Short Term Task # 1 – World Squid Assessment and Management Overview

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The following is a brief summary from the big Arkhipkin et al 2015 Squid Review (https://www.tandfonline.com/doi/full/10.1080/23308249.2015.1026226)

U.S. East Coast *Illex*: Qualitative evaluation regarding historical performance and indices; hard TAC based on historical catches. Canadian *Illex* quota is based on peak catches ratcheted down based on trends in an index, 1979 vs 1983-1997.

U.S. East Coast Longfin: Qualitative evaluation regarding historical performance and predator consumption estimates. Hard TAC based on historical catch ratio (catch to swept-area biomass) and historical catches.

Argentine *Illex*: Depletion modeling to maintain precautionary minimum spawning biomass to generate adequate recruitment. Countries not currently cooperating to fully implement.

Southwest Atlantic Patagonian Squid: Spatial restrictions, seasons, effort control though licenses/ITQs. Stock depletion modeling is used. Early closure of the fishery season may be used in cases when in-season estimations of stock size show that the stock is approaching a minimum escapement level. Predictive ability is limited at present.

Europe & Mediterranean: Minimal assessment, some minimum landing sizes in Southern Europe, indirect general inshore nursery closures and minimum mesh sizes in Mediterranean. No strong assessment-management-sustainability connections.

Indian Ocean: Various assessment efforts but no strong assessment-management action-sustainability connections.

Northwest Pacific: Various assessment efforts but no strong assessment-management action-sustainability connections for many species. There are some bans on fishing on spawning grounds during spawning. For Berryteuthis Magister, trawl track or survey estimates have been used to set TACs at about 45–55% of the total assessed biomass within each major fishing area. Harvests have generally been below the TACs however. For Diamond Squid, depletion and VPA work has been done, and while season and effort controls are used, no measures have been developed to stabilize catches from year to year. Firefly squid in the Sea of Japan has been assessed using the DeLury method, scientific echo sounders, and an egg production method, the latter of which has been most accurate. Fixed gear usage in some areas may also allow more spawning, and trip limits are used in some areas.

For the Japanese flying squid, annual TAC is set by the government through a process that weighs a combination of socioeconomic factors and the ABC recommended by researchers at the national fisheries research institute, using surveys conducted by scientific research vessels with jigging machines at the beginning of the fishing season to estimate stock size. An ABC is calculated based on Fmed (Caddy and Mahon, 1995) and forecasted stock abundance, which are both estimated from a spawner-recruit relationship. Unlike many squid, the paralarval density shows a clear positive relationship with stock abundance in the following year.

Southwest Pacific (New Zealand and Australia): Various assessment efforts but no strong assessment-management action-sustainability connections for most species. Spatial and temporal spawning closures are used for some fisheries. For Gould's and Wellington Flying squids, effort limits are used and depletion triggers are theoretically used but have not been activated.

Northwest Pacific: Doryteuthis opalescens: A TAC and effort controls are used, but are not directly informed by an assessment model.

East Pacific Dosidicus gigas Jumbo Flying Squid – largest squid fishery in the world

Central-East Pacific (Mexico): Management is based on retaining 40% of the stock at the end of each season, and effort is controlled by allocation of fishing permits; based on the analysis of catch and effort data and information obtained from research cruises. Thompson-Bell model and escapement analyses suggest low fishing mortality, considered a developing fishery.

South-eastern Pacific:. Peru: From 1999 onward, biomass estimates of D. gigas were made in the summer months by acoustic methods. This information was combined with other data to produce an index of abundance of recruits starting in 2002. With this information the TACs set each year using a projection of the biomass of recruits. From 2010 the Schaefer Biomass Dynamic Model (Hilborn and Walters, 1992) has been used. Chile: restricted access, the exclusive use of catches for human consumption, and a modifiable TAC based on the landings of the last 10 years.

China has also been working on using CPUE data of Chinese vessels as biomass abundance indices in a state-space surplus production model (https://www.sprfmo.int/assets/SC5-2017/SC5-SQ02-Stock-assessment-for-jumbo-flying-squid-in-SE-Pacific-2017.pdf). China operates a distant-water fleet in international waters (300,000+ tonnes in 2014-2015).

Loligo reynaudi (Chokka - S. Africa): 1998 observation error estimator comprised of a biomass dynamic model which incorporated jig and trawl catch and effort data, as well as biomass indices obtained from demersal trawl research surveys. Suggested 90% risk of collapse, didn't materialize, 2008 stock assessment results indicate the resource was in a healthy condition as a result of above average recruitment. Currently, effort levels are capped at 136 vessels and 2422 crew. In addition, effort is further reduced by an annual 5-week closed season during the peak spawning period (October-November), and a ban on fishing in the Tsitsikamma National Park area on the south coast. (Sauer et al., 2013).

Antarctic: Martialia hyadesi: (Rodhouse, 1997). Used estimated total consumption by predators (seabirds, seals, and toothed whales) to set a TAC (total allowable catch) that was sufficiently low to have a negligible effect on dependent predator populations and was consistent with the ecosystem-based approach to fishery management adopted by CCAMLR.