Fisheries and Oceans Canada | Pêches et Océans Canada
Science | Sciences
Newfoundland and Labrador Region
Canadian Science Advisory Secretariat
Science Advisory Report 2013/035

RECOVERY POTENTIAL ASSESSMENT FOR SMOOTH SKATE (*MALACORAJA SENTA*) FUNK ISLAND DEEP DESIGNATABLE UNIT

Smooth Skate (photo: Carolyn Miri, DFO-NL)

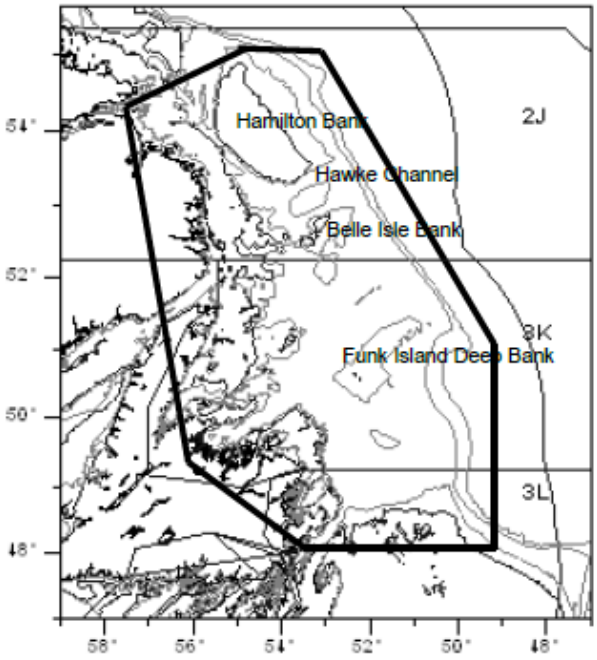

Figure 1. Map of the Smooth Skate Funk Island Deep designatable unit area.

Context

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) recently assessed the status of Smooth Skate (Malacoraja senta) in Canada, and classified the Funk Island Deep designatable unit (DU) as endangered. Environment Canada, in consultation with Fisheries and Oceans Canada (DFO), is responsible for the administration of the Species at Risk Act (SARA), and is therefore required to decide, within a specific timeframe, whether to formally list the population under SARA. In support of the listing recommendation, a number of actions are required, many of which require scientific information on issues such as the current status of the species, population or DU, threats to its survival and recovery, and the feasibility of its recovery. Formulation of this scientific advice has typically been developed through a Recovery Potential Assessment (RPA) that is conducted shortly after the COSEWIC assessment. This timing allows for the inclusion of peer-reviewed scientific analyses into SARA processes, including recovery planning.

In support of listing recommendations for Smooth Skate, DFO Science has been asked to undertake an RPA on the Funk Island Deep DU, which encompasses portions of three Northwest Atlantic Fisheries Organization (NAFO) Divisions - 2J, 3K, and 3L (Fig. 1). The advice in the RPA may be used to inform both scientific and socio-economic elements of the listing decision, as well as development of a recovery strategy and action plan; and to support decision-making with regards to the issuance of permits, agreements and related conditions, as per relevant sections of SARA.

SUMMARY

- In the Funk Island Deep DU Smooth Skate (*Malacoraja senta*) catch rates and abundance declined during the 1980s and 1990s, and have remained low.
- Their greatest abundance is between 200 and 600 m in the Funk Island Deep DU. They typically occur in a narrow temperature range of 1-4˚C.
- A B_{MSY} proxy (biomass giving maximum sustainable yield) was derived from the DFO fall multispecies research vessel (RV) survey series (1981-2012). Empirically-derived reference points were based on the geometric mean of 1981-1988: a period of higher productivity. The default Precautionary Approach (PA) reference points calculated were 40 % B_{MSY} (Limit Reference Point, LRP) and 80 % B_{MSY} (Upper Stock Reference, USR). Stock size averaged 18 % of the LRP over 2008-12.
- The relevant spatial resolution required to identify the habitat of Smooth Skate is unknown. However, there is no evidence of a reduction in suitable habitat, or that it will limit recovery of the Smooth Skate Funk Island Deep DU.
- There is no directed fishery for Smooth Skate in this DU area. Bycatch of this species is very low (<0.1 %), and therefore mitigation is not feasible beyond consideration of closed areas where the abundance is highest. Close monitoring of the bycatch, through adequate Canadian Fisheries Observer coverage, would enable continued evaluation of the potential impacts of fisheries on recovery of Smooth Skate.
- There are inadequate data to quantify the maximum human-induced mortality that the DU can sustain and not jeopardize survival or recovery. The population has remained stable at a low level at current bycatch.

BACKGROUND

Rationale for Assessment

In May 2012, COSEWIC evaluated the status of Smooth Skate in Atlantic Canada, and concluded that Smooth Skate in the Funk Island Deep DU, which consists of a single population, had significantly declined in the 1980s, and was therefore classified as endangered (COSEWIC 2012). The Laurentian-Scotian DU was classified as special concern, while the Hopedale and Nose of the Grand Bank DUs were considered data deficient.

Following receipt of the latest COSEWIC assessment, the Minister of the Environment, in consultation with the Minister of Fisheries and Oceans, will either (a) accept the COSEWIC assessment and add this species to the List of Wildlife Species at Risk under SARA; (b) decide not to add this species to the List; or (c) refer the matter back to COSEWIC for further information or consideration. If the COSEWIC recommendation is accepted, a Recovery Strategy will be required within a specific timeframe.

In support of listing recommendations for this Smooth Skate (Funk Island Deep DU) by the Minister, DFO Science has been asked to undertake an RPA, based on the National Frameworks (DFO 2007a, b), by addressing 27 objectives outlined in the regional advisory meeting's Terms of Reference[1]. The advice in the RPA may be used to inform both scientific

[1] Proceedings of the 2013 Regional Peer Review of the Recovery Potential Assessment for Smooth Skate (*Malacoraja senta*) – Funk Island Deep Designatable Unit; May 1-2, 2013. In the current SAR, various section headings outline which objectives are being addressed.

and socio-economic elements of the listing decision, as well as development of a Recovery Strategy and Action Plan, and to support decision-making with regards to the issuance of permits, agreements and related conditions, as per sections 73, 74, 75, 77, and 78 of SARA. The advice generated via this process will also update and/or consolidate any existing advice regarding Smooth Skate (Funk Island Deep DU).

The general intent of this document is to provide scientific advice in support of the assessment and listing recommendations, and includes information required for development of a Recovery Strategy, should it be deemed necessary. Limited information specific to the Funk Island Deep DU means that descriptions in this document refer to Smooth Skate over its entire range, unless otherwise stated.

Species Biology and Ecology

Similar to other skate species, Smooth Skate have a low reproductive potential due to slow growth, late sexual maturation, low fecundity, and long reproductive cycles (Sosebee 2005; Kulka et al. 2006; Sulikowski et al. 2007, 2009; McPhie and Campana 2009a, b). Recruitment dynamics, natural mortality, impacts of commercial fisheries, and environmental effects are poorly understood.

Time of spawning is not precisely known (Scott and Scott 1988), but it is thought to occur from March to September; although Smooth Skate have been found to be sexually active throughout the year (Kulka et al. 2006). Smooth Skate produce a limited number of large egg cases (<100 annually) that are deposited on the bottom, and therefore have limited dispersion. While strong local bottom currents can transport skate cases over short distances of several meters, or potentially kilometers, wide dispersion is unlikely. Young skates hatch from egg cases as free-swimming animals. This species exhibits sexual dimorphism in growth and maturity. Females attain sexual maturity earlier, and at smaller sizes, than do males. Recent estimates of age at 50 % maturity are 10 years for females, and 12 years for males (McPhie and Campana 2009a). Females attain sexual maturity at approximately 47 cm total length (TL), while males mature at roughly 50 cm TL. Smooth Skate seem to have a maximum age of 15 years (McPhie and Campana 2009b).

The diet of Smooth Skate consists of amphipods, mysids, decapods, euphausiids, and fish (Simpson et al. 2011). This species appears to be quite selective in its feeding. On the Grand Bank, Smooth Skate diet consisted of 22 prey items, of which 72 % (by weight) was crustaceans. The second most important prey group for this species was fish (26 %), of which a large portion was Capelin (*Mallotus villosus*; 8 %). Smaller individuals (<29 cm TL) fed mainly on mysids, while larger individuals (≥40 cm TL) consumed a more varied diet of shrimp, crab, and fish (Simpson et al. 2011). Diet information for the Funk Island Deep DU is not available, but the diet is likely similar to that which has been observed for Smooth Skate from other DUs.

Smooth Skate are generally found over a broad range of bottom types, often in deep troughs and basins (Scott and Scott 1988). Throughout their range, they are found at depths ranging from 25 to 1436 m, but are most abundant between 200 and 600 m in the Funk Island Deep DU area (Kulka et al. 2006; Simpson et al. 2011). Furthermore, most of the multispecies research vessel (RV) sets that captured Smooth Skate occurred in waters ranging from 1-4˚C. This species is seldom found in waters that are <0˚C (Kulka et al. 2006; Simpson et al. 2011).

ASSESSMENT

Status and Trends (Objectives 1-2)

RV indices of Smooth Skate abundance in the Funk Island Deep DU declined during the 1980s and 1990s, and have remained low (Figs. 2 and 3). It should be noted that RV indices for this species prior to and post-gear change are on different scales, since catchability is higher for all size classes with the Campelen trawl, while the Engel trawl captured almost no skates <26 cm TL.

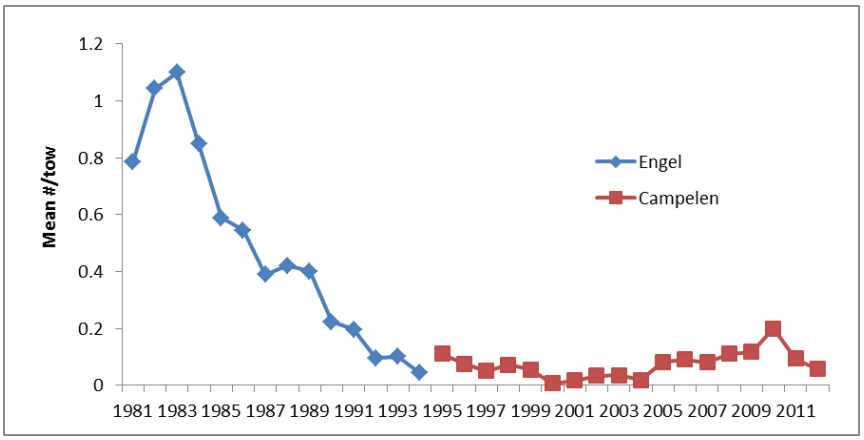

Figure 2. Mean number per tow for Smooth Skate in DFO fall multispecies research vessel (RV) surveys in the Funk Island Deep designatable unit, 1981-2012. Note the change in survey gear from Engel to Campelen trawl in 1995.

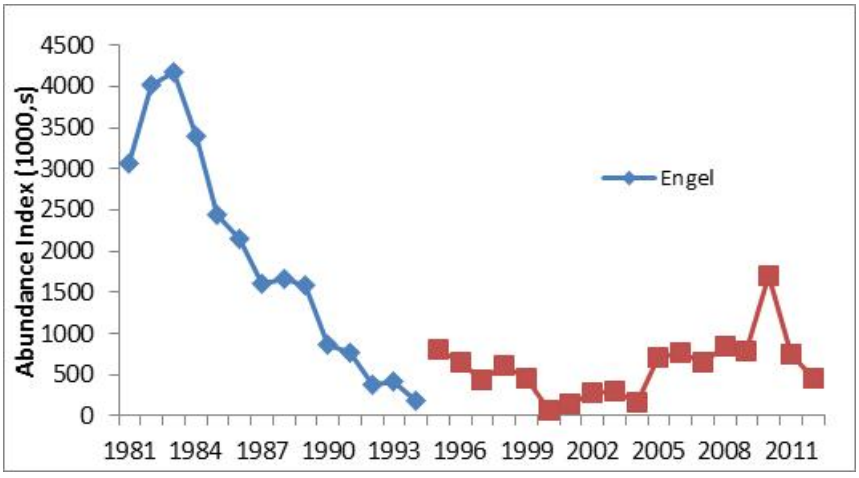

Figure 3. Abundance index of Smooth Skate in DFO fall multispecies research vessel (RV) surveys in the Funk Island Deep designatable unit, 1981-2012. Note the change in survey gear from Engel to Campelen trawl in 1995.

Coincident with changes in abundance, and biomass, Area of Occupancy peaked in 1982 at 38 % of the surveyed area, but declined to <5 % by 1994 (Fig. 4); after which the research survey gear changed. Estimates of area occupied from Campelen surveys averaged 7.5 % over the last five years. The 2012 estimate was 6 %.

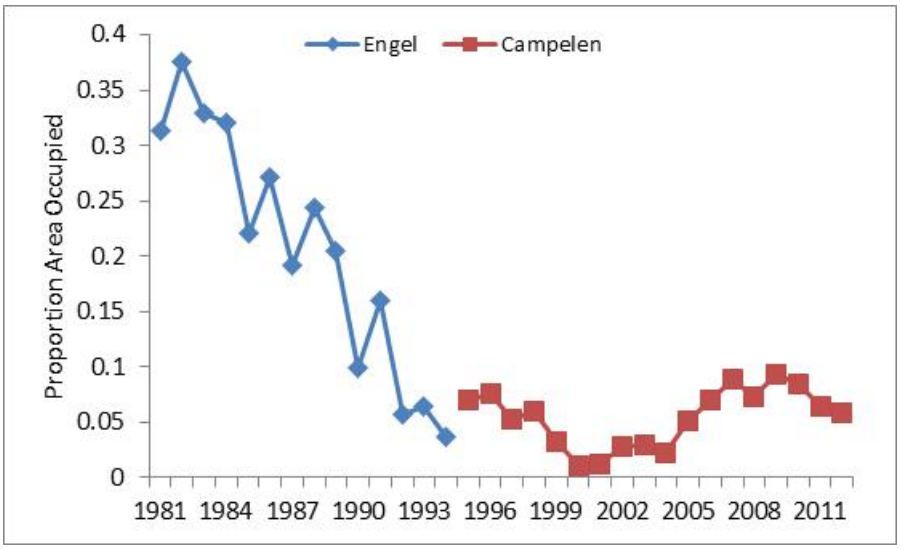

Figure 4. Area of Occupancy of Smooth Skate in DFO fall multispecies research vessel (RV) surveys in the Funk Island Deep designatable unit, 1981-2012. Note the change in survey gear from Engel to Campelen trawl in 1995.

During the 2009-2010 fall multispecies RV surveys, large catches of Smooth Skate occurred in Hawke Channel, between Hamilton Bank and Belle Isle Bank. In 2011-12, larger catches were less common in that area (Fig. 5).

Life History (Objective 3)

See Species Biology and Ecology section.

Habitat Requirements and Considerations

Residence Requirement (Objective 6)

Canada's SARA defines a residence as, "a dwelling-place, such as a den, nest or other similar area or place, that is occupied or habitually occupied by one or more individuals during all or part of their life cycles, including breeding, rearing, staging, wintering, feeding, or hibernating".

Smooth Skate do not have any known dwelling place similar to a den or nest during any stage of their life history.

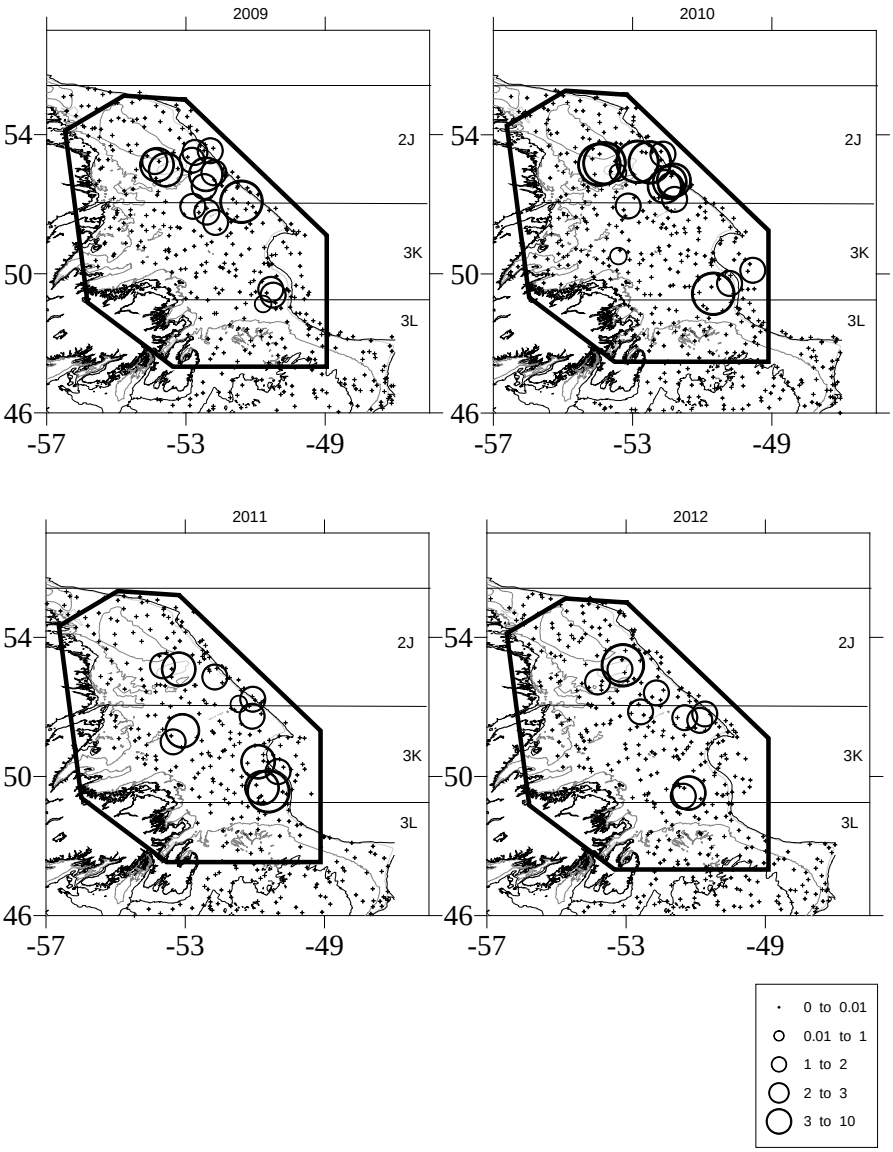

Figure 5. Numbers per tow of Smooth Skate caught in DFO fall multispecies research vessel (RV) surveys conducted in the Funk Island Deep designatable unit area, 2009-12.

Habitat Properties (Objective 7)

Habitat use by Smooth Skate varies by life stage and size.

Egg case distributions are determined by the spawning locations of adult Smooth Skate, and subsequent action by prevailing local bottom currents. Egg cases lie on the bottom, and their paired, hooked extensions (“horns”) may passively anchor them to seaweed, pebbles, or other immobile structures.

Evidence of habitat use is limited to large-scale distribution patterns derived from seasonal multispecies RV surveys. Specific habitat features that influence affinity to a specific area are not well known. Prior analysis in the Funk Island Deep DU suggested that, although there is overlap, juvenile Smooth Skate tend to distribute deeper than adults (Kulka et al 2006). Smooth skate are considered temperature seekers and, in the Funk Island Deep DU, are associated with a narrow temperature range of 1-4˚C (Simpson et al. 2011).

Spatial extent of Habitat (Objective 8)

Geographic distribution of the Smooth Skate Funk Island Deep DU ranges from Hamilton Bank to the edge of the Northern Grand Bank. Adults were widespread throughout this area. However, more information is needed about the relevant spatial resolution required to identify the habitat of Smooth Skate.

Potential Threats to Habitat, and Associated Impacts (Objectives 9; 16)

Fishing

Studies on the impact of groundfish trawling have demonstrated short-term disruption of benthic communities, which include reductions in biomass and diversity of benthic organisms (Collie et al. 2000; Hinz et al. 2009; Kaiser et al. 1998, 2000, 2002, 2006). Effects are not uniform, but depend on specific features of the sea floor habitat being impacted, including type of fishing gear used; frequency with which the area is affected by gear; history of human benthic impacts in the area of concern; and the natural disturbance regime. Some previously fished sea floor habitats showed recovery within one to three years, but frequently trawled habitats remain in an altered state (Kaiser et al. 2000, 2002; Hinz et al. 2009). Fishing with fixed gear (e.g., gillnets, crab pots) may also impact habitat. Similar to bottom trawling, such impacts are contingent on location of the fishery, and methods of gear deployment and retrieval.

There are no data available concerning the impact of fishing gear on Smooth Skate habitat.

Seismic surveys

Seismic surveys are widely used to detect potential drilling locations for oil and gas reserves. Seismic surveying involves sending sound waves down to the sea floor, and recording echoes that return from various sedimentary layers. Impacts on the physical habitat of Smooth Skate are unlikely, but there could be effects on various life stages of their prey.

Oil and gas drilling

Currently, there are no oil and gas drilling activities in the area associated with Funk Island Deep DU (CNLOPB 2012). However, there are significant drilling license (SDL) areas immediately north of this DU (CNLOPB 2012). Any significant oil pollution north of the Funk Island Deep area could be transported by the Labrador Current into this DU area, and thus potentially impact Smooth Skate habitat.

There are no data available on the impact of oil and gas drilling, or of oil pollution, on Smooth Skate habitat.

Other activities such as temperature/climate change

Smooth Skate are considered temperature-keepers, and appear to favour a relatively narrow range of temperatures. Changes in water temperature may have significant effects; though it is currently impossible to quantify these.

Biological Consequences of Changes in Habitat Quality/Quantity (Objective 10)

Specific potential impacts of habitat disturbance and/or alteration on the biological functions of Smooth Skate are largely unknown, and presently cannot be quantified.

Spatial Configuration Constraints (Objective 11)

Spatial configuration constraints, such as connectivity and barriers to access, are not currently limiting factors to Smooth Skate recovery in the Funk Island Deep DU. However, they do create a probable barrier to other DUs; thereby precluding any rescue effect for this population.

Quantity/Quality of Suitable Habitat (Objectives 12-13; 19-20)

The relevant spatial resolution required to identify the habitat of Smooth Skate is unknown. However, there is no evidence of a reduction in suitable habitat, or that it will limit recovery of the Smooth Skate Funk Island Deep DU.

Feasibility of Habitat Restoration (Objective 14)

It is unknown whether habitat restoration is required for Smooth Skate population recovery in this DU.

Risks Associated with Habitat "Allocation" Decisions (Objective 15)

Risks associated with habitat allocation decisions were not assessed for the Smooth Skate Funk Island Deep DU.

Threats to Survival and Limiting Factors for Recovery (Objective 18)

Environmental factors

Given the narrow temperature range preference of Smooth Skate in this DU, extremes of cold or warm temperature could alter productivity, distribution, and mortality rates. Cold waters in the early 1990s were associated with slower growth rates and poorer condition in many fish stocks on the Labrador and Newfoundland shelves (Drinkwater 2002; Rice 2002). Potential impacts of temperature change on Smooth Skate are not presently quantifiable, as the physiology of this species is poorly understood.

Recruitment

Similar to many elasmobranchs, this species exhibits low reproductive potential. Recruitment dynamics are poorly understood; although females are known to produce few egg cases (<100 annually; McPhie and Campana 2009a).

Interspecific Interactions

Research indicates that Smooth Skate is characterized by a selective diet, and relies heavily on crustaceans; except at largest sizes, when fish are also consumed. It is not known whether dietary preferences have influenced/constrained distribution and recovery patterns.

Data concerning impacts of predation on this species' recovery are limited, and from other locations. Adult Smooth Skate are subject to predation by marine mammals (e.g., Grey Seals *Halichoerus grypus*, Benoît and Swain 2011). Predation on skate egg cases by a variety of species (e.g., Atlantic Halibut *Hippoglossus hippoglossus*; Monkfish *Lophius americanus*; Greenland Shark *Somniosus microcephalus*; gastropods) has been documented (Cox et al. 1999).

Tapeworm infestation of Smooth Skate was documented in another part of its range (Randhawa et al. 2008); although potential impacts on productivity or viability of this host species were not quantified. To date, endoparasites such as nematodes (e.g., *Anisakis* sp.; *Pseudoterranova* sp.), observed in several commercially important Northwest Atlantic fish and seal species, have not been studied in Smooth Skate.

Mortality

Although total mortality was high during the period of decline, it is not possible to determine sources of this mortality. Although not targeted directly, incidental capture of this species in a variety of commercial fisheries can impact Smooth Skate populations. Fishing mortality (as bycatch) is presently thought to be low in this DU. Relative fishing mortality, calculated as the

ratio of estimated commercial landings to estimated research survey biomass, averaged 0.0085 over 2000-12 (Fig. 6).

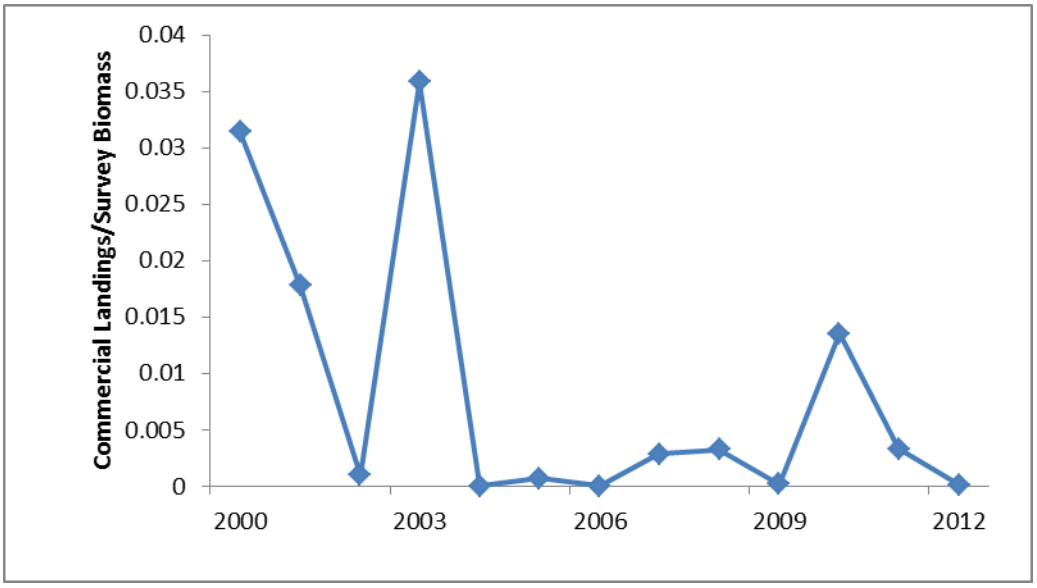

Figure 6. Relative fishing mortality estimates (commercial fishery landings relative to research survey biomass) in the Funk Island Deep DU, 2000-12.

Scope for Management to Facilitate Recovery (Objectives 4-5; 17; 25-26)

Parameter Recommendations and Recovery Targets

Under the DFO PA framework, the Critical, Cautious, and Healthy stock status zones are defined by the LRP and an USR. In situations where there is insufficient information to determine stock biomass from an analytical model, an empirical approach can be used to identifying proxies that can be used to define PA reference points. For Smooth Skate, a B_{MSY} proxy was derived from the DFO fall multispecies RV survey series (1981-2012). Empirically derived reference points were based on the geometric mean of 1981-88: a period of higher productivity (Fig. 7). The default PA reference points calculated were 40 % B_{MSY} (LRP) and 80 % B_{MSY} (USR).

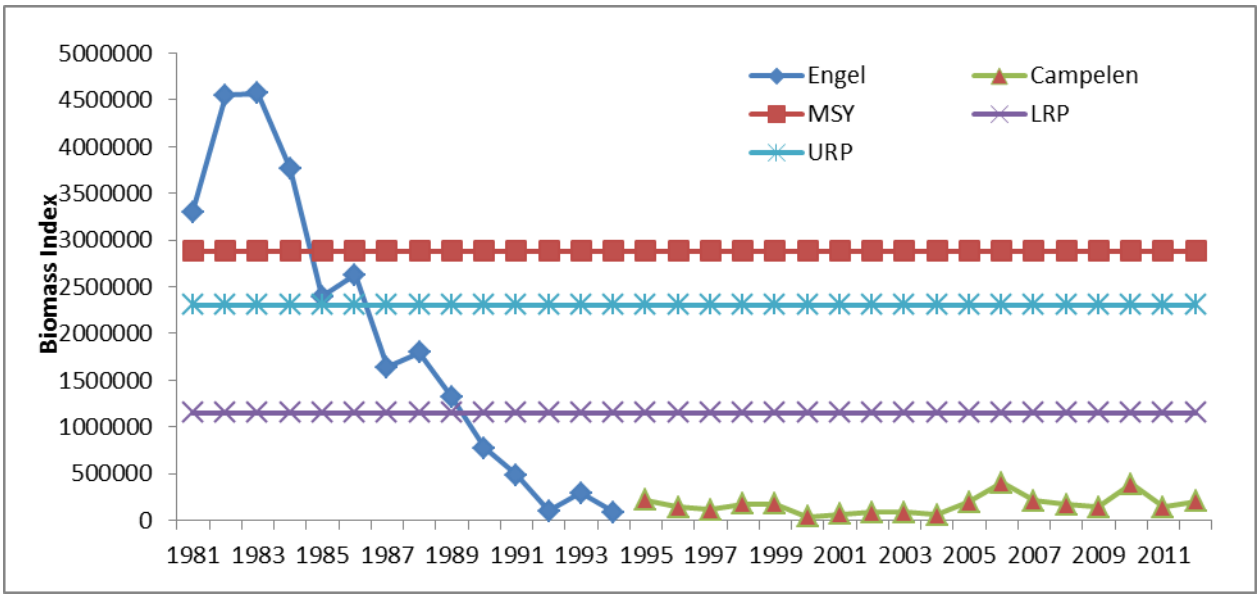

Figure 7. Plot of the B_{MSY} proxy and proposed PA reference points for Smooth Skate in the Funk Island Deep DU. Unit for biomass index is tonnes. Note the change in research survey gear from Engel to Campelen trawl in 1995.

Stock size averaged 18 % of the LRP over 2008-12 (Fig. 8).

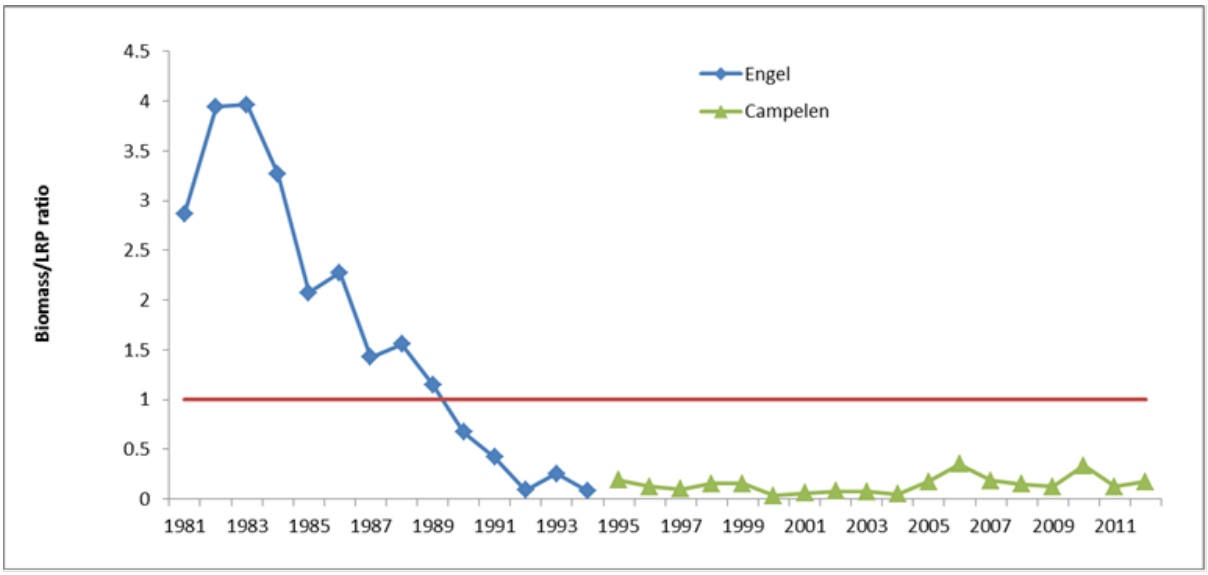

Figure 8. Plot of Biomass relative to the LRP for the Funk Island Deep DU. Note the change in research survey gear from Engel to Campelen trawl in 1995.

Mitigation and Alternatives (Objectives 21-24)

Bycatch of Smooth Skate in this DU is very low (<0.1 %), and therefore mitigation is not feasible beyond consideration of closed areas where the abundance is highest. Close monitoring of the bycatch, through adequate Canadian Fisheries Observer coverage, would enable continued evaluation of the potential impacts of fisheries on recovery of Smooth Skate.

Allowable Harm Assessment (Objective 27)

There are inadequate data to quantify the maximum human-induced mortality that the DU can sustain and not jeopardize survival or recovery. The population has remained stable at a low level at current bycatch.

Other potential sources of harm (e.g., seismic surveys, habitat alteration, oil and gas exploration and production, pollution) were not specifically quantified in this assessment, but are currently considered to have negligible impacts on the viability and recovery of Smooth Skate in this DU.

Sources of Uncertainty

There is considerable uncertainty regarding reasons for collapse of this population in the 1980s, and factors affecting future productivity. In particular, potential effects of climate change are unknown, but probably important, given the narrow temperature range preference of Smooth Skate.

The only source of information on bycatch and discarding at sea is the Canadian Fisheries Observer Program. Low Observer coverage in this DU made it difficult to obtain accurate estimates of Smooth Skate bycatch.

Lack of a quantitative population model limited the ability to estimate impacts of fishing and to project population recovery potential.

Life history data (e.g., growth, maturity, fecundity, population age structure) specific to this DU are not available. Additional information on trophic interactions in this DU is also required.

Functional scales of Smooth Skate habitat are unknown.

SOURCES OF INFORMATION

This Science Advisory Report is from the 1-2 May 2013 Recovery Potential Assessment for Smooth Skate (*Malacoraja senta*), Funk Island Deep population designatable unit. Additional publications from this meeting will be posted on the Fisheries and Oceans Canada (DFO) Science Advisory Schedule as they become available.

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Centre for Science Advice (CSA)
Newfoundland and Labrador Region
Fisheries and Oceans Canada
Northwest Atlantic Fisheries Centre,
P.O. Box 5667
St. John's, Newfoundland and Labrador
A1C 5X1

Telephone: 709-772-8892
E-Mail: DFONLCentreforScienceAdvice@dfo-mpo.gc.ca
Internet address: www.dfo-mpo.gc.ca/csas-sccs/

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