 [tai ping yang zhe rou yu] (Chinese); Japanese flying squid (English); スルメイカ [surume-ika] (Japanese); 살오징어 [sal-o-jing-eo] (Korean); тихоокеанский кальмар [tihookeanskiy Kalmar] (Russian); 日本魷 [ri-ben-you] (Chinese Taipei).

Other common names: Japanese common squid, Pacific flying squid.

Management

Active NPFC Management Measures

The following NPFC conservation and management measure pertains to this species:

CMM 2024-11 For Japanese Sardine, Neon Flying Squid and Japanese Flying Squid

Available from https://www.npfc.int/active-conservation-and-management-measures.

Management Summary

The current management measure for Japanese flying squid (JFS) does not specify catch or effort limits. The CMM states that Members and Cooperating non-Contracting Parties currently harvesting JFS should refrain from expansion of the number of fishing vessels authorized to fish JFS in the Convention Area. New harvest capacity should also be avoided until as stock assessment has been completed.

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Japan has been conducted stock assessment annually for two stocks of JFS such as the autumn- and winter-spawning stocks since 1997. Japanese domestic total allowable catch (TAC) has been annually set for JFS based on acceptable biological catch (ABC) determined based on the stock assessment results.

Table 1. Management Summary

Convention/Management Principle	Status	Comment/Consideration
Biological reference point(s)	🔴	Not established for NPFC CA (Established in Japan EEZ).
Stock status	○	Status determination criteria not established for NPFC CA (Established in Japan EEZ).
Catch limit	🔴	Not established for NPFC CA (Established in Japan EEZ).
Harvest control rule	🔴	Not established for NPFC CA (Established in Japan EEZ).
Other		

🟢 OK 🟡 Intermediate 🔴 Not accomplished ○ Unknown

Stock Assessment

No stock assessment has been conducted by NPFC for the Convention Area.

Japan conducts annual stock assessments for the autumn-spawning stock and winter-spawning stock of JFS (Figure 1, Miyahara et al. 2024, Okamoto et al. 2024). The latest stock assessment for the winter-spawning stock in Japan included overseas catch from Russia, China and Korea (Fig. 1a). Estimated biomass and spawning stock biomass (SSB) have decreased drastically since 2015 (Fig. 1b). Japan uses a Beverton–Holt stock-recruitment relationship (Fig. 1c). In 2022, SSB was estimated lower than SSBmsy and F was lower than Fmsy (Fig. 1d).

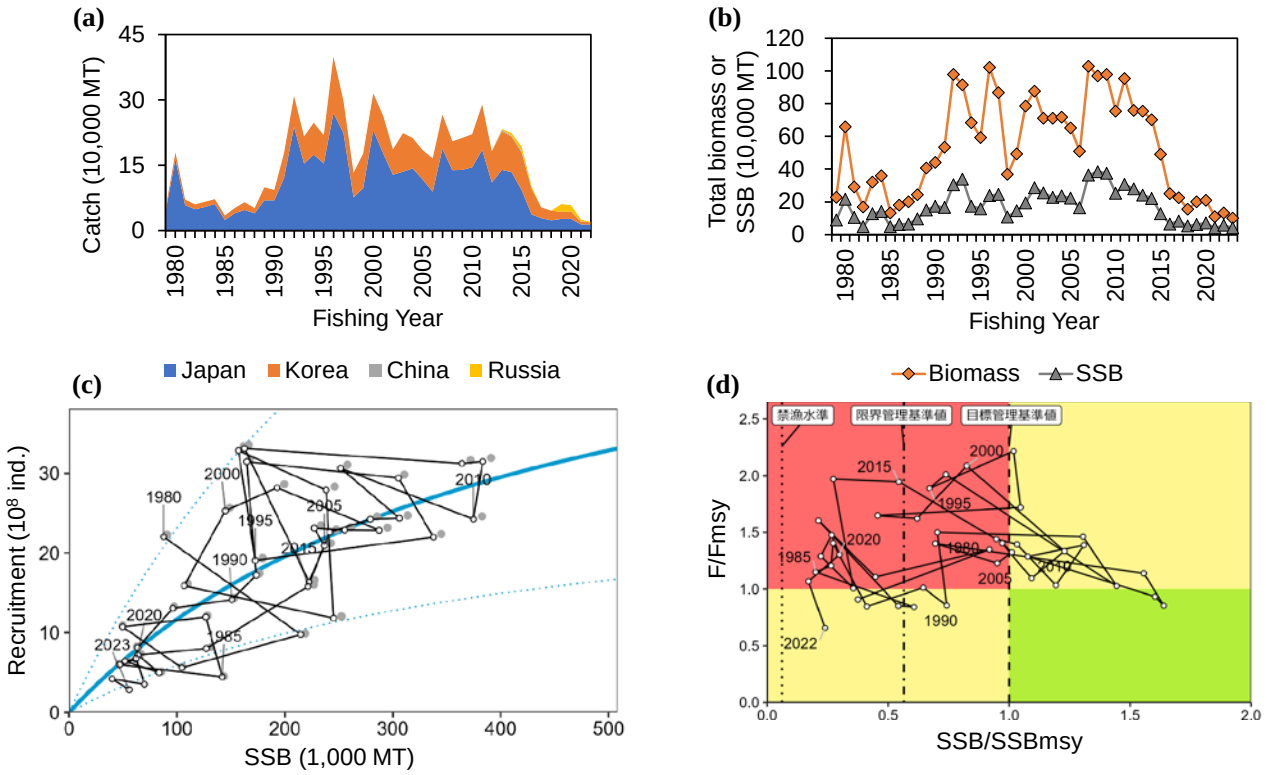

Figure 1. Summary of the stock assessment for the winter-spawning stock Japanese flying squid by Japan (Okamoto et al. 2024). (a) Time series of catch of each Member from fishing year 1979 to 2022. (b)Estimated biomass and SSB. (c) Stock-recruitment relationship. (d) Kobe plot.

Data

Survey

JFS are encountered in several surveys conducted by Japan and Russia. Japanese surveys encounter multiple life history stages of one or more seasonal stocks, including paralarvae (winter survey), recruits (May-June), and adults (July-September). Russia conducts a survey of JFS during their feeding migration into Krill Islands waters, this results in number and biomass estimated by area swept method for Krill Islands waters (annual, for winter stock only). While this survey captures only a portion of the stock so not fully representing stock biomass, it may help identify environmental impact on migration patterns, timing, etc.

Fishery

The winter-spawning stock of JFS is harvested in the NPFC Convention Area (see Biological Information).

JFS are caught by Members in both the Convention Area and National Waters. Catch tables are available at the NPFC website (https://www.npfc.int/system/files/2023-04/NPFC-2023-AR-Annual%20Summary%20Footprint%20-%20Squids%20%28Rev.%201%29_0.xlsx). Catches of JFS in the Convention Area are low, less than 3% of total catches in each year, as the majority of

catches comes from Japanese and Russian national waters (Fig. 2). JFS are caught using a variety of gears, most commonly squid jigging and trawl, but purse seine and set net are also used. They are predominantly caught as a targeted species, not as bycatch in other fisheries. However, in some seasons, they can be caught as bycatch in the Japanese sardine fishery. Chinese fishing fleets do not target JFS but encounter them in low quantities as bycatch in other fisheries.

There is no fishery CPUE index developed for this species in the Convention Area. Japan has already developed fishery-dependent abundance indices of the winter spawning stock of JFS to use in the domestic stock assessment (Okamoto et al. 2016, 2024).

Age data are collected by port samplers from a subset of Japanese fishing ports and for several Japanese prefectural research bodies. The squid's statolith is used for counting daily ages and estimating hatching dates (Nakamura and Sakurai 1991).

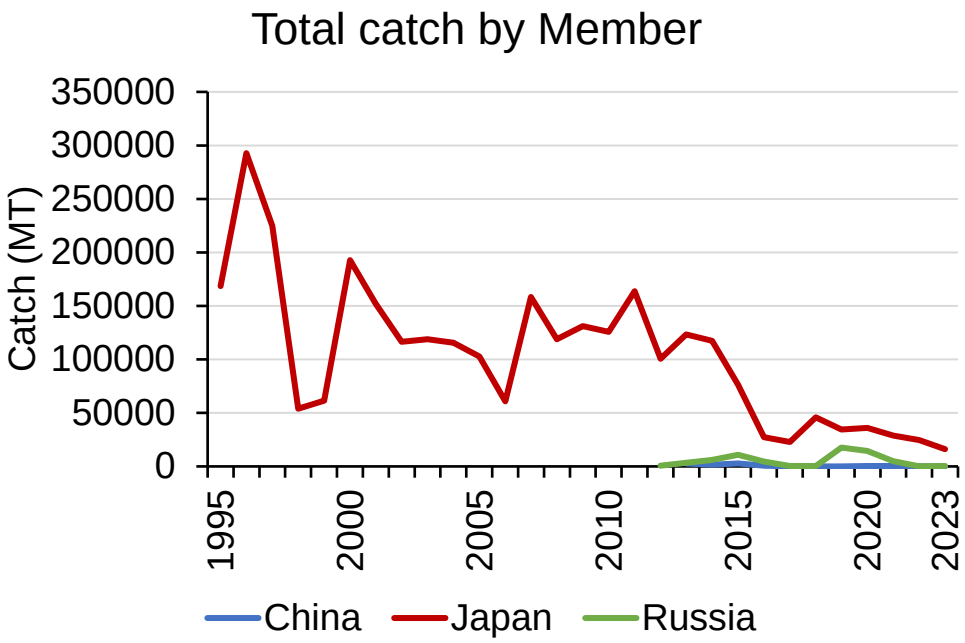

Figure 2. Total catch (MT) for each Member reporting Japanese flying squid catches during 1995-present.

Data table

Table 2. Data availability from Members regarding Japanese flying squid

Japanese flying squid: China*, Japan, Russia.

* No fishery targets Japanese flying squid. No relevant data.

Category and data sources	Description	Years with available data	Average sample size/ year or data	Potential issues to be reviewed

			coverage	
JAPAN				
Catch statistics				
Coastal jigging fishery	Official statistics; Reports from fisheries associations and markets	1979-2023 (only after 1995 at some ports)	Coverage = 100%	
Offshore jigging fishery	Logbook	1979-2023	Coverage = 100%	
Trawl fishery	Logbook	1980-2023	Coverage = 100%	
Purse seine fishery	Official statistics; Reports from fisheries associations and markets (only at Hachinohe and Mie);	1995-2023	Coverage = 100%	
Set net	Official statistics; Reports from fisheries association	1995-2023	Coverage = 100%	
Size composition data				
Length measurements	Port sampling by eight local fisheries research bodies at major ports on the Pacific side	1979-2023	3000-15000 fish/year (about 50 individuals measured per a single size sampling)	Data coverage in the eastern Hokkaido (Nemuro Strait)
Aging	Port sampling by three local fisheries associations and nine fisheries research bodies	2012-2023	500-1200 fish/year	Data coverage in the eastern Hokkaido (Nemuro Strait)
Abundance indices (survey)				

Winter survey for larvae	BONGO net	2001-2023	65-204 stations/year	Review survey protocol and conduct standardization
Survey for recruitment from May to June	Midwater trawl	1996-2023	24-63 stations/year	Review survey protocol and conduct standardization
Survey for recruitment in June	Jigging	1972-2023	25-83 stations/year	Review survey protocol and conduct standardization
Survey for recruitment from June to July	Midwater trawl mainly targeting saury	2001-2023	33-136 stations/year	Review survey protocol and conduct standardization
Survey for recruitment in July	Midwater trawl	2019-2023	20-40 stations/year	Short time series (five years) and ended in 2023
Survey for recruitment in August	Jigging	1979-2023	28-66 stations/year	Review survey protocol and conduct standardization
Abundance indices (commercial)				
Coastal jigging fishery	Monthly catch and effort data reported by fisheries associations and markets in the seven major regions during fishing season from July to December; Standardized CPUE for domestic stock assessment	1979-2023	25-37 observations/year	

Category and data sources	Description	Years with available data	Average sample size/year or data coverage	Potential issues to be reviewed
RUSSIA				
Catch statistics				
Jigging fishery	Official statistics, reports from fisheries associations	Official statistics: 1964-1970, 2013-2023, 1971-2012 (no data available); publications: 1967-2018	Coverage 1964-1970 ?%; Coverage 2013-2023 =100%	Data coverage details to be reviewed
Midwater trawl fishery				
Size composition data				
Length measurements	Sampling from commercial fishing vessels. Sampling during research surveys.	1966-1975 1992-2023	500-3,000 squids /year (ca. 50 measurements per sampling)	Data coverage details to be reviewed
Aging	-	-	-	-
Abundance indices (survey)				
Summer trawl and acoustic (echo integration) surveys to assess pelagic squids abundance	Mid-water upper epipelagic surveys	1992-2023 (June-July) 1992-2023 (July-August)	60-80 stations/year 60-80 stations/year	Changes in abundance and migration patterns; development survey protocol and conduct standardization

Biological Information

Distribution and migration

JFS are distributed mainly in the northwest Pacific (Figs 3 and 4) and their northward/southward shifts in distribution range occur in response to changes in water temperature (Murata 1990, Sakurai et al. 2013). JFS extent their distribution up to 50° N in September. There are northmost (eastmost) and southmost occurrences recorded in Canada and Hong Kong, respectively (Jereb and Roper 2010,

Okutani 2015).

The autumn- and winter-spawning stocks have spatially different nursery areas and migration patterns (Fig. 4). The winter-spawning stock has the nursery area east of Hokkaido and Tohoku regions of Japan, of which a part overlaps the NPFC Convention Area. Both stocks conduct southward migration towards each spawning ground. The main spawning grounds of the autumn-spawning stock are off the northwestern Honshu Island to north of the East China Sea (Fig. 3, Goto 2002, Yamamoto et al. 2002), while those of the winter-spawning stock are in the East China Sea (Okutani and Watanabe 1983, Bower et al. 1999).

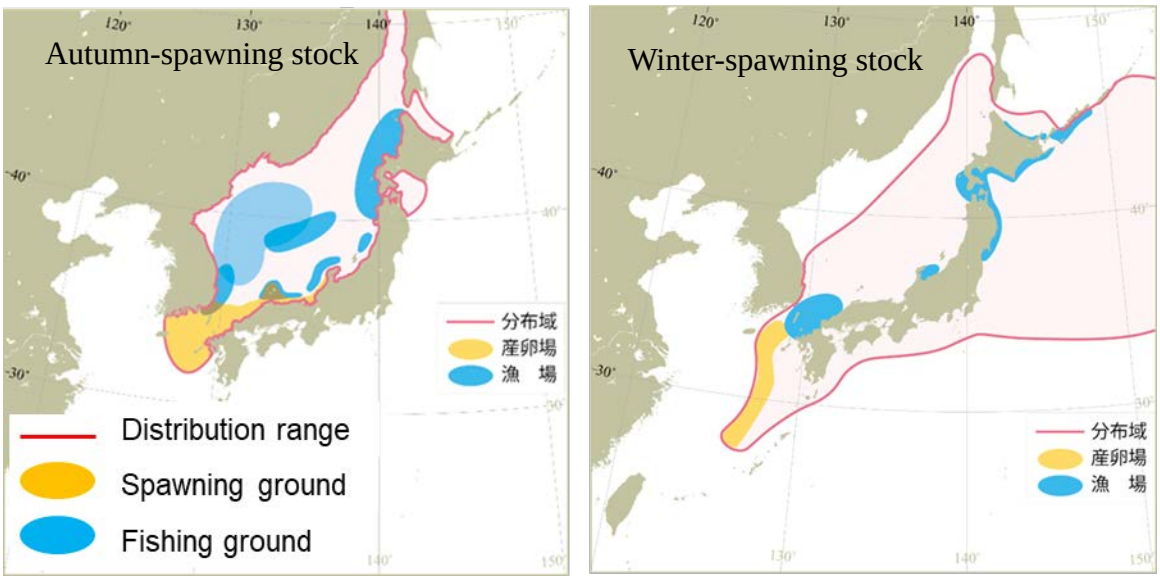

Figure 3. Distribution ranges, spawning grounds, and fishing grounds of the autumn- and winter-spawning stocks. These figures were modified based on Miyahara et al. (2024) and Okamoto et al. (2024).

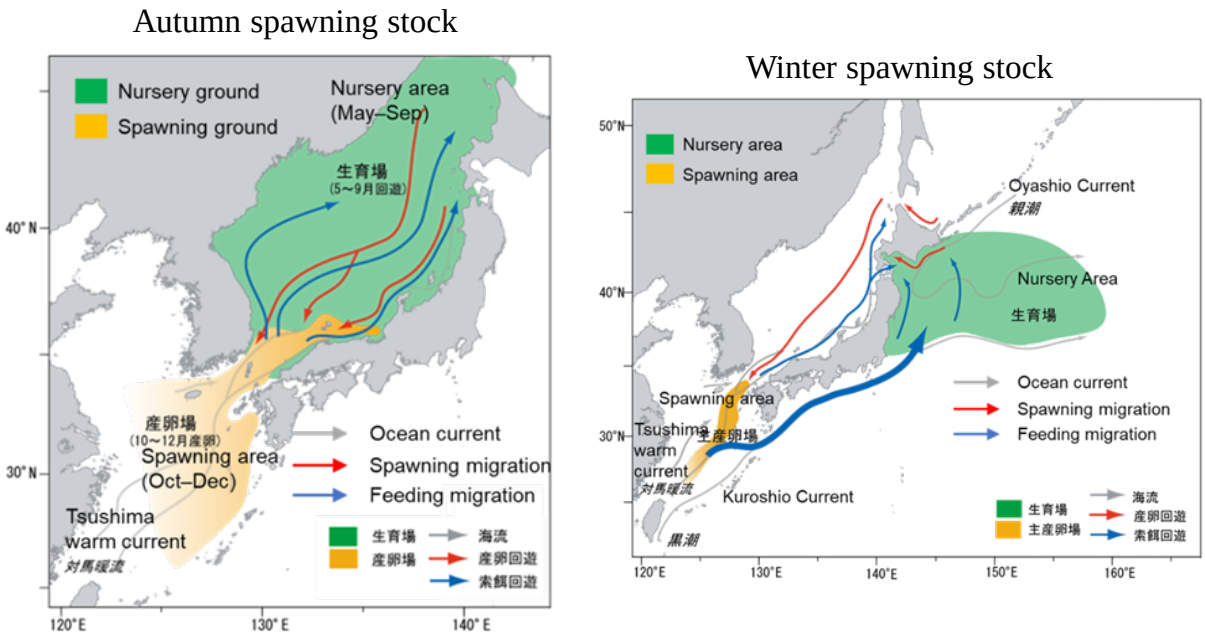

Figure 4. Seasonal migration of the autumn- and winter-spawning stocks. These figures were modified based on Miyahara et al. (2024) and Okamoto et al. (2024).

Stock Structure

There are distinct sub-populations (stocks) which spawn during different seasons (Murata 1990, Sakurai et al. 2013). The autumn-spawning stock is most abundance, followed by the winter-spawning stock which is distributed in the waters off eastern Japan Oyashio region (Sakurai et al. 2013, Miyahara et al. 2024, Okamoto et al. 2024). There is, in addition, minor stock of spring/summer spawned squid.

Life history

Maximum size thought to be 50 cm (mantle length) for females, smaller for males (Jereb and Roper 2010), but both are generally less than 30 cm (Murata 1990, Sakurai et al. 2013). Females are thought to mature around 20-25 cm (mantle length). The JFS lifespan is approximately one year (Murata 1990, Sugawara et al. 2013). Mature female JFS spawns a large egg mass at a time which contains up to 200,000 eggs and is considered to float above the thermocline (Bower et al. 1996, Sakurai et al. 2000, Puneeta et al. 2015). After the paralarvae hatches from the egg, they will swim to the sea surface and are transported to their nursery areas by ocean currents (Fig. 4, Kon et al. 2006, Sakurai et al. 2013). JFS prey on myctophids, anchovies, crustaceans, gastropod larvae, and chaetognaths, and are preyed upon by rays and several marine mammals (Jereb and Roper 2010, Uchikawa and Kidokoro 2013).

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