





**Northern shortfin squid in Subareas 3+4****Advice in September 2022 for 2023 - 2025****Recommendation for 2023 – 2025**

Although the primary stock indices for Div. 4VWX were not available during 2021 and 2022, the 2022 biomass indices for both Divs. 3NO and Div. 3M EU summer surveys were near the lowest levels of their respective time series, suggesting that the stock has returned to a low productivity state.

SC advises catches between 19 000 and 34 000 tonnes per year (two proxies for  $F_{lim}$ , the potential yield which the northern stock component may be able to sustain under a low productivity regime).

**Management objectives**

No explicit management plan or management objectives have been defined by the Commission. Convention General Principles are applied.

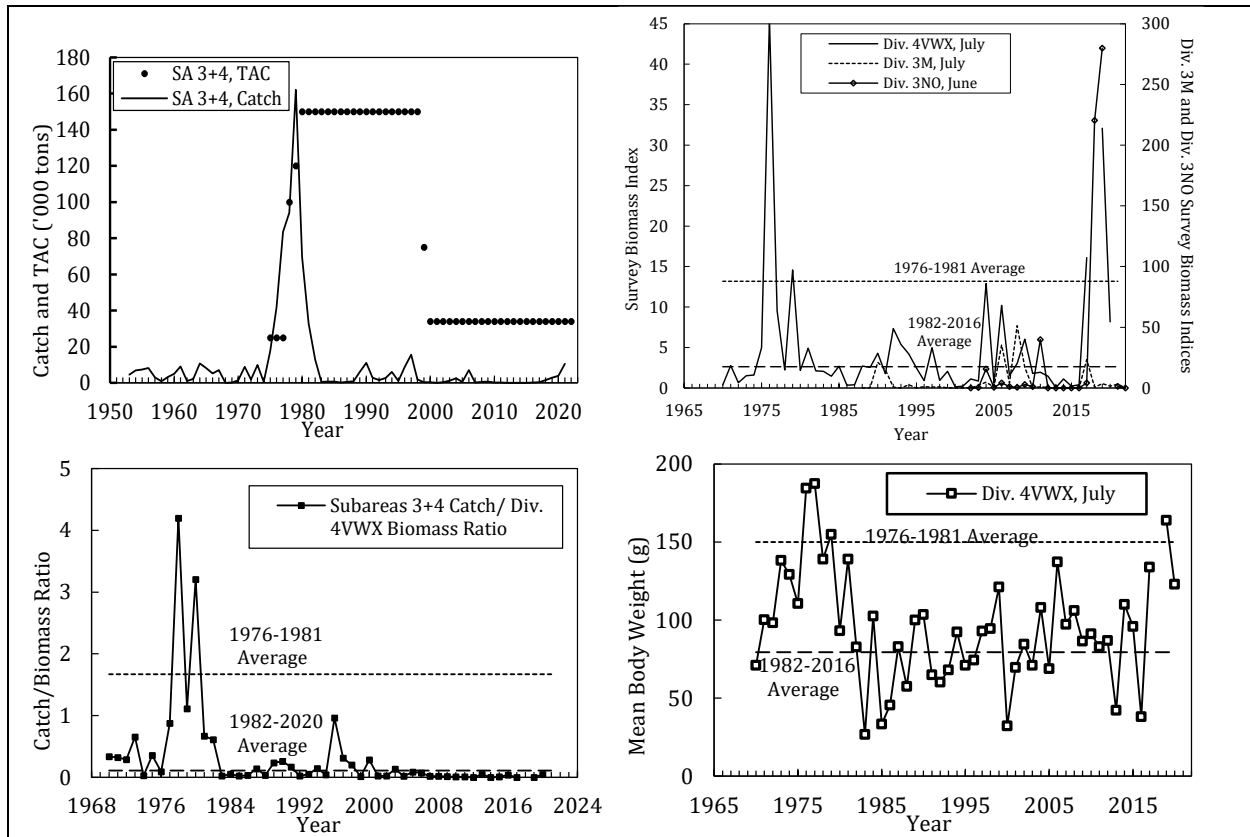
<i>Convention General Principles</i>	<i>Status</i>	<i>Comment/consideration</i>	
Restore to or maintain at $B_{msy}$	<input type="radio"/>	$B_{msy}$ inappropriate given life history	 OK
Eliminate overfishing	<input type="radio"/>	Not quantifiable	 Intermediate
Apply Precautionary Approach	<input type="radio"/>	Reference points based on productivity level	 Not accomplished
Minimize harmful impacts on living marine resources and ecosystems	<input checked="" type="radio"/>	VME closures in effect, no specific measures	 Unknown
Preserve marine biological biodiversity	<input type="radio"/>	Cannot be evaluated	

**Management unit**

The species is assumed to constitute a single stock throughout its range in the Northwest Atlantic Ocean, from Newfoundland and Labrador to Florida, including Subareas 2-6, but is managed separately as northern (Subareas 3+4, by NAFO and by Canada and France, in respect of St. Pierre and Miquelon, within their respective EEZs) and southern stock components (Subareas 5+6, by USA within its EEZ). However, fishery removals in relation to the biomass levels of each stock component affect one another.

**Stock status**

Both biomass and mean body weight indices for Div. 4VWX were well above the high productivity mean during 2019 and near it in 2020, indicating that the stock was in a high productivity state at that time, but these indices were not available during 2021 and 2022. Without these indices for 2021 and 2022, stock status is unknown for the Subareas 3+4 stock component. However, the 2022 biomass indices for both Div. 3NO and Div. 3M EU summer surveys were near the lowest levels of their respective time series, suggesting that the stock has returned to a low productivity state. While there is no relative fishing mortality index for 2021, catches in Subareas 3+4, primarily from the Newfoundland and Labrador squid fisheries in Canadian waters, increased by more than ten-fold between 2018 and 2021.



### Reference points

Conventional reference points are inappropriate for squid stocks because of their unique life history. Two reference states, termed “high productivity” or “low productivity” states are defined by trends in the Div. 4VWX biomass indices and mean body weight. Low productivity periods have an estimated potential annual yield of 19 000 t to 34 000 t. The potential yields for a high productivity state have not been determined.

### Projections

Projections were not possible because, like most squid stocks, recruitment is highly variable and cannot currently be predicted.

### Assessment

No analytical assessment was performed. The Canadian 4VWX survey is considered the primary indicator of the productivity state for this stock component due to its spatial and temporal coverage. One-year stock size forecasts are not currently possible for this subannual species, nor are in-season assessments possible due to data availability issues. As a result, since 2000, the TAC for the northern stock component has been set at 34 000 t, the upper limit of the expected yield during years of low productivity (SCR Doc. 98/75). This TAC was unrestrictive during 2000-2021, but is the only method currently available for fishers to be able to take advantage of sudden interannual increases in stock size.

Due to the short lifespan of this species (less than one year), it is recommended that in-year catch and survey indices and length data, in particular for the Divs. 4VWX July survey, are made available to be used in the stock assessment and monitoring as early as possible prior to the September NAFO Annual Meetings.

The next assessment is scheduled for September of 2025.

### Human impacts

Mainly fishery-related mortality has been documented. Other sources (e.g. pollution, shipping, oil-industry) are undocumented.

### *Biology and Environmental Interactions*

Recruitment for this species is highly variable, and the species is semelparous. A sufficient number of spawners must survive the fishery (spawner escapement) each year in order to ensure a high probability of successful recruitment during the subsequent year, to reduce the risk of stock collapse.

Ocean climate effects have a strong influence on the distribution, growth rates, and recruitment of Northern shortfin squid. The Grand Bank (3LNO) EPU continues to experience low overall productivity conditions, and total biomass remains well below pre-collapse levels. However, recent warming, earlier phytoplankton spring blooms, and an increase in the proportion of energy-rich copepod species may have positive effects on total ecosystem production in the coming years. A 2018 summary of the state of the fish community in the Flemish Cap (3M) EPU indicated that this ecosystem has not experienced sustained reductions in overall productivity observed in other EPUs. With the exception of a short-lived increase in 2005-2009, total biomass has remained fairly stable over time despite the changes in individual stocks.

This broad-ranging species is an important prey and predator species in the Northwest Atlantic ecosystem. The natural mortality of this prey species, which is consumed by a wide range of cetacean, pinniped, avian, invertebrate, and finfish predators, is very high. Small Northern shortfin squid prey primarily upon crustaceans and larger individuals prey primarily upon finfish, and during the fall, on smaller shortfin squid.

### **Fisheries**

Since 1999, there has been no directed fishery in Subarea 4, but some squid bycatch occurs in the Canadian small-mesh bottom trawl fishery for silver hake. Fisheries for Northern shortfin squid in Subarea 3 consist of Canadian commercial and recreational inshore fisheries (predominately jig fisheries) and a Food, Social and Ceremonial (FSC) fishery, all of which occur off Newfoundland and Labrador. Since 2017, a directed bottom trawl fishery has also occurred within the NRA, primarily in Divs. 3NO. A small-mesh bottom trawl fishery occurs within the USA EEZ in Subareas 5+6.

The fisheries in Subareas 3+4 and Subareas 5+6 are managed separately by NAFO and the USA, respectively. The Canadian inshore fisheries in Subarea 3 and the small fishery in St. Pierre et Miquelon (France) are not subject to fishery management plans, are not assessed and are not subject to TACs. Catches reported for Subareas 3 are underestimated, because the Canadian recreational and FSC fisheries have no catch reporting requirements.

Recent catch estimates and TACs ('000 t), including those for Subareas 5+6, are as follows:

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
TAC SA 3+4	34	34	34	34	34	34	34	34	34	34
STATLANT21 SA 3+4	0.1	0.1	<0.1	<0.1	0.4	1.4	2.8	3.9	10.6	
STACFIS SA 3+4	<0.1 <sup>1</sup>	<0.1 <sup>1</sup>	<0.1 <sup>1</sup>	0.1 <sup>1</sup>	0.4 <sup>1</sup>	1.4 <sup>1</sup>	2.9 <sup>1</sup>	3.1 <sup>1</sup>	10.6 <sup>1</sup>	
STACFIS SA 5+6	3.8	8.8	2.4	6.7	22.5	24.1	27.1	28.4	30.9	
STACFIS Total SA 3-6	3.8	8.8	2.4	6.8	22.9	25.5	30.0	31.5	41.4	

<sup>1</sup> Includes amounts, ranging from 0.001-2.6 t, reported as Unspecified Squid from Subarea 4.

### **Effects of the fishery on the ecosystem**

The effects of the directed fisheries on the ecosystem are unknown, but are generally limited to June through November (depending on fishery Subarea) as a result of the species' migration patterns on and off the continental shelves. There has not been a directed fishery in Subarea 4 since 1999 and the catches from the three inshore Canadian fisheries in Subarea 3, the main source of catches in SA 3+4, have increased ten-fold between 2018 and 2021.

The impact of bottom fishing activities on major VMEs in the NRA was last assessed in 2021. The risk of Significant Adverse Impacts (SAIs) on sponge and large gorgonian VMEs was assessed to be low, while this risk for sea pen VMEs has been assessed as intermediate. The risks of SAIs on small gorgonian, black coral, bryozoan and sea squirt VMEs were assessed as high. This assessment of impacts of bottom fishing activities on VMEs does not include waters within coastal states jurisdictions. A number of areas within the Grand Bank (3LNO) and Flemish Cap (3M) EPUs have been closed to fishing to protect corals and sponges.

Northern shortfin squid is a forage species for multiple predators within the wider stock distribution area, so impacts of fishing on the stock could have indirect effects on its predators. The role of squid as prey for the EPU within the NRA is presently not well known.

### **Special comments**

The assessment of this stock component may not reflect stock conditions during the three years for which management advice is given because the species has a sub-annual lifespan and recruitment is highly variable. In addition, there is a two-year time lag between the data used to conduct the assessment and the year for which TAC advice is requested.

SC has concerns regarding the existing reference points for this stock and plans to re-evaluate them in the near future.

### **Sources of information**

SCR Doc. 98/59,75; 99/66; 06/45; 16/34; 19/42REV; COM-SC Doc. 17/08; SCS Doc. 22/06, 10, 13, 14