Annex 2. Detailed Case Studies

In this annex, the four categories discussed in the methods section: data quality, proposed actions, action implementation and bycatch trends; are rated for each of the fisheries selected in the six case studies using a traffic light system. At the end of each case study a summary table is included showing the scores for each of the categories and the total score for each fishery. This annex provides the underpinning rationale for the scores given.

Case study 1. North Atlantic gillnet fisheries

Introduction

This case study includes three gillnet fisheries targeting lumpfish *Cyclopterus lumpus* (or ‘lumpsucker’) in coastal waters around Iceland, Greenland and Norway; and two fisheries which use a wide range of fishing gears, such as gillnets, trawls and longlines to catch a mix of demersal species, including cod *Gadus morhua* and haddock *Melanogrammus aeglefinus*, in inshore Icelandic and Norwegian waters. In these two fisheries, only the gillnet component is assessed. Coastal gillnet fisheries in northern latitudes have a potentially high impact on diving seabirds, such as seaducks and alcids, and marine mammals, such as harbour porpoises and seals (Randall et al., 2013; Zydelis et al., 2013). The name of each fishery (as shown on the MSC website), year of first certification and re-certification, and version of the MSC standard they were certified under are shown in table 1.

<table>
<thead>
<tr>
<th>Name of fishery</th>
<th>Date of first certification</th>
<th>Version of MSC standard</th>
<th>Date of re-certification</th>
<th>Version of MSC standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Icelandic gillnet lumpfish</td>
<td>December 2014</td>
<td>v.1.3</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>2. ISF Iceland cod/haddock</td>
<td>April 2012</td>
<td>v.1.3</td>
<td>April 2017</td>
<td>v.2.0</td>
</tr>
<tr>
<td>3. Greenland lumpfish</td>
<td>August 2015</td>
<td>v.1.3</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>4. NFA Norwegian Lumpfish</td>
<td>November 2017</td>
<td>v.2.0</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>5. Norway North East Arctic cod/haddock</td>
<td>October 2011</td>
<td>v.1.0</td>
<td>October 2015</td>
<td>v.1.3</td>
</tr>
</tbody>
</table>

1.1 Icelandic gillnet lumpfish

1.1.1 Bycatch baseline
The most up-to-date information on bycatch in Icelandic fisheries is found in a recent report from Iceland to the US government, in response to new requirements for seafood exports to the USA (NOAA 2016). In this report, bycatch numbers are provided by the Marine and Freshwater Research Institute (MFRI) for the period 2014-2016 (MFRI 2017).

Common eider *Somateria mollissima* and black guillemot *Cepphus grylle* are the most common seabird species caught in the lumpfish fishery with an estimated average for the 2014-2016 period of 3,106 and 1,711 individuals per year respectively. Total numbers of seabirds caught in this fishery are estimated at around 6,492 individuals per year (MFRI 2017).

In the same report to the US government, seal species are shown as the most common marine mammal bycatch in lump sucker nets, with an estimated average of 1,566 grey seals *Halichoerus grypus*, 928 harbour seals *Phoca vitulina* and 121 harp seals *Pagophilus groenlandicus* caught per year in the period 2014-2016. Harbour porpoises *Phocoena phocoena* (with an estimated 342 animals caught annually) complete the four most-caught marine mammal species (MFRI 2017). Scar studies also indicate that larger marine mammals, including humpback whales *Megaptera novaeangliae* are entangled in gillnets around Iceland (Basran 2014)

*This fishery reports high levels of bycatch of seabirds and marine mammals, including common eider, black guillemot, harbour porpoise and several species of seal.*

1.1.2 Data quality on bycatch

In this fishery, bycatch estimates come mainly from two sources: self-reported data (logbooks) and data from onboard inspectors from the Directorate of Fisheries (DF) and researchers from the Marine and Freshwater Research Institute (MFRI 2017) (Medley et al., 2017) (Gascoigne et al., 2015). Bycatch reporting is mandatory via electronic logbooks (in use since 2010), which must be made available to inspectors from the DF and to MFRI for scientific purposes (Medley et al., 2017). However, returns of electronic log books have been low, though it seems that returns are improving owing to increased effort from the Directorate of Fisheries (85 logbooks returned in 2016 for the lumpfish fishery versus 5 in the previous year) (Gascoigne et al., 2016, Medley et al., 2017). Observer coverage, including inspector effort, represents only 1% of fishing effort, which is considered too low to get reliable estimates of bycatch (Babcock & Pickett 2003).

*Bycatch estimates for the lumpfish fishery are obtained from self-reported data (logbooks) and on-board observers. However, observer coverage is low, below 1%.*

1.1.3 Scores, conditions and management measures implemented
When the Icelandic lumpfish fishery was assessed by the conformity assessment body (CAB), it scored less than 80 in two PIs of the bycatch species component, management strategy (2.2.2) and information (2.2.3); and it therefore received two conditions (Gascoigne et al., 2014). No conditions were set for the outcome component (2.2.1), as a result of the use of the Risk-based framework (RBF). The narrative of these conditions refers to improving data collection on bycatch to detect any increase in risk to the main birds and/or marine mammal bycatch species affected; to specifically evaluate the risk of the fishery posed to harbour porpoise and to put in place a partial strategy to reduce the impact on the species. During the first surveillance audit, newly available information raised possible concerns about the impact of the fishery on black guillemot and this species was included in condition 1 (Gascoigne et al., 2015). The team also considered the possibility of re-scoring PI 2.2.1 for the species, but it was considered that the work being conducted by the client to address the existing conditions would not be changed by this and that the impact of the fishery on this species would be better evaluated before the end of the certification period (Gascoigne et al., 2015). No references to re-scoring 2.2.1 were made in the second surveillance report. However, three new species were considered of concern: great northern diver *Gavia immer* and grey and harbour seals (Gascoigne et al., 2016).

As a result of the certification, in 2015 and 2016 the Small Boat Owners Association started a project with Birdlife International to evaluate seabird bycatch in the lumpfish fishery (Gascoigne et al., 2016). Data from this project is being collated with MFRI data to refine the bycatch estimates across the fishery (R. Crawford, pers obs).

The increasing number of logbooks returned, alongside the observer data collected through the BirdLife project and fisheries inspectors, highlighted that large numbers of black guillemot, grey seal, harbour seals and harbour porpoises were estimated to be caught by the fishery, issues which were unknown at the time of the first assessment. The high levels of black guillemot and grey seal bycatch led to suspension of the fishery in January 2018. A corrective action plan was prepared by the fishery in collaboration with Fisheries Iceland (SFS), MII and MFRI, which includes six actions to reduce bycatch: to collaborate with stakeholders to discuss, analyse and seek measures to reduce bycatch and analyse the sustainability of this fishery; to increase the depth at which lumpfish gillnets are set to reduce the bycatch of black guillemot; to study the overlap between fishing areas and cormorant *Phalacrocorax carbo* and grey seal distributions to identify potential area closures to mitigate interaction with both species; and to investigate the impact of the fishery on harbour seals and the main reasons for the decline of this species in the area. As this plan has only recently been agreed, its efficacy cannot be assessed.
Proposed actions: Proposed corrective actions focused on improving logbook returns and collecting independent bycatch data.

Action implementation: The Small Boat Owners Association supported a project with Birdlife International to evaluate seabird bycatch in the fishery, and these data, together with higher levels of government observer data and self-reported information, were fed into the certification process. This information raised concerns about the impact of the fishery on other species (black guillemot, grey and harbour seal) (MFRI 2017), leading to the suspension of the certification until corrective actions are resolved. No other management actions were implemented before the fishery was suspended; corrective action proposals included potential spatial closures, though it is not clear to what extent these are being implemented.

1.1.4 Trends in bycatch and population sizes

Total (estimated) seabird bycatch numbers for the Icelandic lumpfish fishery are 9,892, 8,654 and 3,992 individuals for 2014, 2015 and 2016 respectively, of which common eider represents 53%, black guillemot 24%, cormorant species 12% and common guillemot 8%. Although some decrease in bird bycatch is observed, there is no evident reason for this, as no new management measures have been introduced during the certification period. The most likely explanation is that MFRI estimate total bycatch from relatively low observer coverage rates (around 1%) and estimates have wide confidence intervals which affect reliability of the data (Gascoigne et al., 2016) (MFRI 2017).

Of these species, common eider, although widely distributed around the mid- to high-latitude coasts of the northern hemisphere, has recently been uplisted to near threatened due to moderate declines within Europe (Birdlife 2016). *Cepphus grylle islandicus*, the subspecies of black guillemot present only in Iceland, has an estimated population size of 30,000-45,000 individuals, showing a significant long-term decline (Berglund & Hentati-Sundberg, 2015). Common guillemot *Uria aalge*, despite having an extremely large range and population size estimated at around > c.18, 000,000 individuals (del Hoyo et al. 1996), is also declining in Iceland, Scotland, Norway and the Faroes, fulfilling the criteria for categorization as ‘Significant Long-term Decline’ within the AEWA (African-Eurasian Waterbird Agreement) area (Berglund & Hentati-Sundberg, 2015). And finally, Great northern diver, although evaluated by the IUCN as ‘least concern’ based on the large population size and range (Birdlife 2016), only forms a small Icelandic breeding population which may be separate from neighbouring populations in North America. So, the cumulative impact of this fishery on this species, although relatively small in numbers (40 individuals/year), could represent around 4% of the total population size (Gascoigne et al., 2016) (MFRI 2017).
In the case of marine mammal bycatch, latter reports of grey and harbour seal captures are higher than the reported bycatch values during the initial assessment of the fishery in 2014 (Gascoigne et al., 2014) and no changes are reported in harbour porpoise bycatch.

The most recent estimate of the harbour porpoise population in Icelandic waters dates from 2007, estimated at around 43,179 individuals (95% CI 31,755-161,899) (NAMMCO 2017). This is a single estimate (new data is expected for 2018) which does not allow for the identification of trends in the population (NAMMCO 2017). The 2014 harbour seal survey, although incomplete, showed a considerable decline in this species from the 11,000 animals found in 2011, implying that the population size is likely to be smaller than the figures defined in the management objectives by the Icelandic government, and thus below biological limits (NAMMCO 2017). In the case of grey seals, calculations based on the latest population count in 2012 reveal that the population was smaller than the recommended number of 4,100 animals (NAMMCO 2017).

Seabird bycatch appears to be decreasing, although this may be an artefact of low observer coverage and could be linked to decreasing fishing effort. Marine mammal bycatch appears to be increasing, though this could be linked to aforementioned observer coverage issues. Seal and black guillemot bycatch was recently identified as a significant problem in this fishery.

1.2 ISF Iceland cod/haddock

1.2.1 Bycatch baseline

Total numbers of seabirds caught in cod nets were estimated at around 2,547 individuals per year between 2014 and 2016, with northern fulmar *Fulmarus glacialis* being the most commonly captured bird, at an average of 1,702 individuals per year, followed by common guillemot and common eider with an average of 454 and 142 individuals per year respectively (MFRI 2017).

Harbour porpoises are the most common marine mammal bycatch in this fishery with an average of 1,841 individuals caught per year. The cod fishery also caught harp seals, harbour seals and ringed seals *Pusa hispida*. As noted for the Icelandic lumpfish fishery, humpback whales have been recorded with scarring linked to entanglements in gillnets in Iceland waters (Basran 2014).

This fishery reports moderate levels of seabird bycatch and high levels of harbour porpoise bycatch.

1.2.2 Data quality on bycatch

In the cod fishery, bycatch estimates come mainly from three sources: self-reported data (logbooks), data from onboard inspectors from the Directorate of Fisheries and records from researchers from the Marine and Freshwater Research Institute (MFRI), and data from the scientific cod gillnet surveys,
conducted in April each year (MFRI 2017) (Medley et al., 2017) (Gascoigne et al., 2015). Bycatch reporting is mandatory via electronic logbooks (since 2010), which must be made available to inspectors for scientific purposes (MFRI 2010) (Medley et al., 2017). However, returns of electronic logbooks have been low and bycatch is not adequately reported (Medley et al., 2017). Observer coverage, including inspector effort, represents only 1% of fishing effort which is considered too low to get reliable estimates of bycatch (Babcock & Pikitch 2003). In addition, some differences have been observed between observer-collected data and self-reported data on bycatch, with observer data reporting higher rates (Medley et al., 2017). The MFRI spring gillnet survey is undertaken over two weeks in April and is equivalent to 2% of the total cod gillnet fishing effort during this month. In this survey, marine mammals and seabirds caught have been registered since 1997 and 2009 respectively (MFRI 2017) (Medley et al., 2017).

Bycatch estimates in this fishery come from three sources: self-reported data (logbooks), data from on-board observers and data from the scientific cod gillnet surveys (MFRI 2017). However, observer coverage is low - below 1%, and the scientific cod survey only covers 2% of fishing effort.

1.2.3 Scores, conditions and management measures implemented

The Icelandic cod fishery did not receive any conditions during the first assessment process in 2011 (Lockwood et al., 2011), though it received three conditions during the re-assessment for 2.2.1, 2.2.2 and 2.2.3 in 2016. These referred to the taxa as the Icelandic lumpfish fishery: seabirds and marine mammals. It is noteworthy to highlight that the condition for 2.2.3 was set and new species were added to 2.2.2 and 2.2.3 as a consequence of the comments made by stakeholders and peer reviewers on the PCDR (Medley et al., 2017). The narrative of the conditions focuses on improving bycatch reporting, assessing the impact of the fishery on bycatch species and developing a strategy to reduce it. Several species are specifically named in the conditions: fulmars, shags Phalacrocorax artisotelis, cormorants, northern gannet Morus bassanus, great black-backed gull Larus marinus, common guillemot and harbour seal (Medley et al., 2017). As the fishery was re-certified very recently, progress on these conditions cannot be evaluated. It seems that data on bycatch is still not adequately recorded in electronic logbooks (Medley et al., 2017). No other management measures have been implemented during the certification period.

Proposed actions: No conditions were set for the fishery during the first assessment process, but stakeholder comments were addressed during the recertification process and conditions added to improve bycatch reporting and reduction strategies.
Action implementation: Management measures have focused on improving logbook returns. No other actions have been implemented.

1.2.4 Trends in bycatch and population sizes

For the Icelandic cod fishery, total numbers of seabird caught annually are estimated at 2,981, 3,172 and 1,877 individuals for 2014, 2015 and 2016 respectively. Northern fulmar represents 69% and common guillemot 17% of the bycatch composition. This decrease in bycatch is in line with decreased cod gillnet effort (Medley et al., 2017), so it would appear that bycatch rates have not declined, but limited observer coverage makes the determination of trends difficult.

In the case of marine mammals, a peak in harbour porpoise bycatch was observed in 2016.

A peak in harbour porpoise bycatch was observed in 2016 with 2,618 individuals caught. Seabird bycatch is not showing an obvious trend, and limited observer coverage affects the ability to determine this.

1.3 Greenland lumpfish

1.3.1 Bycatch baseline

An average of 7,948 birds were estimated caught per year in the Greenlandic lumpfish fishery between 2011 and 2013 (Merkel 2011) (Lassen et al., 2015). Common guillemots/Brünnich’s guillemots *Uria lomvia* and common eiders represented 53% and 42% of the total bird bycatch respectively. King eiders *Somateria spectabilis* and little auks *Alle alle* completed the remainder. In previous years, catches of around 20,000 common eiders/year were estimated by Merkel 2011, although there may be issues with this estimate because of data deficiencies (Lassen et al., 2015). Only two species of marine mammals are found in the inshore waters of the lumpfish spawning grounds during the fishing spawning season: ringed seal and harp seal. Both species are therefore the only reported bycatch species in the lumpfish fishery and in very small numbers, with a total of 68 and 22 individuals respectively for the period 2016-2017 (Lassen et al., 2015, Lassen & Chaudhury 2017). However, this marine mammal bycatch data is not extrapolated to the whole fishery.

An average of 7,948 birds were estimated caught per year in the Greenlandic lumpfish fishery between 2011 and 2013 (Merkel 2011). Marine mammal bycatch is unknown as bycatch data is not extrapolated to the whole fishery.

1.3.2 Data quality on bycatch

In Greenland, under a recently established licence system, all species of fish caught, commercial and non-commercial, must be retained, recorded and landed; all seabirds and marine mammals caught in
the course of fishing must also be reported (Lassen et al., 2015). Hunting wardens monitor a portion of hauled nets on surveillance trips. However, there is uncertainty around the accuracy of the seabird and marine mammal reported catch (Lassen & Chaudhury 2017) and the scientific committee of NAMMCO has recommended that the Ministry of Fisheries validate the catches, assess if bycatch is being reported either as direct catch or bycatch and recommended that alternative methods to assess trends in bycatch are examined (NAMMCO 2017).

**Bycatch data is mainly based on self-reporting and some at-sea inspections of hauls. It is unclear how accurate these data are (NAMMCO 2016).**

1.3.3 **Scores, conditions and management measures implemented**

The Greenland lumpfish fishery received three conditions for outcome, management and information in the bycatch species (2.2.1., 2.2.2 and 2.2.3) component. Conditions set by the assessment team referred to the need to improve data availability to assess the impact of the fishery on bycatch species in general, on Brunnich’s guillemot in particular, and develop a strategy to reduce bycatch of seabirds. The conditions were closed during the second surveillance visit based largely on port-based bycatch data (i.e. birds landed and daily landing reports), combined with some data from at-sea inspections. It is apparent that these two different sources of data were collated and presented in the surveillance report as raw data, intended to represent the sum total of bycatch in the fishery. Birdlife contested this approach, highlighting that it presented several issues, largely that these separate data sources represented a combination of independent (at-sea inspections) and self-reported (port-based) sources, and were therefore open to biases and should be assessed and analysed separately to determine the scale of bycatch in the fishery. Except more controls on fishing effort and the prohibition of offering seabird bycatch for sale, in place since 2004, no new management measures to protect bycatch species have been established since the certification (Lassen & Chaudhury 2017).

**Proposed actions: Corrective actions have mainly focused on improving data quality on bycatch through self-reporting and the establishment of some independent data collection systems.**

**Action implementation: Fishing effort controls have been implemented to reduce seabird mortality but there is no formal monitoring of the effectiveness of this measure. The CAB closed key bycatch conditions on the basis of limited data and consequently no new management measures have been introduced to reduce seabird mortality.**

1.3.4 **Trends in bycatch and population sizes**

In the last surveillance report for the Greenland lumpfish fishery, reported bycatch numbers of guillemots are very low and an average of 281 of common eiders are reported for the period 2016-
2017 (Lassen & Chaudhury 2017). However, these numbers are very low compared to previously reported levels and are based on a combination of self-reporting and sub-sampling effort by hunting inspectors, which is unlikely to provide a realistic estimate of overall bycatch. In Greenland, the most abundant seabird species are the common eider, Brünnich’s guillemot and little auk. Less common are King eider and the common guillemot, which is a relatively rare winter migrant limited to the southern coast of Greenland (Boertmann, 2007, 2009). Although there has been a three to fourfold increase in eider abundance over the past 10–15 years in the country, this species, and Brünnich’s guillemot, are listed as vulnerable (Lassen et al., 2015). Three species of coastal seabirds are categorised as near threatened (NT) because their populations are small: great northern diver, harlequin duck Histrionicus histrionicus and Atlantic puffin Fratercula arctica (Boertmann 2008).

Bycatch trends are unknown. Changes in fishing patterns may have helped to reduce the impact of the fishery on coastal divers. Population sizes for the main bycatch species (Brünnich’s guillemot, common eider) appear to be stable.

1.4 NFA Norwegian lumpfish

1.4.1 Bycatch baseline

The assessment report of the Norway lumpfish fishery (Gaudian et al., 2017), uses a recent estimation (Fangel et al., 2015) and follow up study (2012-2015) (Fangel et al., 2016) of bird bycatch which suggests a bycatch rate of approximately 0.84 birds per trip for the Norwegian lumpfish fishery, resulting in a total bycatch of 2,000-3,000 birds per year. This is dominated by black guillemot (49%), cormorants (23%; both shag and cormorants) and other species, including razorbills Alca torda, common guillemots and common eider (28%) (Fangel et al., 2015). According to the authors of this study, there is considerable variation in bird bycatch depending on season and proximity to the coast, affecting primarily adult black guillemots (Gaudian et al., 2017).

Marine mammal bycatch in the Norwegian lumpfish fishery is unknown, despite the fact that the fishery was identified by coastal fishermen as one of the gear types associated with high incidental mortality of these animals in a pilot study in 2005 (Bjørge et al., 2013). Harbour porpoise, harbour seals and grey seals were mentioned as the most frequently bycaught mammals in this study, although no interactions with marine mammals have been formally reported by the fishery in the last ten years (Gaudian et al., 2017).

Bird bycatch in this fishery appears to be high, dominated by black guillemot and cormorants. Marine mammal bycatch is unknown.

1.4.2 Data quality on bycatch
In Norway, seabirds and marine mammal populations are monitored by NINA and the Institute for Marine Research (IMR) respectively (Gaudian et al., 2017). To evaluate the impact of the lumpfish fishery on seabirds, some fishermen were paid by the Norwegian Institute for Nature Research (NINA) to report a (random) sample of their fishing trips. NINA have also deployed onboard observers, but this is not always practical as these vessels are very small (Baerum, K. pers. comm.). Mandatory electronic logbooks are also supposed to be submitted by all vessels >15m to record any interactions with seabirds (including ‘zero’ results). However, there is no formal bycatch monitoring programme on Norwegian lumpfish vessels, as they do not compose part of the Coastal Reference Fleet (CRF) (Gaudian et al., 2017).

*Bycatch data are not formally collected in the Norwegian lumpfish fleet; seabird data considered in this MSC assessment came from a small sample of self-reporting fishers.*

1.4.3 Scores, conditions and management measures implemented

The Norwegian lumpfish fishery received three conditions for outcome, management and information in the ETP (2.3.1, 2.3.2 and 2.3.3) component during the assessment process. In the assessment report there was not any reference to specific bycatch species in the conditions set. As a result of a comment sent by Birdlife on the PCDR, the assessment team included specific reference to the type of data necessary (self-reported and independent data) to adequately assess the impact of the fishery on seabirds and to implement a strategy to minimise seabird bycatch in which alternative measures are explored (including technical mitigation measures and spatial and temporal limitations) (Gaudian 2017). The client action plan addressed these conditions. The implementation cannot be evaluated due to the recent certification.

Proposed actions: Conditions set by the team were improved based on stakeholders’ comments. They are strong, focused on data collection and implementing a bycatch reduction strategy, and have been addressed in the client action plan.

Action implementation: Corrective actions have not been introduced yet for the fishery due to the recent certification.

1.4.4 Trends in bycatch and population sizes

Trends in seabird bycatch cannot be evaluated for this fishery as these have not been monitored over an extended period and the fishery was only certified very recently (Gaudian 2017).

A large proportion of the seabird species in the Northeast Atlantic are in decline (e.g. ICES, 2013), and many populations inhabiting Norwegian waters have been significantly reduced over the last decades.
Rates of population change over the last ten years are disturbingly negative for a large number of populations, although on average still worse for pelagic (-5.1% p.a., n=33) than coastal (-3.5% p.a., n=33) species. Such rates will reduce a population by 50% in only 13 or 19 years, respectively (Anker-Nilssen et al., 2017). The situation seems to be especially severe for pelagic species such as northern fulmar, common guillemot, Atlantic puffin and black-legged kittiwake *Rissa tridactyla* (Kålås et al., 2010). Common guillemot (CR), Brunnich’s guillemot (EN), Razorbill (EN) and common scoter *Melanitta nigra* (NT) are now listed on Norway’s red list (Norwegian Red List 2015). Common guillemots in particular have a very small population in Norway (an estimated 35,000 nesting pairs (Fangel et al. 2015; Berglund & Hentati-Sundberg, 2015).

Trends in marine mammal bycatch in the lumpfish fishery cannot be evaluated either, despite being identified as a fishery with high incidental mortality of marine mammals (Bjørge et al., 2013). Based on this information, a programme to monitor bycatch was developed for the cod and monkfish fisheries starting in October 2005, although the lumpfish fishery was not included (NAMMCO 2006).

The Norwegian coast from 62°N to Lofoten was covered by aerial surveys as part of the SCANS-III survey in 2016 (NAMMCO 2016). This is the third of a series of large scale surveys for cetaceans in European Atlantic waters initiated in 1994 in the North Sea and adjacent waters (SCANS 1995). This survey estimated the harbour porpoise population in Norwegian coastal waters at around 24,526 individuals (Hammond et al., 2017). Trends in this population are unknown, although the North Sea population seems to have been stable since the mid-1990s (Hammond et al., 2017).

Trends in bycatch cannot be evaluated because the fishery was certified in 2017 and historical data are limited.

1.5 Norway North East Arctic cod/haddock

1.5.1 Bycatch baseline

According to Fangel et al. (2015), seabird bycatch per unit effort in the Norwegian gillnet cod fishery is lower than in the lumpfish fishery, 0.002 vs 0.038 individuals/net/day. However, due to greater effort in the cod fishery (2,500 cod vessels vs 310 lumpfish vessels in 2009 (Fangel et al., 2015)), the total numbers of seabirds caught in both fisheries are very similar, at around 3,100 – 3,400 individuals for the cod fishery, dominated by auk species (Fangel et al., 2015).

Mohan (2017) estimated marine mammal bycatch mortality of the Norway cod gillnet fishery using two techniques, the traditional stratified ratio technique and a GLM-based approach. Bycatch mortalities ranged from 2,211 to 3,218 for harbour porpoises, from 424 to 600 for harbour seals and from 68 to 128 for grey seals. A recent letter from Norway to the US government gave bycatch
estimates of 3,000 harbour porpoises, 555 harbour seals and 466 grey seals for the cod and monkfish gillnet fisheries combined (Royal Norwegian Ministry of Trade, Industry and Fisheries 2017).

This fishery has a substantial impact on harbour porpoises. Bycatch of seabirds and harbour seals is estimated at around 3,100 – 3,400 and 424- 600 individuals respectively.

1.5.2 Data quality on bycatch

In Norway, bycatch data is obtained from fishing logs from the CRF, which is administered by the IMR. The CRF constitutes a monitored segment of 16 to 24 vessels from the Norwegian coastal fleet, which is comprised of approximately 5500 – 6500 fishing vessels less than 15 m in length (Mahon 2017). The vessels from the CRF are distributed across nine statistical fishing areas, collectively covering the entire Norwegian coastline. Norwegian coastal fisheries for cod, lumpfish and monkfish comprise more than 400 vessels. The CRF accounts for only 1% and 3% of the total landings of cod and monkfish respectively (Bjørge et al., 2013) and does not include lumpfish vessels at all (NAMMCO 2017).

Bycatch data is obtained from fishing logs from the Coastal Reference Fleet (CRF), which is administered by the Institute of Marine Research (IMR). Seabird and marine mammal populations are monitored by NINA and IMR respectively. However, with respect to target catch, the CRF vessels accounted for only 1% of the total landings of cod.

1.5.3 Scores, conditions and management measures implemented

This fishery received one bycatch-relevant condition during the first assessment (in 2011) for 2.3.1 (harp seals and harbour porpoises). This condition was carried over from the initial assessment to the new certification period, based on a process allowed by MSC due to the combination of the inshore and offshore components of the fishery (Nichols et al., 2014). Conditions picked up during the re-assessment, for 2.3.1 and 2.3.2, refer to the need to evaluate the harbour porpoise population, to assess the impact of the fishery on the population and to minimise it if necessary. Bycatch numbers of this species were recently corrected (NAMMCO 2017). The impact of the fishery on porpoises is over the Potential Biological Removal (PBR) recommended by the IMR and although some mitigation measures (e.g. pingers) are being tested, the fishery has not yet implemented any of them to reduce bycatch (Lassen and Sandhya 2017).

Proposed actions: The action plan developed for the first certification period did not require the introduction of any management measures (e.g. pingers or spatial/temporal closures), though at re-certification the need to develop a strategy to reduce bycatch was raised as a condition.
Action implementation: The fishery was permitted to carry over conditions set for the ETP component from the first certification period, despite high bycatch rates of harbour porpoise. Management measures to reduce bycatch have not been introduced at a fishery-wide scale yet, though some vessels have participated in pinger trials.

1.5.4 Trends in bycatch and population sizes

Bird bycatch data in the Norwegian cod gillnet fishery is incomplete and scattered. As explained above, Fangel et al. (2015) estimated a mortality of around 3,100 individuals/year, with auks the most commonly caught species. Although this fishery was first certified in 2011, no new data has been provided in recent years by the assessment teams. The status of the populations of seabirds affected by the fishery is covered in the previous case study.

The number of harbour porpoises caught as bycatch has recently been corrected, as the previous estimations were based on incorrect landings data. The current mortality estimates, between 2,350 and 2,900/year (Mohan 2016) (NAMMCO 2017) are still very high and it is reasonable to assume, in the absence of active mitigation measures, that porpoise mortality has not decreased since the fishery was certified. If the population numbers estimated by the SCANS-III survey are accurate, 10% of the Norwegian harbour porpoise coastal population could be killed by the fishery annually (Mohan 2017, NAMMCO 2017, Hammond et al., 2017).

Bycatch numbers have not changed despite the fishery being certified for more than 6 years. Ten per cent of the coastal population of harbour porpoise could be killed by the fishery annually.

Scores received by the fisheries during the first certification and re-certification processes are shown in table 2 below:

<table>
<thead>
<tr>
<th>PI</th>
<th>Icelandic gillnet lumpfish</th>
<th>ISF Iceland cod/haddock</th>
<th>Greenland lumpfish</th>
<th>NFA Norwegian Lumpfish</th>
<th>Norway North East Arctic cod/haddock</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.1.1</td>
<td>80</td>
<td>80</td>
<td>100</td>
<td>85</td>
<td>80</td>
</tr>
<tr>
<td>2.1.2</td>
<td>85</td>
<td>90</td>
<td>95</td>
<td>95</td>
<td>90</td>
</tr>
<tr>
<td>2.1.3</td>
<td>85</td>
<td>85</td>
<td>100</td>
<td>85</td>
<td>90</td>
</tr>
<tr>
<td>2.2.1</td>
<td>80</td>
<td>95 (100)</td>
<td>75</td>
<td>65 (95)</td>
<td>80</td>
</tr>
<tr>
<td>2.2.2</td>
<td>75 (100)</td>
<td>90</td>
<td>65</td>
<td>75 (90)</td>
<td>90</td>
</tr>
</tbody>
</table>

Table 2 Scores obtained by the fisheries during the MSC certification assessments (numbers in red represent the scoring issues which scored less than 80, which represents “global best practice” level).
1.6 Results

Table 3 RAG summary table for North Atlantic gillnet fisheries

<table>
<thead>
<tr>
<th>Name of the fishery</th>
<th>Evidence from the fisheries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Icelandic gillnet lumpfish</td>
<td><strong>Bycatch baseline:</strong> The number of seabirds caught in this fishery is estimated at around 6,492 individuals/year (MFRI 2017). The fishery is also estimated to have a high impact on grey and harbour seals, with an average of 1,566 and 900 animals caught, respectively, in the period 2014-2016 (MFRI 2017).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Data quality</th>
<th>Proposed actions</th>
<th>Action implementation</th>
<th>Bycatch trends</th>
<th>Final score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amber (1)</td>
<td>Green (2)</td>
<td>Amber (1)</td>
<td>Red (0)</td>
<td></td>
</tr>
</tbody>
</table>

**Justification:**

**Data quality:** Bycatch estimates for the fishery are obtained from self-reported data (logbooks) and from on-board observers. However, observer coverage is low, below 1% (MFRI 2017).

**Proposed actions:** Proposed corrective actions focused on improving logbook returns and collecting independent bycatch data.

**Action implementation:** The Small Boat Owners Association supported a project with Birdlife International to evaluate seabird bycatch in the fishery, and these data, together with higher levels of government observer data and self-reported information, were fed into the certification process. This information raised concerns about the impact of the fishery on other species (black guillemot, grey and harbour seal) (MFRI 2017), leading to the suspension of
the certification until corrective actions are resolved. No other management actions were implemented before the fishery was suspended; corrective action proposals included potential spatial closures, though it is not clear to what extent these are being implemented.

**Bycatch trends:** Seabird bycatch appears to be decreasing, although this may be an artefact of low observer coverage and could be linked to decreasing fishing effort. Marine mammal bycatch appears to be increasing, though this could be linked to aforementioned observer coverage issues. Seal and black guillemot bycatch was recently identified as a significant problem in this fishery.

<table>
<thead>
<tr>
<th>ISF Iceland cod/haddock</th>
<th>Bycatch baseline: The number of seabirds caught in this fishery are estimated at around 2,547 individuals/year, with northern fulmar the most common species (MFRI 2017). Harbour porpoise bycatch is high, with an average of 1,841 individuals caught per year (MFRI 2017).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data quality</td>
<td>Proposed actions</td>
</tr>
<tr>
<td>Amber (1)</td>
<td>Amber (1)</td>
</tr>
</tbody>
</table>
| **Justification:**     | **Data quality:** Bycatch estimates in this fishery come from three sources: self-reported data (logbooks), data from on-board observers and data from the scientific cod gillnet surveys (MFRI 2017). However, observer coverage is low - below 1%, and the scientific cod survey only covers 2% of fishing effort.

**Proposed actions:** No conditions were set for the fishery during the first assessment process, but stakeholder comments were addressed during the recertification process and conditions added to improve bycatch reporting and reduction strategies.

**Action implementation:** Management measures have focused on improving logbook returns. No other actions have been implemented.

**Bycatch trends:** A peak in harbour porpoise bycatch was observed in 2016 with 2,618 individuals caught. Seabird bycatch is not showing an obvious trend, and limited observer coverage affects the ability to determine this.

| Greenland lumpfish | Bycatch baseline: An average of 7,948 birds were estimated caught per year in the Greenlandic lumpfish fishery between 2011 and 2013 (Merkel 2011). |
Marine mammal bycatch is unknown as bycatch data it is not extrapolated to the whole fishery.

<table>
<thead>
<tr>
<th>Data quality</th>
<th>Proposed actions</th>
<th>Action implementation</th>
<th>Bycatch trends</th>
<th>Final score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red (0)</td>
<td>Amber (1)</td>
<td>Red (0)</td>
<td>Amber (1)</td>
<td></td>
</tr>
</tbody>
</table>

**Justification:**

**Data quality:** Bycatch data is mainly based on self-reporting and some at-sea inspections of hauls. It is unclear how accurate these data are (NAMMCO 2016).

**Proposed actions:** Corrective actions have mainly focused on improving data quality on bycatch through self-reporting and the establishment of some independent data collection systems.

**Action implementation.** Fishing effort controls have been implemented to reduce seabird mortality but there is no formal monitoring of the effectiveness of this measure. The CAB closed key bycatch conditions on the basis of limited data and consequently no new management measures have been introduced to reduce seabird mortality.

**Bycatch trends:** Bycatch trends are unknown. Changes in fishing patterns may have helped to reduce the impact of the fishery on coastal divers. Population sizes for the main bycatch species (Brunnich’s guillemot, common eider) appear to be stable.

**NFA Norwegian Lumpfish**

**Bycatch baseline:** Fangel et al., 2015 estimated a bird bycatch of around 2,000-3,000 birds per year, dominated by black guillemot (49%) and shags/cormorants (23%). Marine mammal bycatch is unknown.

<table>
<thead>
<tr>
<th>Data quality</th>
<th>Proposed actions</th>
<th>Action implementation</th>
<th>Bycatch trends</th>
<th>Final score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red (0)</td>
<td>Green (2)</td>
<td>Amber (1)</td>
<td>Amber (1)</td>
<td></td>
</tr>
</tbody>
</table>

**Justification:**

**Data quality:** Bycatch data are not formally collected in the Norwegian lumpfish fleet; seabird data considered in this MSC assessment came from a small sample of self-reporting fishers.

**Proposed actions:** The conditions set by the team were improved based on stakeholders’ comments. They are strong, focused on data collection and implementing a bycatch reduction strategy, and have been addressed in the client action plan.
**Action implementation**: Corrective actions have not been introduced yet for the fishery due to the recent certification.

**Bycatch trends**: Trends in bycatch cannot be evaluated because the fishery was certified in 2017 and historical data are limited.

**Norway North East Arctic cod/haddock**

**Bycatch baseline**: This fishery has a substantial impact on harbour porpoises, ranging from 2,200 to 3,200 individuals per year. Bycatch of seabirds and harbour seals is estimated at around 3,100 – 3,400 and 424– 600 individuals respectively.

<table>
<thead>
<tr>
<th>Data quality</th>
<th>Proposed actions</th>
<th>Action implementation</th>
<th>Bycatch trends</th>
<th>Final score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amber (1)</td>
<td>Amber (1)</td>
<td>Red (0)</td>
<td>Red (0)</td>
<td>Red (2)</td>
</tr>
</tbody>
</table>

**Justification**: Data quality: Bycatch data is obtained from fishing logs from the Coastal Reference Fleet (CRF), which is administered by the Institute of Marine Research (IMR). Seabird and marine mammal populations are monitored by NINA and IMR respectively. However, with respect to target catch, the CRF vessels accounted for only 1% of the total landings of cod (Bjørge et al., 2013).

**Proposed actions**: The action plan developed for the first certification period did not require the introduction of any management measures (e.g. pingers or spatial/temporal closures), though at re-certification the need to develop a strategy to reduce bycatch was raised as a condition.

**Action implementation**: The fishery was permitted to carry over conditions set for the ETP component from the first certification period into re-certification, despite high bycatch rates of harbour porpoise. Management measures to reduce bycatch have not been introduced at a fishery-wide scale yet, though some vessels have participated in pinger trials.

**Bycatch trends**: Bycatch numbers have not changed despite the fishery being certified for more than 6 years. Ten per cent of the coastal population of harbour porpoise could be killed by the fishery annually (Mohan 2016, NAMMCO 2016, Hammond et al., 2017).
Case study 2. North Atlantic longline fisheries

Introduction

This case study examines three pelagic longline fisheries certified between 2012 and 2017. Two of these fisheries target swordfish *Xiphias gladius* and tuna species (*Thunnus alalunga*, *T. obesus* and *T. albacares*) in waters off the East Coast of Canada and the US. Assessment of two separate US fisheries (both numbered ‘7’ in table 4) was combined into a single fishery as these fall under the same management regime. The Spanish fishery, operating in North and South Atlantic waters, also targets blue shark *Prionace glauca* in addition to tuna and swordfish species. Two of these fisheries (the Spanish fishery, which was not ultimately certified, and the US SSLLC fishery, which was certified but then suspended) withdrew from the program in 2016 and 2017 (see table 4) but they have been included in this review because it allows us to compare performance between different versions of the MSC standards. Another US longline fishery was certified in 2011 but it has not been included here as it was withdrawn from the MSC more than 5 years ago and no surveillance visits were undertaken after the certification of the fishery.

Pelagic longline fisheries have a potentially high impact on pelagic sharks (i.e: Carcharhinidae), sea turtles, marine mammals and pelagic seabirds. In this case study, the focus is on the impact on sharks, sea turtles and marine mammals (pelagic seabird bycatch is not recorded as a major issue in these fisheries).

The name of each fishery (as shown on the MSC website), year of first certification and re-certification, and version of the MSC standard they were certified under are shown in Table 4.

<table>
<thead>
<tr>
<th>Name of the fishery</th>
<th>Date of the first certification</th>
<th>Version of the MSC standard</th>
<th>Date of the re-certification</th>
<th>Version of the MSC standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>6. North West Atlantic Canada Longline Swordfish</td>
<td>April 2012</td>
<td>v.1.0</td>
<td>December 2017</td>
<td>v.1.3¹</td>
</tr>
<tr>
<td>7. US North Atlantic Swordfish Pelagic Longline and Handgear Buoy Line Fishery</td>
<td>June 2015</td>
<td>v.1.2</td>
<td>In assessment²</td>
<td>v.1.3</td>
</tr>
<tr>
<td>7. SSLLC US North Atlantic Swordfish Longline Fishery</td>
<td>December 2014²</td>
<td>v.1.2</td>
<td>NA</td>
<td>NA</td>
</tr>
</tbody>
</table>
2.1 North West Atlantic Canada Longline Swordfish

2.1.1 Bycatch - baseline

Elasmobranch species are regularly caught in the Canadian longline fishery. The average catch of blue shark *Prionace glauca* in this fishery over the period 2011-2015 was approximately 1,512 t per year, a volume higher than that of the main target species in this fishery, swordfish, with 1,369 t per year (Knapman et al., 2017). The majority of this blue shark is discarded as this species has no commercial value in North America (Campana 2016b). Other shark species caught in the fishery include shortfin mako *Isurus oxyrinchus* and porbeagle *Lamna nasus*, with an average catch of 81.7 t and 19.8 t per year respectively over the same period. Common thresher shark *Alopias vulpinus*, with 9.3 t per year and Atlantic manta ray *Manta birostris* with 3.2 t year complete the five most-caught elasmobranch species (Knapman et al., 2017). Other elasmobranch species caught in the fishery include hammerhead sharks *Sphyrna spp.*, pelagic stingray *Pteroplatytrygon violacea*, longfin mako *Isurus paucus* and oceanic whitetip shark *Carcharhinus longimanus* (Knapman et al., 2017). Of these species, swordfish, shortfin mako and porbeagle are retained and all others are discarded, resulting in more than 45% of the volume caught in this fishery being discarded.

The Canadian fishery also catches two species of sea turtles, leatherback *Dermochelys coriacea* and loggerhead *Caretta caretta*. The estimated annual average catch for these species in the period 2011-2015, was 25.5 t. and 6.1 t. per year, respectively (Knapman et al., 2017). This corresponds to 60-90 encounters per year since 2012 for leatherback turtles (Knapman et al., 2017). The fishery also interacts with the endangered Scotian Shelf Northern Bottlenose Whale *Hyperoodon ampullatus* (there have been two entanglements in the last 20 years), which has an average population estimate of only 163 individuals (Harris et al. 2013).
This fishery reports high levels of shark (including blue, shortfin mako, porbeagle and thresher sharks) and sea turtle bycatch. The volume of blue shark caught annually exceeds the volume caught of the main target species in this fishery, swordfish, but it is discarded because of its low commercial value. Although occasional, bycatch of northern bottlenose whale is significant given the small population size.

2.1.2 Data quality on bycatch

In Canada, landings data for retained species are recorded in logbooks and verified routinely with 100% dockside monitoring in the swordfish fishery (Knapman et al., 2017). Canada's At-Sea Observer Program places certified private-sector observers aboard fishing vessels to monitor fishing activities, collect scientific data and monitor industry compliance with fishing regulations and licence conditions (DFO 2017). Observers are deployed routinely, with a target of 5% coverage for the period 2011-2015, although it increased to 10% for 2017 following a risk review which indicated that there was some uncertainty over the level of discarding from the fishery (DFO 2016, Knapman et al., 2017). Skippers are also required to report catch and interaction with species listed under Species at Risk Act (SARA) in the mandatory SARA logbook. This includes the recording of information on species, hooked or entangled, condition upon release, and whether the gear was removed or not (Devitt et al., 2012).

Bycatch data is obtained from fishing logbooks, port inspections and observer data, which covers around 5% of the trips. The target observer coverage was increased to 10% in 2017 following a risk review which indicates that there was some uncertainty over the level of discarding from the fishery.

2.1.3 Scores, conditions and management measures implemented

In the case of the Canadian longline fishery, during the first certification process it received 6 conditions for P2 related to 2.1.1, 2.1.2, 2.2.2 and 2.3.1, 2.3.2 and 2.3.3. The narrative of the retained and bycatch performance indicators referred to the need to assess the impact on porbeagle and shortfin mako and develop a partial strategy for the conservation of these species alongside blue shark. The ETP related conditions specifically addressed the bycatch of loggerhead sea turtles (Knapman et al., 2017). During the Final Report and Determination consultation period, an objection was lodged by the Ecology Action Center (EAC) on behalf of the EAC, David Suzuki Foundation, Oceana, and Sea Turtle Conservancy (Knapman et al., 2017). This objection was made on the basis that the conditions, milestones and deliverables set by the certification body to address the impact on bycatch species didn’t specify effective and measurable outcomes. Following the MSC Objections Procedure, the determination to certify the fishery was upheld by an Independent Adjudicator. Conditions for
shortfin mako and porbeagle (2.1.1 and 2.1.2) were closed in years 2 and 4 respectively (Knapman et al., 2017). The condition for developing a partial strategy for blue shark (2.2.2) was also closed in year 2. Conditions for loggerhead turtle (2.3.1, 2.3.2 and 2.3.3) were closed in years 3 and 4. Taking into account that bycatch numbers for these species have not decreased, the new information about the poor state of the shortfin mako in the North Atlantic (see section 1.4) and the unfinished actions for sea turtles (see paragraph below), it suggests that these conditions were closed too quickly.

During the re-assessment, no conditions were set. However, the assessment team made five recommendations in the PCDR, of which three were related to bycatch (Knapman et al., 2017c). The assessment team recommended that the client improve the quality and consistency of discard reporting to investigate and implement new approaches, and also recommended a re-running of the Regional Peer Review assessment of incidental catch to assess the approach to incidental catch monitoring (Knapman 2017). A recommendation that the client help with the timely completion of a loggerhead sea turtle tagging study was also set in the Year 4 audit report (Knapman et al. 2017b) and repeated again in the re-certification report (Knapman et al., 2017). Lastly, a new recommendation was included in the FR due to changes in the state of the shortfin mako stock (Knapman et al., 2017). Unlike conditions, recommendations are not the result of a failure to meet the unconditional pass mark; they are non-binding and are not auditable. Arguably, some of these recommendations should have been set as conditions, as observer coverage is still inadequate to assess the impact on bycatch species (mainly sea turtles) due to shifts in fishing areas (Knapman et al., 2017).

In general, ICCAT does not manage fisheries for sharks, but it makes recommendations concerning sharks caught incidentally in ICCAT managed fisheries. Recommendations include measures to discourage shark finning, reduce fishing mortality on some species (including porbeagle and North Atlantic shortfin mako), and prohibit the retention of bigeye thresher, oceanic whitetip, hammerhead and silky sharks. In Canada, some of these measures have been introduced in this fishery through conditions included in the licensing system (DFO 2016c) to which the vessel/owner must adhere.

In Canada, there is a National Plan of Action on the Conservation and Management of Sharks (DFO 2017). Shortfin mako and porbeagle are designated by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) as ‘threatened’ and ‘endangered’ respectively. The strategy for managing sharks includes a 100t bycatch provision for mako shark in all Canadian fisheries. For porbeagle, there is 185t catch limit and all live specimens have to be released alive and recorded in the log. This catch limit represents a mortality rate of approximately 4% (Knapman et al., 2017). However, it is unclear which measures are implemented when these limits are approached or
surpassed. Research to improve knowledge of these species (for example, to quantify post-release mortality) has also been undertaken (DFO 2017b).

Various measures are employed in the swordfish longline fishery to minimise lethal interactions with turtle species, including the use of circle hooks and shallow setting that allows turtles to reach the surface if they take the bait or are entangled, as well as through the mandatory requirement for swordfish skippers to release turtles and to be trained in how to do this safely (ALRT 2006, DFO 2016, Knapman et al., 2012 and 2017). However, the Atlantic Canadian Loggerhead Turtle Conservation Action Plan (ACLTCAP) has not been updated since 2010, and many planned actions remain outstanding (Ecology Action Center pers. comm.).

With regard to northern bottlenose whale, the Gully Marine Protected Area on the Scotian Shelf was created to protect the species and in some areas longlining is not permitted. Harris et al (2013) states that entanglement in pelagic swordfish gear is rare, and a reasonable approach to mitigate such events would be to educate members of the industry in safe handling and release techniques. However, given the small size of the population, this measure seems to be inadequate.

In summary, the industry is working in close collaboration with the Department of Fisheries and Oceans Canada and has implemented a number of mitigation measures to reduce the impact on bycatch species. The annual longline swordfish fishing licences (DFO 2016c) include a list of conditions, some of them referring to bycatch, to which vessels must adhere prior to carrying the activity. Compliance with these measures is enforced by the DFO Conservation and Protection (C&P) staff (Knapman et al., 2017). The fishery also collaborates in a research program examining patterns of bycatch in the pelagic longline fishery, with a view to mitigate catches of sensitive species (DFO 2017b).

Proposed actions: Conditions set by the assessment team during the first certification did not include effective and measurable outcomes, which resulted in conditions being closed prematurely. The recommendations set during the re-certification appear to be based on unfinished tasks from the first certification period and are non-binding and non-auditable.

Action implementation: Various management measures are in place in the swordfish longline fishery for bycatch species, including closed areas, catch limits for shark species, requirements for proper handling and release of identified species-at-risk. However, measures implemented when bycatch limits are approached for sharks are unclear. Many planned actions from the ACLTCAP remain outstanding. Measures for northern bottlenose whale entanglement are also inadequate.

2.1.4 Trends in bycatch and population sizes
Catches of blue, shortfin mako and thresher sharks, Atlantic manta ray, pelagic stingray and other elasmobranch species shown in the re-certification report for the period 2011-2015 are variable and no trends are identified. Landings of porbeagle declined from 9,706 kg in 2011 to 503 kg in 2015, but the estimated total catch was much higher, at around 28.7 t. in 2015. Landings of shortfin mako increased over the same period (Knapman et al., 2017). The catch of blue shark, shortfin mako and porbeagle, the three most-caught shark species in the Canadian swordfish longline fishery, were equivalent to approximately 3.9%, 2.3% and 0.6% respectively of the average total catch of these species in the North Atlantic during the period 2011-2015 (ICCAT 2017, Knapman et al., 2017).

The most recent assessment of the North Atlantic blue shark stock was undertaken in 2015 (ICCAT 2015). All scenarios considered that in 2013 the stock was not overfished and that overfishing was not occurring, in line with the 2008 stock assessment (ICCAT 2015). However, the level of uncertainty in data inputs and assumptions were high, so the possibility that the stock was being overfished and that overfishing was occurring could not be ruled out (ICCAT 2015).

Shortfin mako shark was designated as threatened in Atlantic Canada in April 2006. ICCAT’s latest assessment of shortfin mako, from 2017, highlighted that with a combined probability of 90%, the northern stock is overfished and is undergoing overfishing (ICCAT 2017). For the North Atlantic stock, projections indicated that catches would need to be reduced to 1,000 t or lower to prevent further population declines. Overall, this implies reductions in catches in the order of 72-79% (ICCAT 2017).

The Canadian assessment of the Northwest Atlantic porbeagle stock indicated that biomass is depleted to well below BMSY, but recent fishing mortality is below FMSY and recent biomass appears to be increasing. Under the Canadian strategy of a 4% exploitation rate, the stock is expected to recover in 30 to 100+ years according to the projections. Canadian directed fisheries for porbeagle have been closed since 2013 (ICCAT 2015).

Due to a shift in location of fishing effort in this fleet since the mid-2000s, interactions of the fishery with loggerhead sea turtles have decreased in recent years, whereas interactions with leatherbacks have increased due to the move to more inshore waters (Knapman et al., 2017). According to the DFO Recovery Potential Assessment for loggerhead sea turtle, the swordfish longline fishery interacted with an estimated average of 1,200 loggerhead sea turtles annually (estimated on-board mortality 200-500 individuals) between 2002 and 2008 (DFO 2010). Current interactions are estimated in the hundreds. The total number of leatherback turtles caught in the swordfish longline fishery is estimated to be 60-90 per year since 2006. Numbers of leatherback interactions for the period 2011-2015 in the recertification report do not show a clear trend (Knapman et al., 2017).
In Canada, loggerhead and leatherback turtle species are listed as ‘endangered’ on Schedule 1 of SARA and are also listed on CITES Appendix I. The Northwest Atlantic subpopulation, of relevance to the swordfish longline fishery, is listed as being ‘Least Concern’ by IUCN and shows an overall increasing trend over the past three generations (Casale & Tucker 2017, Ceriani & Meylan 2017). The Northwest Atlantic leatherback turtle (designated as a single management unit (Tiwari et al. 2013)) is large (>50,000 nests yr\(^{-1}\), ~10,000 females yr\(^{-1}\)), has increased by 20.6% over the past three generations, and is projected to increase to >180,000 nests yr\(^{-1}\) by 2040. It is therefore also considered Least Concern under IUCN Red List Criteria and (Wallace et al. 2013). So, impacts of the fishery on these populations are not apparent.

Interaction with the Scotian Shelf Northern bottlenose whale has not been adequately quantified. This species is listed as ‘endangered’ under SARA in 2006. In 2011, COSEWIC reassessed the populations and designated the Scotian Shelf population as Endangered. Records indicate that the species may also interact with the fishery, but frequency of entanglements and incidental catch of this species is unknown, and the resultant mortality rate has not been quantified. Through sightings data and a photographic catalogue, Whitehead and Wimmer (2004) estimated the size of the northern bottlenose whale Scotian Shelf population to be 163 individuals (95% CI 119–214). The size of the population has been relatively stable since 1988 and there is no discernible trend in abundance (Gowans et al. (2001); Whitehead and Wimmer (2005); DFO’s Recovery Potential Assessment). However, the potential biological removal for the Scotian Shelf population of Northern Bottlenose Whales is low, estimated at 0.3 whales per year (Harris et al. 2007) and every single entanglement could potentially be significant. Interactions with pilot whales were also considered in 2012 during the first certification report but no references to this species were made during the re-assessment (Devitt et al., 2012, Knapman et al., 2017).

**Trends in bycatch of shark species are uncertain. Shortfin mako and porbeagle are overfished.** Due to a shift in fishing areas, interactions with loggerhead turtles have decreased whereas interactions with leatherbacks have increased in recent years. Populations of both species in the area are increasing. The potential biological removal for the Scotian Shelf population of Northern Bottlenose Whales is low, less than 1 whale per year.

2.2 **United States swordfish fisheries (US North Atlantic Swordfish Pelagic Longline and Handgear Buoy Line Fishery and SSLCC US North Atlantic Swordfish Longline Fishery).**

2.2.1 **Bycatch baseline**
Two US longline fisheries are included in this case study, the US North Atlantic swordfish and the SSLLC US North Atlantic swordfish Longline.

In the re-assessment report of the US North Atlantic swordfish fishery, bycatch is reported in number of individuals as opposed to tonnage. Total catch of blue shark for the period 2012-2016 was 190,739 individuals (Parkes et al., 2017). Shortfin mako shark was the second most numerous elasmobranch species caught by the fishery with 14,322 individuals (UoA 76 t. in 2016). Tiger *Galacerus cuvier*, hammerhead, silky *Carcharhinus falciformis*, sandbar *Carcharhinus plumbeus* and porbeagle sharks complete the main shark species caught by the fishery with 8,065, 6,778, 5,057, 4,729 and 4,122 individuals respectively (Parkes et al., 2017). IUCN vulnerable sharks (Amorim et al., 2009, Reardon et al., 2006) such as bigeye thresher and longfin mako are also caught by the fishery in lower numbers. With the exception of makos, all these species are discarded (Parkes et al., 2017).

In the same period 2012-2016, this fishery caught 363 and 321 leatherback and loggerhead sea turtles respectively (Parkes et al., 2017). Additionally, due to incidental mortality and serious injury to marine mammals (primarily of pilot whales (*Globicephala sp.*) in the mid-Atlantic), the US Atlantic pelagic longline fishery is classified as a Category I fishery, i.e. fisheries with frequent serious injury or mortality to marine mammals (NOAA 2017a). The mean annual fishery-related mortality/serious injuries between 2010 and 2014 were estimated to total 192 short-finned pilot whales *Globicephala macrorhynchus* (Harvey et al., 2016), which is above PBR. Risso’s dolphin *Grampus griseus* is the next most frequently caught marine mammal in the fishery with nine individuals recorded caught from 2012 to 2016 (Parkes et al., 2017).

Data provided by the assessment team on bycatch species in the SSLLC US fishery is difficult to interpret. The bycatch information in the report is based on observer data for the period 2005-2011 but it seems that estimates are not extrapolated to the fleet level. Based on the data provided in the logbooks for the area where the fishery occurs, it appears that 9,245 t. of swordfish and 643 t. of mako were retained by the fishery in this period (Aldous et al., 2015). Other species reported by the fishery are sand bar, hammerhead, thresher and blue sharks. However, as these species are not retained, their numbers are not adequately recorded in logbooks. Based on observer data for all areas included in the fishery, blue shark represents 21.5% of the catch, pelagic ray 4%, and silky and tiger sharks around 1% (Aldous et al., 2015). Other species caught by the fishery are dusky shark *Carcharhinus obscurus* (0.25%), porbeagle (around 0.2% of the catch) and longfin mako (0.09%) (Aldous et al., 2015).

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1 These fisheries are treated together as they occur in the same area and under the same management regime. Their impact on bycatch species and the management measures implemented in both fisheries are very similar.
In the same period (2005-2011), 301 loggerhead and 140 leatherback turtles interacted with the fishery (Aldous et al., 2015). Again, it is unclear if this data is extrapolated to the fleet level. According to the report, the most recent estimates of turtle takes in the entire Atlantic US Pelagic Longline fishery in 2011 were leatherback turtles - 238.5 (95% CI 156.8-362.8) and Loggerhead turtles - 437.6 (95% CI 309.1-619.5) (Garrison and Stokes (2012)). A total of 83 pilot whales also interacted with the fishery, as well as ten other species of marine mammals, including dolphins (Risso’s dolphins, bottlenose dolphins *Tursiops truncatus*) and whales (particularly minke whale *Balaenoptera acutorostrata*) (Aldous et al., 2015).

This fishery reports high levels of shark bycatch, including blue, shortfin mako, tiger and thresher among others, as well as sea turtles. The impact on short-finned pilot whales is above PBR and swordfish longline is considered a category I fishery by NOAA.

2.2.2 Data quality on bycatch

In the US fisheries, there are two main sources of information on bycatch: the Fishery Logbook System (FLS), a mandatory self-reporting system and the Pelagic Observer Program (POP). Skippers are required to record the numbers of target species and discards, specifying if they were retained onboard or released alive or dead (Aldous et al., 2015, Parker et al., 2017). In addition, skippers have to report the number of protected species encountered, providing details of the nature of the interaction and whether individual animals were injured or killed (Parkes et al., 2017). The Pelagic Observer Program began in 1992, and observers record fish species, length, weight, sex, location, and environmental information and the disposition of the catch (retained or discarded). The condition of animals released alive is also registered (Aldous et al., 2015, Parker et al., 2017).

Substantial discrepancies and inconsistencies have been identified between logbook and observed data, suggesting incomplete reporting of protected species interactions by fishermen (Parker et al., 2017). Therefore, the US National Marine Fisheries Service (NMFS) primarily uses POP data to estimate discard rates when such data is available (Aldous et al., 2015). Garrison and Stokes (2012) concluded that the observer coverage in the pelagic longline fishery is generally high compared to other commercial fisheries and the sampling level is sufficient to provide reasonably precise estimates of interaction with protected species. In the US North Atlantic swordfish fishery, observer coverage doubled from 2012, representing 14.5% of the hauls in 2016 (Parkes et al., 2017).

Bycatch data is obtained from fishing logbooks, port inspections and observer data, which in 2016 covered around 14.5% of the hauls. Substantial discrepancies have been identified between
logbook and observer data, suggesting incomplete reporting of protected species interactions by fishermen.

2.2.3 Scores, conditions and management measures implemented

The US North Atlantic swordfish fishery received five P2 conditions at certification related to non-target bycatch. One condition on PI 2.5.3, referring to the development of a research plan for evaluating the fishery impacts on ecosystem structure and function, was closed at the first surveillance visit. The condition on P.I. 2.3.2, related to limiting longline length to no more than 20 nautical miles, was closed at the second annual audit. Conditions on 2.3.1(a), referring to the need for separate estimates of long and short-finned pilot whale bycatch, were closed at the third annual audit. As the impact on short-finned pilot whale was above PBR, one new condition on 2.3.1(b) was applied to the fishery at the third annual audit. During the fourth surveillance audit the assessment team stated that: “five years may not be sufficient time to develop and implement a final rule and to have pilot whale take reduced in following years sufficient to bring the 5-yr average below the PBR”. However, 6 months later, during the recertification assessment, the assessment team closed this condition based on the rationale that marine mammals affected by this fishery (pilot whales and Risso’s dolphin) are not endangered or threatened and do not require recovery or rebuilding (Parkes et al., 2017). This interpretation of the ETP definition in the MSC program and the meaning of PBR is questionable as these are protected species and the impact of the fishery is over the level set by the authorities.

At the time of the third annual surveillance audit, MSC approved a variation request to align the conditions and the condition milestones with those of the more recently certified SSLLC fishery (which has since withdrawn from the MSC program) (Parkes & Valle-Esquivel 2017). Conditions on bycatch and ETP information (2.2.3 and 2.3.3), referring to billfish (out of the scope of this review) and to improve monitoring interactions with ETP species, respectively, were carried over during the re-assessment and are expected to be closed during the re-certification period, at the second and the fourth surveillance audit respectively (Parker et al., 2017). Taking into account the quick withdrawal of the SSLLC fishery from the MSC program, it is unclear if these time extensions were sufficiently justified.

When the SSLLC US North Atlantic swordfish longline underwent certification, it received three conditions, for 2.2.3, 2.3.1 and 2.3.2. A notice of objection was submitted by Day Boat Seafood LLC (DBSLLC), asserting irregularities in the harmonisation with the overlapping fisheries and a failure of peer review and stakeholder consultation. The David Suzuki Foundation, the Ecology Action Centre, the New England Aquarium, Oceana, Sea Turtle Conservancy and the Pew Charitable Trusts provided a joint submission supporting the objection. As result of this objection, the assessment teams
redrafted some of their scoring rationales and revised their conditions and milestones so that they were the same as the other certified fishery. In this case, progress in the implementation of the conditions cannot be evaluated as this fishery withdrew from the program before the first surveillance visit.

NOAA Fisheries manages bycatch and its impacts through several authorities, including the Magnuson-Stevens Fishery Conservation and Management Act (MSA), the Marine Mammal Protection Act (MMPA), the Endangered Species Act (ESA), and other domestic laws and international agreements. ICCAT recommendations are also implemented in the United States under the authority of Atlantic Tunas Convention Act (ATCA) (Parkes et al., 2017). In 2016, NMFS developed the National Bycatch Reduction Strategy (NMFS 2016) with the goal of coordinating U.S. efforts to reduce bycatch and bycatch mortality in support of sustainably managing fisheries and recovering and conserving protected species (NOAA 2017d). For the purposes of this strategy, reducing bycatch includes efforts to minimise the amount of bycatch, as well as minimise the mortality, serious injury, and adverse impacts of bycatch that does occur (NOAA 2017d).

Most of the shark species are managed under the highly migratory species fishery management plan (HMS FMP) (NFMS 1993, NOAA 2006) which identifies three management groups: large coastal sharks, small coastal sharks, and pelagic sharks, setting commercial quotas for each complex. This plan has been amended several times and new measures introduced: reduction of quotas in response to declines in Atlantic shark abundance, establishment of separate quotas for porbeagle and blue sharks, new commercial and recreational management measures for shortfin mako, and prohibition of the retention of several shark species such as longfin mako or bigeye thresher sharks by commercial fisheries (Parker et al., 2017). In March 2018, NOAA implemented a series of emergency regulations to address overfishing of North Atlantic shortfin mako sharks (NOAA 2018e).

With regard to marine mammals, as stated above, the longline fishery is classified as category I\(^2\) and NMFS established a take reduction team to address the incidental mortality and serious injury of long-finned and short-finned pilot whales in the mid-Atlantic region of the Atlantic pelagic longline fishery. A number of recommendations were included in a draft ‘Take Reduction Plan’ in 2006, including limiting longline length (which has been implemented, as noted above) and reducing soak times, though the extent to which these recommendations have been implemented appears variable (NOAA 2017e).

\(^{2}\) Fisheries with frequent serious injury or mortality to marine mammals
Proposed actions: Management measures for the swordfish longline fishery include catch limits, TACs for shark complexes, prohibition of retaining some species, minimum size limits for retained sharks, time/area/gear restriction, use of circle hooks and use of de-hooking devices. Impacts and measures for short-finned pilot whales have been identified, though proposed actions were not substantive.

Action implementation: Implementation of measures for sharks appears to be adequate. However, the condition set to minimise the impact of the fishery on short-finned pilot whales was closed in spite of catch levels above PBR, with the rationale that this species was neither endangered or threatened. The harmonisation carried out for separate certified U.S. fisheries resulted in time extensions for closing conditions.

2.2.4 Trends in bycatch and population sizes

Total reported numbers of sharks and rays caught in the US longline fishery (FLS data) were 277,225 individuals for the period 2005-2011 (Parkes et al., 2013) and 244,656 individuals between 2012 and 2016 (Parkes et al., 2017). Decreases in the numbers caught were identified in blue shark (208,391 versus 190,739), shortfin mako (23,376 versus 14,233), silky, sandbar, dusky sharks and common thresher, whereas increases in porbeagle (2,319 versus 4,122) and tiger shark (1,296 versus 8,065) were recorded. The number of hammerhead sharks caught were largely constant (around 6,800-6,900). Although some of these species are not commercial and are released, post-release mortality rates are variable. For example, Campana et al. (2016) looked at hooking and post-release mortality rates for blue shark, porbeagle and shortfin mako and the overall non-landed fishing mortality in the pelagic longline fishery was estimated at 23.1% (95% CI: 16–30%), 59.1% (95% CI: 46–72%) and 49.3% (95% CI: 23–73%) respectively. Silky sharks are thought to have a 60-80 % catch mortality and additional 50-60% post release mortality (Simpfendorfer et al., 2011, Eddy et al., 2016, Poisson et al., 2014). POP data also shows that almost 50% of the thresher sharks, longfin mako and hammerhead sharks were released dead (Parkes et al., 2017). Post release mortality for other species is unknown. According to Cortes et al., (2008), bigeye thresher, longfin and shortfin makos, porbeagle, and night sharks are the most vulnerable stocks to pelagic longline fishing. The stock status of these species is noted above.

Sea turtle population status is covered above and appears to be adequate despite the bycatch recorded. The best available abundance estimates for short-finned pilot whale are from aerial and ship surveys conducted during the summer of 2011. At the time the population was estimated at 21,515 (Palka 2012, Garrison & Stokes 2016). Population trends cannot be estimated (Harvey et al.,
However, the estimated mean annual fishery-related mortality and serious injury during 2010–2014 due to the pelagic longline fishery is above PBR which is estimated at 159 (Harvey et al., 2016).

The SSLLC US North Atlantic swordfish Longline withdrew from the MSC process before the first surveillance visit and changes in bycatch cannot be evaluated.

**Catches of sharks and interactions with sea turtles and marine mammals appear to be stable and no trends are observed, though short-finned pilot whale bycatch is above PBR. Trends in catches cannot be evaluated in the SSLLC US North Atlantic swordfish Longline because the fishery withdrew from the program before the first surveillance visit.**

### 2.3 Spanish North and South Atlantic swordfish longline fishery

#### 2.3.1 Bycatch - baseline

In the North Atlantic Spanish swordfish longline fishery, the blue shark is by far the largest component of the catch (76%), with a reported annual average catch of around 9,000 t. in the period 2010-2014. Swordfish only represents 13.8% of the catch, at around 1,631 t per year. Shortfin mako, at 696 t. per year and 5.9% of the total catch, is the third most-caught species by weight (Espino et al., 2016). In the Spanish swordfish longline fishery carried out in the South Atlantic, blue shark is also the main catch, with an annual catch of 8,900 t in the period 2010-2014. In this case, this species represents 59% of the total catch (Espino et al., 2016). In this fishery, swordfish represents 25% of the catch at 3,800 t per year. Shortfin mako is again the third most-caught species by weight, with 800 t. caught per year in the same period (Espino et al., 2016). Other shark species caught in the fishery (but not reported in logbooks) include porbeagle, thresher sharks, hammerheads and other species such as silky, oceanic whitetip and tiger sharks (Espino et al., 2016). Based on observed data from the Spanish Institute of Oceanography (IEO), it is estimated that the UoA catches between 50-200t thresher sharks each year and over 150t of hammerhead sharks (Kanstinger et al., 2016).

Loggerhead, leatherback sea turtles and to a lesser extent other sea turtles such as green turtle *Chelonia mydas* also interact with this fishery, with an overall encounter rate for all the turtle species of between 3.0 and 4.24E-04 specimens per hook (Mejuto et al., 2006) (ICCAT 2014). Six species of marine mammal are included in the ICCAT list of species that interact with longline fisheries: fin whale *Balaenoptera physalus*, pilot whale, Risso’s dolphin, striped dolphin *Stenella coeruleoalba*, bottlenose dolphin and Cuvier’s beaked whale *Ziphius cavirostris*. False killer whales *Pseudorca crassidens* also interact with the fishery (pers. observation). Total bycatch of these species are not shown in the draft certification report (Espino et al., 2016).
The fishery has a high impact on sharks and sea turtles. Blue shark represents 76% of the total catch and is the main target species.

2.3.2 Data quality on bycatch

Skippers and onboard officers must record fishing activity in logbooks. They are required to report the number and weight of each species caught, numbers of animals retained or discarded (alive or dead), the setting positions, technical characteristics of the fishing gears, and soak times (Espino et al., 2016). In accordance with the Spanish order AAA/658/2014, all interactions with ETP species must be registered, recording the species, the result of the interaction (dead, live, released live specimen), date and position. However, no interactions with ETP species were recorded in the logbooks of any vessel included in any of the two UoAs between 2010 and 2014 (Espino et al., 2016).

The Spanish Institute of Oceanography oversees the observer program conducted in the Spanish longline fleet as part of the EU Data Collection Framework. On-board observers collect data on swordfish, tuna, billfish, and elasmobranch bycatch, as well as the incidence of unwanted incidental catch, including birds, turtles, and marine mammals. This programme complements other monitoring and scientific sampling programmes undertaken at the port (Espino et al. 2016). However, this fishery has extremely low observer coverage of only 1% in the North Atlantic and 3% in the South Atlantic, despite ICCAT requirements for at least 5% coverage (Kanstinger et al., 2016).

Contravening Spanish laws and ICCAT recommendations, interactions with sea turtles and sharks (except blue sharks) were not recorded in logbooks between 2010 and 2014. Observer coverage in the fishery is very low at around 1-3%.

2.3.3 Scores, conditions and management measures implemented

The Spanish swordfish fishery scored less than 80 in two P.I. of the ETP species components, impact (2.3.1) and information (2.3.3), and therefore received two proposed conditions in the PCDR to improve the level of information to assess the impact of the fishery on sea turtles and shark species (Espino et al., 2016). As this fishery withdrew from the program after the publication of the PCDR, progress on conditions cannot be assessed. A coalition of NGOs (The Shark Trust, Project AWARE, SUBMON, Ecology Action Centre and WWF) submitted comments on the PCDR (Kanstinger et al., 2016). These NGOs raised serious general concerns regarding the lack of governance and management of shark species in the affected area, at EU and ICCAT levels (Kanstinger et al., 2016). This coalition also highlighted other technical issues, such as the CAB’s decision not to use the RBF to assess bycatch and ETP species, and the inclusion of some species as minor/main catch (Kanstinger et al., 2016).

Notably, the initial intention of the fishery was to include blue shark alongside swordfish (i.e: target
species assessed under P1), but blue sharks were removed from P1 due to the difficulties that certification presented for this species (Bureau Veritas 2016).

Spanish Law 42/2007 on Natural Heritage and Biodiversity gives protection to wildlife throughout Spain and its surrounding marine Exclusive Economic Zone (EEZ), and it also applies to the entire Spanish fishing fleet including that working in international waters. The law covers the List of Wild Species under a Special Protection Regime (LESPE), and the Spanish Catalogue of Endangered Species (CEA), which includes several species of shark, including thresher and hammerhead sharks. These species were therefore considered ETP in this assessment (Espino et al., 2016). Since 2010 the EU TAC for porbeagle in European waters has also been set at zero (ICCAT 2016).

However, despite ICCAT recommendations and national legislation on shark bycatch, the fishery does not report discards and observer coverage is too low for the necessary spatial and temporal coverage. Some species, like the longfin mako shark, remain completely unprotected and unassessed, while discarding rates and post release mortality are not incorporated into management decision making (Kanstinger et al., 2016). The fishery is considering participation in a Fisheries Improvement Programme (FIP) to improve management (MSC and WWF Spain pers. comm.).

Proposed actions: This fishery principally catches blue shark. However, this was removed from P1 due to difficulties that certification of this species presented, resulting in the fishery being termed a swordfish fishery. This raised a fundamental concern around the fishery being certified for a small proportion of its catch, while impacts on blue shark continued.

Action implementation: As the fishery left the MSC program, improvements in management cannot be evaluated but it appears that no major changes have been introduced. Some species remain completely unprotected and unassessed in the area. The fishery is currently involved in a FIP.

2.3.4 Trends in bycatch and population sizes

Trends in bycatch in the Spanish longline fishery cannot be evaluated. However, it is apparent that improvements have not been made in recent years (WWF Spain pers. comm.). As stated in the bycatch section, blue shark, mako shark and porbeagle are regularly caught. Leatherback and loggerhead turtles also interact with the fishery.

In the most recent ICCAT stock assessment for South Atlantic blue shark, the models were disperse (ICCAT 2015). The authors explicitly stressed that the results should be interpreted with caution, that quantitative projections of future stock condition are not possible and that it was not possible to determine whether the stock was overfished or overfishing was occurring (Kanstinger et al., 2016).
In the 2017 shortfin mako assessment, the results from the different models used to assess the South Atlantic stock were disparate (ICCAT 2017). The combined model results indicate a probability of 19% that the stock was both overfished and experiencing overfishing. The ICCAT group considered the stock status results for the South Atlantic to be highly uncertain. Despite this uncertainty, it is not possible to discount that in recent years the stock may have been at, or already below, BMSY and that fishing mortality is already exceeding FMSY. No projections were conducted for the South Atlantic due to these uncertainties (ICCAT 2017).

In 2009, the Standing Committee Research and Statistics (SCRS) attempted an assessment of the four porbeagle stocks in the Atlantic Ocean: Northwest, Northeast, Southwest and Southeast (ICCAT, 2010). For the northeast stock, exploratory assessments indicate that biomass is below BMSY and that recent fishing mortality is near or above FMSY. Recovery of this stock to BMSY under no fishing mortality is estimated to take ca. 15-34 years (Espino et al., 2016). Data for southern hemisphere porbeagle were considered too limited to provide a robust indication on the status of the stocks (ICCAT 2010, Kanstinger et al., 2016). A recent risk assessment for porbeagle shark in the southern hemisphere (Hoyle et al., 2017) treats the population as five separate subpopulations, and provides estimates of the risk of exceeding the maximum impact sustainable threshold limit reference point. Results indicate low fishing mortality rates and low risk from commercial pelagic longline fisheries to porbeagle shark over the spatial domain of the assessment (Hoyle et al., 2017). These results are consistent with the trends observed in catch rate indicators over the entire Southern Hemisphere range of the porbeagle shark population, which in most cases show stable or increasing catch rates (Hoyle et al., 2017).

The North East Atlantic subpopulation of loggerhead sea turtle only nests in the Cape Verde Archipelago and is listed as endangered on the IUCN red list (Casale & Marco 2015). Based on an encounter rate of 0.00080 turtles per hook in the North Atlantic Area (Garcia-Cortes 2015) and the fishing effort of this UoA in this area in 2015, Kanstinger et al., (2016), concluded that over 3,200 turtles are caught in this relatively small area around Cape Verde each year by this fishery. This subpopulation is estimated at 10,000-20,000 nests per year and 8,900 adult females (Marco et al. 2012).

Trends in bycatch cannot be evaluated. Shortfin mako and porbeagle are overfished. The North East population of loggerhead sea turtle is endangered.

Scores received by the fisheries during the first certification and re-certification processes are shown in table 5 below:
Table 5 Scores obtained by the fisheries during the MSC certification assessments (numbers in red represent the scoring issues which scored less than 80, which represents “global best practice” level).

<table>
<thead>
<tr>
<th>PI</th>
<th>SSLLC US North Atlantic swordfish Longline</th>
<th>North and South Atlantic swordfish Spanish longline fishery (was not certified)</th>
<th>US North Atlantic Swordfish</th>
<th>North West Atlantic Canada Longline Swordfish</th>
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<tbody>
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<td>1st assessment</td>
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<td>South Atlantic</td>
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</table>

*In parenthesis, the scores given by the team in the Public consultation draft report (PCDR)

2.4 Results

Table 6 RAG summary table for North Atlantic pelagic longline fisheries

<table>
<thead>
<tr>
<th>Name of the fishery</th>
<th>Evidence from the fisheries</th>
</tr>
</thead>
<tbody>
<tr>
<td>North West Atlantic Canada</td>
<td>Bycatch baseline: This fishery reports high levels of shark (including blue, shortfin mako, porbeagle and thresher sharks) and sea turtle bycatch. The volume of blue shark caught annually exceeds the volume caught of the main target species in this fishery, swordfish,</td>
</tr>
</tbody>
</table>
but it is discarded because of its low commercial value. Although occasional, bycatch of northern bottlenose whale is significant given the small population size.

<table>
<thead>
<tr>
<th>Data quality</th>
<th>Proposed actions</th>
<th>Action implementation</th>
<th>Bycatch trends</th>
<th>Final score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green (2)</td>
<td>Red (0)</td>
<td>Amber (1)</td>
<td>Amber (1)</td>
<td></td>
</tr>
</tbody>
</table>

**Justification:**

**Data quality:** Bycatch data is obtained from fishing logbooks, port inspections and observer data, which covers around 5% of the trips. The target observer coverage was increased to 10% in 2017 following a risk review which indicates that there was some uncertainty over the level of discarding from the fishery.

**Proposed actions:** Conditions set by the assessment team seem during the first certification did not include effective and measurable outcomes which resulted in conditions being closed prematurely. The recommendations set during the recertification appear to be based on unfinished tasks from the first certification period and are non-binding and non-auditable.

**Action implementation:** Various management measures are in place in the swordfish longline fishery for bycatch species, including closed areas, catch limits for shark species, requirements for proper handling and release of identified species-at-risk. However, measures implemented when bycatch limits are approached for sharks are unclear. Many planned actions from the Atlantic Canadian Loggerhead Turtle Conservation Action Plan remain outstanding. Measures for northern bottlenose whale entanglement are also inadequate.

**Bycatch trends:** Trends in bycatch of shark species are uncertain. The state of the blue shark stock is uncertain, but it appears that it is not overfished and that overfishing is not occurring (ICCAT 2015). However, stocks of shortfin mako and Northwest Atlantic porbeagle are overfished and depleted respectively (ICCAT 2017). Due to a shift in fishing areas, interactions with loggerhead turtles have decreased, while interactions with leatherback turtles have increased in recent years. Populations of both species in the area are increasing. The potential biological removal for the Scotian Shelf population of northern bottlenose whale is low, less than 1/year, given the small population size.

**US North Atlantic swordfish/SSLLC US North Atlantic**

**Bycatch - baseline:** This fishery reports high levels of bycatch of sharks, including blue, shortfin mako, tiger and thresher sharks (among others), and sea turtles. The impact on short-finned pilot whales is above PBR and swordfish longline is considered a category I fishery by NOAA.
### Swordfish Longline

<table>
<thead>
<tr>
<th>Justification:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Data quality:</strong> Bycatch data is obtained from fishing logbooks, port inspections and observer data, which in 2016 covered around 14.5% of the hauls. Substantial discrepancies have been identified between logbook and observer data, suggesting incomplete reporting of protected species interactions by fishermen.</td>
</tr>
<tr>
<td><strong>Proposed actions:</strong> Management measures for the swordfish longline fishery include catch limits, TACs for shark complexes, prohibition of retaining some species, minimum size limits for retained sharks, time/area/gear restrictions, use of circle hooks and use of de-hooking devices. Impacts and measures for short-finned pilot whales have been identified, though proposed actions were not substantive.</td>
</tr>
<tr>
<td><strong>Action implementation:</strong> Implementation of measures for sharks appears to be adequate. However, the condition set to minimise the impact of the fishery on short-finned pilot whales was closed in spite of catch levels above PBR, with the rationale that this species was neither endangered or threatened. The harmonisation carried out for separate certified U.S. fisheries resulted in time extensions for closing conditions.</td>
</tr>
<tr>
<td><strong>Bycatch trends:</strong> Catches of sharks and interactions with sea turtles and marine mammals appear to be stable and no trends are observed, though short-finned pilot whale bycatch is above PBR. Trends in catches cannot be evaluated in the SSLC US North Atlantic swordfish Longline because the fishery withdrew from the program before the first surveillance visit.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Data quality</th>
<th>Proposed actions</th>
<th>Action implementation</th>
<th>Bycatch trends</th>
<th>Final score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red (0)</td>
<td>Red (0)</td>
<td>Amber (1)</td>
<td>Amber (1)</td>
<td>Amber (4)</td>
</tr>
</tbody>
</table>

### Spanish North and South Atlantic Swordfish Longline Fishery (NB. This fishery was not ultimately certified)

<table>
<thead>
<tr>
<th>Justification:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Data quality:</strong> Contravening Spanish laws and ICCAT recommendations, interactions with sea turtles and sharks (except blue sharks) were not recorded in logbooks. Observer coverage in the fishery is very low at around 1-3%. It appears that the fishery is working in collaboration with the Spanish government to try and improve observer coverage, but no changes have been made in recent years.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Data quality</th>
<th>Proposed actions</th>
<th>Action implementation</th>
<th>Bycatch trends</th>
<th>Final score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red (0)</td>
<td>Red (0)</td>
<td>Amber (1)</td>
<td>Amber (1)</td>
<td>Red (2)</td>
</tr>
</tbody>
</table>
**Proposed actions:** This fishery principally catches blue shark. However, this was removed from P1 due to difficulties that certification of this species presented, resulting in the fishery being termed a swordfish fishery. This raised a fundamental concern around the fishery being certified for a small proportion of its catch, while impacts on blue shark continued.

**Action implementation:** As the fishery left the MSC program, improvements in management have not been evaluated but it seems that no major changes have been introduced. Some species remain completely unprotected and unassessed in the area. The fishery is currently involved in a FIP.

**Bycatch trends:** Trends in bycatch cannot be evaluated. The state of the shark species affected by the fishery in the South Atlantic are uncertain. However, the shortfin mako northern stock is overfished and is undergoing overfishing. Exploratory assessments indicate that biomass of the Northeast Atlantic porbeagle stock is below BMSY and that recovery of this stock under no fishing mortality is estimated to take ca. 15-34 years. The North East population of loggerhead sea turtle is endangered.
Case study 3. Tuna purse seine fisheries

Introduction

This case study examines the bycatch performance of all the MSC certified tuna purse seine fisheries\(^3\). Four such fisheries: PNA (Parties to the Nauru Agreement), the Solomon Islands, American Samoa (Tri marine) and PAST (Pacific Alliance for Sustainable Tuna) occur in the Pacific Ocean and are certified for both skipjack *Katsuwonus pelamis* and yellowfin tuna *Thunnus albacares*. The Talley and Echebastar fisheries occur in New Zealand’s waters and the Indian Ocean respectively, and are the only fisheries certified for skipjack tuna. The PNA fishery was the first tuna purse seine certified by the MSC in 2011 and was recently re-certified\(^4\). The other three Pacific fisheries were certified between 2016 and 2017. In 2013-2015, the Echebastar Indian Ocean purse seine tuna ‘free school’\(^5\) fishery entered the MSC process. Following an objection by WWF and independent adjudication, it was determined that the fishery did not meet the MSC standard. It is currently being certified through a pilot process that aims to simplify the v2.0 assessment process to reduce complexity and cost whilst improving effectiveness of stakeholder engagement (DeAlteris et al., 2018).

In both the Solomon Islands and Echebastar fisheries, ‘free school’ and Fisheries Aggregation Device (FAD)\(^6\) sets (in the first case, anchored FADs (aFADs)) are certified. In the PAST fishery, both free-swimming schools of tuna (unassociated sets) and tuna schools swimming with dolphins (dolphin-associated sets) were certified. In the PNA\(^7\), Talley and Tri Marine fisheries, only the free school element is certified. This distinction is important, as bycatch rates differ between FAD/dolphin-associated and “free school” sets, being higher in the former.

Two new tuna purse seine fisheries, the Sant Yago TF unassociated purse seine Atlantic yellowfin tuna fishery and the WPSTA Western and Central Pacific skipjack and yellowfin free school purse seine have recently entered the MSC program but at the time of this review no documents had been published. They have not been included here.

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\(^3\) As at January 2018

\(^4\) The certification of the fishery was objected by the International Pole & Line Foundation (IPNLF) mainly based on the definition of FAD associated and free school sets. This objection was dismissed by the Independent Adjudicator.

\(^5\) The term “free-school” means that the tuna caught by the fishery is not associated with any floating object (FADs, whales, etc.)

\(^6\) FAD fishing is when a floating object is set in the ocean that schools of fish will congregate around, making it easier to find and encircle whole schools of tuna

\(^7\) In the PNA purse seine fishery, log sets were included during the first assessment, but this element failed (mostly due to the presence of relatively high catches of bigeye tuna) and this element has not been included in the recertification
In terms of non-target bycatch, tuna purse seine fisheries primarily interact with pelagic sharks (i.e. Carcharhinidae), sea turtles and marine mammals. In this case study, the performance of these fisheries with regard to the impact on these groups is evaluated.

The name of each fishery (as shown on the MSC website), year of first certification and re-certification, and version of the MSC standard they were certified under are shown in table 7.

**Table 7.1 Selected fisheries (name, year and version of the MSC standards)**

<table>
<thead>
<tr>
<th>Name of the fishery</th>
<th>Date of the first certification</th>
<th>Version of the MSC standards</th>
<th>Date of the re-certification</th>
<th>Version of the MSC standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>9. PNA Western and Central Pacific unassociated purse seine skipjack tuna and yellowfin tuna fishery</td>
<td>December 2011</td>
<td>FAM v.2</td>
<td>March 2018</td>
<td>v.2.0</td>
</tr>
<tr>
<td>10. Tri Marine Western and Central Pacific skipjack and yellowfin tuna</td>
<td>June 2016</td>
<td>v.1.3</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>11. Solomon Islands Skipjack and Yellowfin Tuna Purse Seine Anchored FAD, Purse Seine unassociated, and Pole and Line</td>
<td>July 2016</td>
<td>v.1.3</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>12. Talley’s New Zealand skipjack Tuna Purse Seine</td>
<td>August 2017</td>
<td>v.2.0</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>13. North-eastern Tropical Pacific (PAST) Purse Seine yellowfin and skipjack tuna fishery</td>
<td>September 2017</td>
<td>v.1.3</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>14. Echebastar Indian Ocean purse seine skipjack tuna</td>
<td>November 2015(^1) January 2018</td>
<td>v.1.3, v.2.0</td>
<td>NA</td>
<td>NA</td>
</tr>
</tbody>
</table>

\(^1\) The Echebastar fishery was not certified at the first assessment attempt

3.1. Pacific Islands (PNA) tuna fishery

3.1.1 Bycatch - baseline
Elasmobranch species are regularly caught in this fishery. The annual average catch of silky sharks over the period 2014-2015 in free school tuna sets was approximately 223.6 t.\(^8\). Williams (1997) estimated that the CPUE of silky sharks in FAD-associated purse seine sets was 9.7 times that of the CPUE in unassociated sets. Data reported indicates that only 10-20\% of the individuals returned to the sea may survive (Filmalter et al. 2012). For whale sharks *Rhincodon typus*, an annual average of 92.7 t. was caught per year between 2014 and 2015, or an average of 61 animals annually over the period 2011-2015 (Blyth-Skyrme et al., 2017). The mortality rate for this species is estimated at 12\%, although the fate of the individuals caught was not noted in 35.9\% of the events recorded (Clarke 2015). The annual average catch of devil manta ray (Mobula sp.) and giant manta *Manta birostris* were 45.9 t. and 39.0 t. per year respectively in 2014-2015, or an annual average of 634 animals over the period 2011-2015. Other elasmobranchs caught in the fishery are unidentified manta rays (9.9 t. per year in 2014-2015) and oceanic whitetip shark *Carcharhinus longimanus* (2.43 t. per year in 2014-2015) (Blyth-Skyrme et al., 2017).

At least six species of marine mammals interact with the fishery. False killer whale and Risso's dolphin are the most-caught species, with an annual average catch of 6.4 t. (11.4 animals annually over the period 2011-2015) and 2.13 t. respectively. Mortality rates for toothed whales, including false killer whales, have been estimated at 66\% in this fishery (SPC 2010). Pygmy sperm whale *Kogia breviceps*, bottlenose dolphin *Tursiops aduncus*, rough-toothed dolphin *Steno bredanensis*, melon-headed whale *Peponocephala electra* and unidentified dolphins/porpoises are the other species reported as bycatch, with annual average catches between 1.6 t. and 0.15 t. in 2014-15 (Blyth-Skyrme et al., 2017).

The fishery also catches five of the seven sea turtle species: Olive Ridley *Lepidochelys olivacea*, green, leatherback, loggerhead and Hawksbill *Eretmochelys imbricata*, with an annual average catch under 1 t. in the period 2014-2015 for free school sets (Blyth-Skyrme et al., 2017).

This fishery reports moderate to high levels of bycatch of silky sharks, whale sharks and manta rays. At least six species of marine mammal, including false killer whales and Risso's dolphins, and five species of sea turtle are reported as bycatch.

3.1.2 Data quality on bycatch

PNA have introduced a comprehensive fishery information e-reporting system as well as 100\% observer coverage of their fleet. Observers are now an integral part of nearly all aspects of the management of the fishery. Observers record all species caught in the West Central Pacific Ocean

\(^8\) Data shown in the public certification report for this fishery refers to 20,029 (11,037 successful) sets in 2014, and 15,113 (9,086 successful) sets in 2015, covering > 60\% of the total PNAFTF tuna catch from each year.
(WCPO) and all discards, including tunas, sharks and seabirds. They also record the use of mitigation devices for sea turtles and interactions with marine mammals. Observer data are mostly managed through the PNA Fisheries Integrated Management System (FIMS) and are provided to the Secretariat to the Pacific Community (SPC). Landings are permitted only at designated landing sites, and independent monitors are required to be present for landings; they are responsible for checking and tallying landings data. Some issues with compliance in this fishery have been raised by stakeholders, as 50% of observers working in WCPFC reported that vessels inaccurately reported catch & discards (Blyth-Skyrme et al., 2017). In the assessment, it is reported that there are some inconsistencies in the data presented due to delays in receiving and processing observer data, and unconfirmed queries over data (Blyth-Skyrme et al., 2017). However, it seems that the quality of the observer training and reporting is improving.

**Bycatch data is obtained from fishing logbooks and observer data which covers 100% of the trips. Some concerns around compliance in this fishery have been raised by stakeholders, although the quality of observer data seems to be improving.**

### 3.1.3 Scores, conditions and management measures implemented

The PNA tuna purse seine fishery entered the MSC process in 2010. Log and unassociated sets were included in the first assessment but the former failed to reach a minimum score of 80 in P2, mostly due to the relatively high catches of bigeye tuna (overfished at the time) (Banks et al., 2011). The unassociated school fishery was certified in 2011 and two conditions were set by the assessment team. A condition on PI 2.2.2, requiring a strategy for managing bycatch to ensure the fishery didn’t pose a risk to shark populations (specifically silky sharks), was closed during the first surveillance audit based on the implementation of a package of measures to reduce fishery impacts (Scott and Stokes 2013). A recommendation was also made to assess the stock of silky shark (Banks et al., 2011). A stock assessment for silky shark was completed in 2013 (Rice & Harley 2013) and new conservation and management measures (CMMs) to protect this species were introduced (CMM 2013-08). However, the effectiveness of the measures has not been assessed (Daume & Morison 2016).

The second condition set during the first certification assessment related to the ETP species ‘outcome’ (P.I. 2.3.1 – i.e. population-level impacts) and focused on whale sharks. This was closed out during the 2nd surveillance audit, based on the reclassification of unassociated sets, which defined the encircling of whale sharks as associated and therefore not included in the certification (Scott and Stokes 2013). During the fourth surveillance audit the assessment team stated that it was unclear if sets that interact with whale sharks would be disqualified and therefore ineligible for certification. It was decided that this would be reconsidered at the time of the re-assessment (Daume & Morison 2016). However, it
appears that no specific references to this issue are made in the re-assessment report, as whale sharks are still reported as bycatch by the certified fishery (Blyth-Skyrme et al., 2017).

During the re-assessment process, the fishery received one condition for the management of ETP species. It required the client to develop a strategy to ensure that the fishery doesn’t impact on manta and devil rays (Blyth-Skyrme et al., 2017). Progress on this new condition cannot be evaluated. However, it is notable that at the time of the first assessment, manta rays were not considered of interest, with no reference made to these species (Banks et al., 2011). In the re-assessment report, the assessment team also proposed two non-binding recommendations, one related to shark finning and the other to assess compliance with shark and pollution CMMs annually. The high scores given for some of the outcome issues in this assessment (2.1.1, 2.2.1) compared to other assessments in the area are difficult to justify, taking into consideration that species such as bigeye tuna or silky shark are overfished. The re-certification of the fishery was subject to an objection by the International Pole & Line Foundation (IPNLF) based on the difficulty of defining and separating catches of FAD associated and free school sets but was dismissed by an Independent Adjudicator (MSC 2018a)

In the WCPFC Convention Area (WCPFC-CA) there are no specific conservation and management measures in place addressing the catch of ray species. Nevertheless, a general resolution requires that any non-target fish species that are not to be retained shall, to the extent practicable, be promptly released unharmed (WCPFC 2005). A good practice guide was also produced and distributed to inform fishermen of the best techniques for releasing shark and ray species (Pisson et al. 2012). There are other CMMs in place addressing the impact on specific shark species, prohibiting the retention and storing of silky and oceanic whitetip sharks (although WCPO-specific data on silky shark survival post release is not available, post-release survival is low, around 10-20% (Filmalter et al. 2012)) and prohibiting vessels from setting on tuna schools associated with whale sharks (CMM 2010-07, CMM 2014-05, CMM 2013-08, CMM 2011-04, CMM 2012-04).

The incidental capture of cetaceans is addressed under CMM 2011-03, which prohibits vessels from setting a purse seine net on a school of tuna associated with a cetacean in the high seas and EEZs of the WCPFC-CA. There is also another resolution specific to the conservation and management of sea turtles, which requires a range of measures including the avoidance of encircling turtles and safe release in the event of capture, including those observed entangled in FADs. Guidelines on the safe release of encircled animals have also been endorsed by the WCPFC (WCPFC 2016, Blyth-Skyrme et al., 2017). However, it is unclear what impact this guidance has had on the rate of successful releases, as no further research has been undertaken.
Proposed actions: The impact on manta rays was not taken into account during the first certification of the fishery and no actions were required. During re-certification, sets associated with whale shark were still considered to be unassociated, despite the assessment team in the first certification period raising questions over the validity of including these sets. Whale sharks are still reported as bycatch by the certified fishery.

Action implementation: A strategy to address bycatch of manta and devil rays still needs to be developed. Measures to reduce the bycatch of silky sharks were introduced under the first certification. According to the assessment team, the impact of the fishery on cetaceans and sea turtles could not be evaluated.

3.1.4 Trends in bycatch and population sizes

Catches of silky sharks declined significantly from 2011 to 2015 from 10,013 to 1,770 individuals. Catches of oceanic sharks were also lower in 2015 compared to any of the previous 4 years (Daume & Morison 2016). Recorded interactions with silky sharks, manta rays and whale sharks appear to have increased from the first to the most recent certification, but this is likely because of under-reporting of interactions in the first certification. Interactions with whale sharks appear to have decreased (101 animals per year between 2005 and 2008 and 61 animals per year between 2011 and 2015) (Banks et al., 2011, Blyth-Skyrme et al., 2017).

Bycatch of false killer whales has increased from the first to the most recent certification (Blyth-Skyrme et al., 2017). The observer coverage during the first assessment process was not sufficient to provide statistically robust estimates of total marine turtle encounters in WCPO purse seine fisheries. Catches of silky sharks in the re-assessment process are reported in volume which makes it difficult to compare quantities between assessments.

There are no formal reference points established for silky shark in the area, but a stock assessment of this species in 2013 concluded that fishing mortality now exceeds FMSY, while spawning biomass has declined to levels below SBMSY, the species was therefore considered overfished and subject to overfishing (Rice & Harley 2013). The latest SPC report by Harley et al. (2015) for this species noted that assessments have shown that they are severely depleted. The species is listed as vulnerable on the IUCN red list (Rigby et al., 2017), as are oceanic whitetip sharks (Baum et al., 2015) Rice & Harley (2012) summarised available information on the stock status of whale shark in the WCPO. Due to its late age of maturity (around 30 years), the species is likely to have low population growth and therefore is vulnerable to fishing-related mortality and post-capture mortality is thought to be underestimated (Clarke, 2015). The species is currently considered to be endangered (Pierce &
Although there have been no assessments of manta or mobula populations in the WCPFC, overall, the rate of population reduction for giant manta ray appears to be high in several regions, up to as much as 80% over the last three generations (approximately 75 years), and globally a decline of >30% is strongly suspected (Blyth-Skyrme et al., 2017). Giant manta and Chilean devil ray are assessed as vulnerable on the IUCN Redlist (Marshall et al., 2011) (Pardo et al., 2016). Silky sharks and oceanic whitetips are, respectively, overfished and depleted in the area. Whale sharks are endangered. Giant mantas have suffered a severe decline in recent years and are considered vulnerable, as are Chilean devil rays. Trends in bycatch indicate the impact on silky sharks, ocean whitetip sharks and whale sharks has been reduced, whilst it has increased for false killer whales.

3.2. American Samoa (Tri Marine) tuna fishery

3.2.1 Bycatch - baseline

The Tri Marine fleet and other U.S. vessels indicate that very few cetaceans or turtles interact with the fishery but that larger numbers of elasmobranchs are caught. In the period 2010-2013, 288 oceanic whitetip sharks, 25 devil rays, 30 giant mantas, 31 whale sharks and 33 unidentified mantas were reported as bycatch by the fishery. This represents 22% and 8% of all the catches reported by US vessels for oceanic whitetips and whale sharks respectively. A total catch volume of 99 tonnes of silky sharks was also caught by the Tri Marine fleet in the same period (Morison & McLoughlin 2015).

No interactions with marine mammals are reported by this fleet (Morison & McLoughlin 2015).

Relatively low numbers of turtles are reported by the fishery - 6 Olive Ridley, 1 green and 3 loggerhead turtles (Morison and McLoughlin 2015), which represent 20%, 3.5% and 20% of the total numbers reported by U.S. vessels. (Morison and McLoughlin 2015).

The impact of the fishery on oceanic whitetip sharks, devil rays, giant mantas and whale sharks seems to be moderate. Low numbers of sea turtles are reported as bycatch. Unlike other fisheries in the area, interactions with marine mammals have not been found.

3.2.2 Data quality on bycatch

Under existing WCPFC legal requirements, all fishing masters must complete an official logbook which records information about the fishing vessel’s activities including inter alia set location, type of set, catch volumes and numbers by species (including tuna species, marlins, swordfish and several species of shark). For U.S. vessels, there are also U.S. regulations for the completion of daily logbooks which are collected by NMFS scientists. (Morison & McLoughlin 2015). Logbook data, detailing daily activities
of the fleet, and landings data, are collected from all vessels. Catch length for tuna species and species composition data are taken by biological technicians in American Samoa, as vessels unload at the canneries. In the WCPFC, there is also a regional observer programme which requires 100% observer coverage on large purse-seiners. However, no data are available on the status of any of these animals after they were caught: observers do not record the life status on board purse seine vessels, only the condition of species of special interest (Morison & MacLoughlin 2015).

Bycatch data come from 100% observer coverage of the fleet. Discrepancies in the data have not been reported.

3.2.3 Scores, conditions and management measures implemented

This tuna purse seine fishery received one condition during the certification process in reference to shark finning. During the first surveillance visit, the client provided a shark finning policy (TMI 2012) and SPC reports that there have been no incidents of shark finning on Tri Marine vessels from 2014 to 2016. The assessment team therefore considered that this condition was on target (Morison & Humberstone 2017).

In this assessment, a larger number of species were included as ETP compared to the PNA fishery (assessed in the previous section). However, while oceanic whitetip shark was considered as an ETP species under a conservation measure (CMM 2011-04), silky shark was considered only as a bycatch species, despite a similar measure being in place for this species (CMM 2013-08) (Blyth-Skyrme et al., 2017). (CMM 2013-08) (Blyth-Skyrme et al., 2017). Although fishing is conducted in the same area as the PNA fishery, measures for manta and mobula rays were not discussed in the scoring of this fishery, in spite of the fact that fishing is the main threat for these species (Morison & McLoughlin 2016). No recommendations were made by the assessment team. Stakeholder comments received during the PCDR focused mainly on P1 components (HCR) and very few comments were made on bycatch issues.

The same CMMs apply to this fishery as for the PNA fishery, assessed in the previous section, with both fisheries operating under the same management regime. Tri Marine International has also introduced its own policy regarding shark finning (Tri Marine International 2012) prohibiting the practice of shark finning on board its own vessels and those of its subsidiary companies. However, there is little evidence to indicate the successful implementation and the efficacy of these measures in minimising impacts to bycatch species.

Proposed actions. Key bycatch species were not considered: measures for manta rays were not discussed and silky sharks were not considered protected species.
Action implementations. Management measures are being implemented to minimise the impact on sharks, but the efficacy of these measures could not be evaluated.

3.2.4 Trends in bycatch and population sizes

Numbers for silky shark, oceanic whitetip shark, giant manta rays, devil rays and whale sharks do not show any trend. Moreover, the assessment team notes that conservation measures for these species came into force very recently, meaning it is too early to detect impacts on populations (Morison & McLoughlin 2016).

Elasmobranch species population trends can be seen in the previous case study as this fishery operates in the same area as PNA.

This fishery also reports its impact on loggerhead, olive ridley and green turtles, but trends in bycatch cannot be evaluated. The first species is listed as vulnerable on the IUCN red list (Abreu-Grobois & Plotkin 2008), whereas the green turtle is considered to be endangered (Seminoff 2004). The South Pacific subpopulation of loggerhead turtle, which nests in eastern Australia and New Caledonia, is listed as critically endangered (Limpus & Casale 2015).

Silky sharks and oceanic whitetips are overfished and depleted respectively in the area. Whale sharks are endangered. Giant mantas have suffered a severe decline in recent years and are considered vulnerable, as are Chilean devil rays. The state of the turtle species affected by the fishery range from vulnerable to critically endangered. No trends in bycatch are identified.

3.3 Solomon Islands tuna fishery

3.3.1 Bycatch - baseline

Total bycatch in this fishery is difficult to assess as the level of observer coverage is difficult to discern from MSC reports. However, it appears that the bycatch data provided is based on observer coverage of around 12% of the anchored FAD sets and 20% of the free-swimming school sets. Therefore, these values have been used to make coarse estimates total annual bycatch. The anchored FAD fishery reports an annual average catch of 44 t. (5.3 t.9) of silky shark, 4 t. (0.5 t.) of mobula rays and 3.5 t. (0.4 t.) of giant manta in 2010-2014. Other elasmobranch species caught in the fishery in lower numbers are shortfin mako, pelagic stingray and to a lesser extent bigeye thresher, oceanic whitetip shark, great hammerhead Sphyrna mokarran and copper shark Carcharinus brachyurus (Trumble & Stocker 2016).

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9 The values in parenthesis refer to the original values shown in the report.
Green and olive ridley turtle, Risso’s dolphin and harbour porpoise also interact with the fishery in low numbers. It is notable that in this fishery harbour porpoise is reported as retained (Trumble & Stocker 2016).

In the free-swimming school fishery, 14.5 t. (2.9 t.) of silky shark, 3 t. (0.6 t.) of copper shark, 0.88 t. (0.18 t.) of mobula and 0.15 t. (0.03 t.) of giant manta were caught annually between 2010 and 2014. No turtle or marine mammal bycatch is reported for this set type (Trumble & Stocker 2016).

This fishery interacts with silky sharks, whale sharks, devil and manta rays, though numbers caught are moderate. Green turtle, olive ridley turtle, Risso’s dolphin and harbour porpoise also interact with the fishery in low numbers. Bycatch impacts appear to be higher in aFADs.

3.3.2 Data quality on bycatch

Purse seine vessels fishing exclusively within Solomon national waters are not required to have 100% observer coverage. According to the assessment report, the observer coverage of the aFAD and unassociated fisheries sampled between 12 and 20% of the catch over the period 2010-2014. However, this fishery is aiming for 100% observer coverage and the Ministry of Fisheries and Natural Resources (MFNR) reports substantially improved coverage of the fleet starting in 2014, with 100% coverage achieved in 2015. The vessels also submit catch logsheets to MFNR at the conclusion of each fishing trip (Trumble & Stocker 2016). Logbooks and observer data reports estimate the survival of bycatch species but the assessment team stated that they did not receive any discard mortality information at the time of the assessment (Trumble & Stocker 2016).

[Green] Observer coverage is high, at 100% in recent years. The quality of the bycatch information is considered adequate although some improvements are required.

3.3.3 Scores, conditions and management measures implemented

This fishery received no conditions for P2 issues. Solomon Islands is a Non-Party to the Convention on Migratory Species (CMS), so manta and mobula were not considered ETP species in this assessment. However, the 2016 Solomon Islands license specifically prohibits the retention of these and other shark species on board (Trumble & Stocker 2016). Still, these species were not considered relevant as ETP and no reference was made to them in scoring. In this assessment, the scores for FAD and free school sets were very similar, with the only difference in P.I. 2.3.3, which scored lower in the FAD component. This was based on the lack of adequate information to support a comprehensive strategy to manage impacts on ETP species (Trumble & Stocker 2016).
Management measures implemented to address the impact on bycatch species are the same as the aforementioned fisheries. A National Plan of Action for sharks (NPOA-Sharks) has been drafted by the government and is undergoing finalisation (Stocker et al., 2017). The International Seafood Sustainability Foundation (ISSF) has also developed a resolution prohibiting shark finning among its members (ISSF 2012), which has been adopted by this fleet (Trumble & Stocker 2016). A series of conditions included in the purse seine license conditions address the impact on other species, such as seabirds, marine mammals and sea turtles. According to the PCR, high compliance has been found in this fleet, through at-sea vessel observer coverage, port inspections, and monitoring of logbooks (Trumble & stocker 2016).

**Proposed actions:** No reference was made to mobula or manta species were made in the assessment of the fishery despite the existence of local regulations prohibiting the retention of these species.

**Action implementation:** Management measures have been implemented in the area to minimise the impact on sharks. A national plan for sharks has been developed in the Solomon Islands.

### 3.3.4 Trends in bycatch and population sizes

Trends in bycatch cannot be evaluated for this fishery because of differing observer coverage between years. The state of some of the species affected by the fishery, including silky sharks, giant manta, green turtle and olive ridley turtle have been indicated in the previous section. Other species caught in the fishery to a lesser extent, such as shortfin mako and bigeye thresher, are both considered to be globally vulnerable (Cailliet et al., 2009; Amorim et al., 2009), while bronze whaler shark is listed as near threatened (Duffy & Gordon 2003).

Risso’s dolphin and harbour porpoise are also affected by the fishery and are globally listed as least concern (Taylor et al., 2012) (Hammon et al., 2008) but no information is available at the population level.

Silky sharks and oceanic whitetips are overfished and depleted respectively in the area. Trends in bycatch cannot be evaluated.

### 3.4 New Zealand (Talley) tuna fishery

#### 3.4.1 Bycatch - baseline

Very few bycatch species are reported in this fishery. Data in the final report (Akroyd & McLoughlin 2017) lists ten species of relevance to this review: spine-tailed devil ray *Mobula japonica*, manta rays
Manta birostris, stringray, thresher, mako, bronze whaler and hammerhead sharks. In addition, common dolphin Delphinus delphis, Buller’s shearwater Puffinus bulleri and white-faced storm petrel Pelagodroma marina maoriana are listed. Only spine-tailed devil ray and manta rays have been shown to have significant interactions with the fishery, with 39 and 27 individuals caught respectively in the period 2011-2015 (Akroyd & McLoughlin 2017).

Although the fishery has developed a code of practice for sea turtles, interactions have not occurred in recent years.

Spine-tailed devil ray is the main bycatch of this fishery. Other bycatch species are reported in very low numbers.

3.4.2 Data quality on bycatch

New Zealand catch, fishing effort, fishing operation data, and vessel information are recorded on logsheets for each day of fishing and are submitted monthly. Interactions with ETP species are required to be reported on the Ministry of Primary Industries (MPI)’s Non-fish and Protected Species Catch Return form.

Observer coverage for the NZ domestic skipjack purse seine fishery was 18.2% of sets in 2014 and 19.6% in 2015. MPI annual reports to WCPFC Scientific Committee provide information on species composition data for vessels operating in the EEZ (WCPFC-SC 2015). WCPFC requires retention of all purse seine catches in the tropical fishery (i.e. no discarding of unwanted fish such as juveniles), coupled with 100% observer coverage. On purse seine vessels, it is not possible to sample the entire catch, so the observers focus on detailed sampling of the bycatch species and sub-sampling of the target species. Misreporting of mobulid rays, likely spinetail devilrays, in this fishery is possible (AEBR 2015).

Observer coverage in international waters represents 100% of the trips. In NZ waters, it decreases to around 18-19%. However, this level of coverage is considered adequate to assess the impact on bycatch species.

3.4.3 Scores, conditions and management measures implemented

During the certification process, the New Zealand tuna fishery received one condition for P.I. 2.3.2, requiring the implementation of an action plan to mitigate unintended impacts on spine-tail devil rays. The client action plan committed to engage with MPI to agree and fully implement a code of practice for this species. Very few stakeholder comments were submitted for this certification and they
referred mainly to the difficulties of separating catches from free schools and FAD/object associated schools rather than bycatch (Akroyd & McLoughlin 2017).

New Zealand law protects elasmobranch species in EEZ waters, including oceanic whitetip, basking *Cetorhinus maximus*, deepwater nurse *Odontaspis ferox*, white *Carcharodon carcharias* and whale sharks, as well as manta and spinetail devil rays, and requires interactions to be reported in logbooks. Further, there are obligations to minimise mortalities where possible (NZ Wildlife Act 1953). A Conservation Service Programme (CSP) in place since 1996 aims to avoid, remedy and mitigate the adverse effects of commercial fisheries on protected species (DOC 2015). The DOC CSP has been investigating potential mitigation approaches for spinetail devil rays and factors affecting their post-release survival in the purse seine fishery through the use of pop-off survival tags (DOC 2016). In New Zealand, a DOC-funded and industry-supported programme to develop methods for mobulid live release has been initiated in the NZ skipjack tuna purse seine fishery, although it seems that measures are not still being applied (Francis, 2014).

In 2009, the industry adopted a Code of Best Practice for mitigation of the effects of fishing on sea turtles in NZ purse seine fisheries, although interaction with sea turtles has not been reported. A broader code of practice is also being collaboratively developed between industry, MPI and DOC to guide skippers in how to deal with bycatch species. This code of practice also contains measures to avoid and mitigate potential dolphin interactions (Akroyd & McLoughlin 2017).

In international waters, the WCPFC Conservation and Management Measures for sharks noted in the two previous case studies are also in place.

- **Proposed actions:** Very few stakeholder comments were received during the assessment process. Conditions set by the assessment team were adequately addressed by the client action plan.

- **Action implementation:** A code of practice is being developed and management measures are being implemented, although they are not still in place for mobulid species, which constitute the main bycatch of this fishery.

### 3.4.4 Trends in bycatch and population sizes

Trends in bycatch in this fishery cannot be evaluated as it was only recently certified. The two species most affected by the fishery are spinetail devil ray and manta ray. Spinetail devil ray is globally widespread (Couturier et al. 2012) and their population size is classified as moderate in New Zealand waters. The species is listed as near threatened on the IUCN red list (White et al., 2006). Manta ray are globally widespread (Ebert et al. 2013) and classified as having a relatively large population in New
Zealand waters. A qualitative risk assessment workshop, using the MSC methodology, resulted in spintetail devil ray receiving an overall high risk score of 13.5, the highest risk score of all species caught in this fishery. Manta rays were assessed as less likely to be impacted, with a low risk score of 1. Other species affected to a lesser extent by the fishery, such as thresher, hammerhead, bronze whale and mako shark, received overall risk scores of 10.5, 12, 14 and 15 respectively (Ebert et al., 2013). Common thresher shark, smooth hammerhead shark and mako sharks are listed as vulnerable on the IUCN red list (Goldman et al., 2009), (Casper et al., 2005), (Cailliet et al., 2009).

**Trends in bycatch in the fishery cannot be evaluated.** Spintetail devil and manta ray, the two main species affected by the fishery, have a moderate and large population size in New Zealand respectively. Spintetail devil ray is listed as near threatened on the IUCN red list.

### 3.5 Northeastern Tropical Pacific (PAST) tuna fishery

#### 3.5.1 Bycatch - baseline

Fourteen species of shark are retained by purse seine vessels in this fishery. The two most-caught species are silky sharks, with an average catch per year of 30 t. for dolphin sets and 13 t. for free school sets (2009-2013), and oceanic whitetip shark with 0.4 t. caught, on average per year in the dolphin set fishery. In addition, 8 species of rays are caught and discarded, including giant, smoothtail *Mobula thurstoni* and spintail manta, Chilean and Munk’s devil rays *Mobula munkiana*. The most caught species in this group is giant manta with 26 t. and 51 t. caught respectively per year in the dolphin and free school sets in the period 2009-2013 (Morgan et al., 2016).

In 2013, 482 mortalities of dolphins were reported for the PAST fleet. Spinner *Stenella longirostris*, pantropical spotted *Stenella attenuata* and short-beaked common dolphin represented 50%, 38% and 10% of the marine mammals caught by the fleet. Individuals of a number of other cetacean species have also been reported to have been killed in the fishery, including striped *S. coeruleoalba*, Fraser’s *Lagenodelphis hosei*, rough-toothed *Steno bredanensis* and bottlenose dolphins, as well as short-finned pilot whales (Whalen et al. 1986, Reilly et al. 2005), but the numbers involved are small. A total of 517 individuals of four species of sea turtle (green (14%), hawksbill (0.7%), loggerhead (16%) and olive ridley (52%)) were reported to have been caught by vessels in the UoA between 2009 and 2013. Capture rates were higher for free school sets than for dolphin sets (Morgan et al., 2015).

**Fourteen species of shark are caught in this fishery in moderate numbers.** Three species of dolphin, including spinner dolphins, pantropical spotted dolphin and short-beaked common dolphin are also regularly caught by the fishery. Sea turtles also interact with purse seines in the area.
3.5.2 Data quality on bycatch

The Agreement on the International Dolphin Conservation Program (AIDCP) establishes requirements for all vessels with a carrying capacity greater than 363 mt to carry an observer during each fishing trip, with 50% of the coverage conducted by the IATTC (Hinton et al., 2014). The observers are required to collect data on bycatch at the species or species group level, location and size of dolphin pods when fishing and dolphin mortality, among other metrics. The level of reporting of bycatch from larger vessels in the purse seine fleet gradually increased from less than 50% of trips in the early 1990s to 100% by 2007 (Morgan et al., 2015). This is, therefore, the principal source of information on bycatch of non-target species. Observers do not have a formal compliance role while at sea, but are required to report any apparent violations of any rules or regulations. However, a key limitation of the data collected by observers is that it is based on animals that remain on the deck after the completion of a set, whereas most bycatch is dumped overboard as soon as it is brought aboard (Hinton et al. 2014). This lack of access by observers leads to uncertainties in some species identifications and underestimates of numbers of individuals. In the certification report, it was also noted that dolphin mortalities may be systematically under-reported by PNAAPD observers when compared to IATTC observers (Morgan et al., 2015).

Observer coverage represents 100% of the trips. However, it appears that dolphin mortalities may be systematically under-reported.

3.5.3 Scores, conditions and management measures implemented

At the time of certification (2017), this fishery received conditions on six performance indicators for dolphin-associated sets related to retained and Endangered, Threatened, and Protected (ETP) species (2.1.1., 2.1.2, 2.1.3, 2.3.1, 2.3.2, 2.3.3.); free school sets received Conditions on three Performance Indicators, all related to retained species (2.1.1, 2.1.2 & 2.1.3) (Morgan et al., 2016). At the scoring issue level, improvements were required for sharks, rays (ten conditions) and dolphins (six conditions). Conditions related to sharks and rays focused mainly on silky and oceanic whitetip sharks in dolphin sets, and silky sharks and mobulid rays in free school sets. According to the assessment team, these conditions arose from the need to clarify conflicting national regulations defining fisheries’ obligations to retain or return sharks and rays, greater need to design release protocols that are fit for purpose, as well as improved information systems (Morgan et al., 2016). The ETP species related conditions referred to the need to assess the impact of the fishery on dolphins and to develop a strategy to reduce bycatch (Morgan et al., 2016). Performance of these conditions cannot be evaluated as the fishery was only recently certified.
WWF Smart Fishing Initiative and the Earth Island Institute submitted a Notice of Objection to the certification of this fishery based on the underestimated dolphin mortality data shown in the assessment, on the basis that it was likely to be hindering recovery of the dolphin population. This notice of objection was unsuccessful (MSC 2018b).

There are a series of IATTC resolutions for the conservation of sharks which require, variously: the establishment and implementation of national plans of action for conservation and management of stocks; the development of a research plan for a comprehensive assessment of stocks; and requirements on the prompt release of all sharks unharmed (to the extent possible) (Resolutions C-05-03 and C-04-05). A recent IATTC resolution also prohibits any retention of mobulid rays, requires their prompt release and requires observers to record the status (dead or alive) of these species. The retention of oceanic white tip sharks is also specifically prohibited by both IATTC and Mexican regulations (C-11-10, NOM 001) (Morgan et al., 2016), however, in this assessment this species is considered as a retained non-target, along with mobulid rays. The requirements set by different shark measures appear to be contradictory – while measure (NOM-029) requires the retention aboard of all sharks species caught by the fishery, another requires that all species have to be released unharmed. Shark finning is also prohibited (Morgan et al., 2016).

Dolphin bycatch is managed through AIDCP, the main objective of which is to progressively reduce incidental dolphin mortalities in the fishery to levels approaching zero, through the setting of annual vessel-specific Dolphin Mortality Limits (DMLs). The levels of mortality are set as a per-stock per-year cap of between 0.2% of the Minimum Estimated Abundance (Nmin)\(^{10}\) and 0.1% of Nmin, but with the total mortality never exceeding 5000 dolphins (Morgan et al., 2016).

During the assessment, the team specifically stated that they were not aware of any data or analyses that provide evidence of the effectiveness or the level of implementation of the measures adopted by the IATTC or the Mexican Government (Morgan et al., 2016).

**Proposed actions.** A large number of conditions were set by the assessment team to clarify conflicting national regulations and develop a strategy to reduce bycatch. However, dolphin mortality data shown in the assessment was potentially underestimated and conditions set by the team were vague and did not address this issue.

\(^{10}\) As calculated by the U.S. National Marine Fisheries Service or equivalent calculation standard
Action implementation. A series of regulations are in place to address the impact of the fisheries on bycatch species but evidence of the implementation of these measures was not provided at the time of the certification.

3.5.4 Trends in bycatch and population sizes

According to the assessment report, catches of silky sharks in the Eastern Tropical Pacific Ocean (ETPO) have declined from over 25,000 mt in the early 1990s and now range between about 10,000 and 17,000 mt, though purse seine catch is thought to represent a small proportion of this total. The total mortality rate of silky sharks captured in purse seine gear in the Western and Central Pacific Ocean was found to exceed 84% (Hutchinson et al., 2015), so similar mortality rates are expected in this fishery. It is estimated that only about 5% of the total catch of silky sharks in the ETPO are taken by tuna purse-seine vessels, of which object sets account for 72%, dolphin sets 19% and free school sets 9% (Morgan et al., 2016). Trends on catches of other elasmobranch species caught in the fishery cannot be evaluated.

Examination of the stock status indicators for silky shark indicate that overall this species is considered to be depleted in the area (Morgan et al., 2016). The unstandardized average bycatches per set of oceanic whitetip sharks show decreasing trends for all three set types in the ETPO, but the cause of this (i.e. fishery impact versus environmental) have not been determined (IATTC 2015). Munk’s devil rays, also caught by the fishery, do not have trend data but are listed as Near Threatened on the IUCN red list (Bizarro et al., 2006).

The AIDCP program has successfully reduced the number of dolphins killed annually from an estimated tens of thousands in the early nineties to less than a thousand. Mortality in the PAST fleet has declined from 565 in 2009 to 482 in 2013 (more recent data are not available). However, despite reduced kills from more than six million to fewer than 1000 dolphins in the ETPO per year, the populations of dolphins are not showing signs of recovery (Gerrodette and Forcada 2005; Wade et al. 2007), and the rate of calf production has been declining since the 1980s (Cramer et al. 2008). The eastern spinner dolphin has declined 54.5–84.5% from historical levels (Wade et al. 2007) and is considered to be globally vulnerable (Hammond et al., 2012). Spotted dolphin is listed as least concern at the IUCN red list (Hammond et al., 2012) but there are subspecies and populations, such as those in the Eastern Tropical Pacific Ocean, which are depleted and may require separate conservation assessment.

Bycatch of silky sharks and dolphins in this fishery has decreased since the nineties but the populations of dolphins affected do not show signs of recovery.

3.6 Indian Ocean (Echebastar) tuna fishery
3.6.1 Bycatch - baseline

The average annual catch of silky shark in the Echebastar fishery was estimated to be around 101 t (4,406 individuals) and 2 t (68 individuals) for FAD (Fish Aggregating Devices) and FSC (Free school) sets respectively between 2014 and 2016. About 50% of the animals are released alive, although only around 20% of them survive (Eddy et al. 2016). In FAD sets, there was an average annual catch of 33 t.\(^{11}\) (295.8 individuals), 5.3 t. (101.4 individuals) and 0.2 t. (2 individuals) of bull, oceanic whitetip and shortfin mako sharks respectively. Other elasmobranch species reported caught in this fishery include 14 species of manta and devil rays, with a total average catch of 2.7 t. in FADs and 0.2t in FSC for 2014-2016 (DeAlteris et al., 2017).

There appear to be differences between the Indian Ocean Tuna Commission (IOTC) compliance report data and observed data with regard to sea turtle bycatch, though it seems that, overall, these species are caught in low numbers. The estimated annual average catch of individual sea turtles for the period 2014-2016 was two loggerhead, 1.3 green, two hawksbill and 1.9 olive ridley turtles. The capture of these species was entirely in FAD sets (DeAlteris et al., 2017).

**The impact of this fishery on elasmobranch species seems to be moderate to high, particularly silky sharks in FAD sets. Very low numbers of other species are reported.**

3.6.2 Data quality on bycatch

In this fishery, catch data is collected through compulsory electronic logbooks and an observer programme. Observers record data on target and bycatch (non-tuna) species, both by weight and number of individuals. The observers also check FADs for entangled animals, in particular sharks and sea turtles. Although observer coverage was previously less than 5%, from 2014 all Echebastar fishing activity had 100% observer coverage (deAlteris et al., 2017). However, delays and errors in the coding and transcription of the data from field data sheets to electronic database files meant that only a portion of the total collected data were available for analysis at the time of the certification report (the available data represented 29%, 53% and 34% of the fishing sets respectively for the 2014-2016 period) (deAlteris et al., 2017). The Seychelles Fishing Authority (SFA) has worked with the Basque fisheries research institute (AZTI) to improve the capacity of the SFA Observer Programme. This process led to 100% observer coverage across the purse seine fleet in 2017, with processed data reaching 96.2%. Landings data is also collected as the fishing vessels unload in Port Victoria, with monitoring by Seychelles government fishery officers (deAlteris et al., 2017).

\(^{11}\) We have estimated these values taking into account the average size of male and female bull sharks. For these species, only numbers of individuals are given in the MSC assessment report.
Observer coverage has increased to 100% since 2014. However, only three years of data and 30% of the observer reports were available at the time of the assessment. More than three years of information is considered necessary to measure trends and support a strategy to manage impacts on ETP species.

3.6.3 Scores, conditions and management measures implemented

The fishery received three conditions for the information performance indicators related to ETP species, habitats and ecosystems. The condition on ETP species information requires the client to demonstrate that information is adequate to measure trends and support a strategy to manage impacts on ETP species. In the client action plan, Echebastar committed to ensure the 100% observer coverage resulted in usable data (DeAlteris et al., 2017). Two non-binding recommendations were also made, recommending that a higher percentage of observer data be available for review each year to better assess impacts on ETP species and requesting the fishery to maintain a database of the number of lost FADs by area and date. The first recommendation is apparently related to condition one (on P.I. 2.3.3) and it is unclear why this distinction was made. The second recommendation, although related to P.I. 2.4, does have some relevance for bycatch, as FADs have an impact on these species (although Echebastar uses non-entangling FADs).

After the public comment draft report was published, a substantial number of comments were received from the MSC and stakeholders. It led to significant edits to the report, including improved scoring rationales and some score changes. One substantial change from the PCDR to the FR was that silky sharks and shortfin mako were ultimately included as ETP species, based on the fact that both species are listed on the CMS. As in the previous examples, it demonstrates the ambiguity of the MSC standard in relation to the classification of elasmobranch species, which leads to inconsistencies (even with very similar fisheries) in assessment teams categorising P2 components (primary, secondary or ETP species).

WWF lodged a formal objection over the proposed certification, based on several issues. In particular, they considered that the fishery is not following best practice FAD management, including a credible, written and audited FAD management plan. Additionally, they highlighted that the IOTC does not collect sufficient FAD data and has not adopted a FAD management plan covering this fishery. Moreover, WWF argued that there is no strategy in place to address the bycatch of silky sharks or the impact of the fishery on other ETP species, and that the monitoring, control and surveillance system in the fishery does not meet necessary standards (WWF 2018).
Echebastar has its own policy on bycatch reduction (including sharks, mantas and turtles), reporting and sustainability which includes research on the escape of unwanted species from purse seines through technical measures, plus monitoring through full cooperation with the SFA observer programme. Echebastar has also a policy of not setting on marine mammals or large sharks (DeAlteris et al., 2017). EU regulations prohibiting the retention of some elasmobranch species, such as giant mantas, also apply to this fishery (EC 40/2013). A series of conservation measures to encourage the release of live sharks, prohibitions from intentionally setting purse seine nets around whale sharks, mitigate the impact on turtles and release them if caught, prohibitions on the retention of thresher and oceanic whitetip sharks and to manage the number of FADs have been set by the IOTC (IOTC 2017). Reporting interactions with all these species is compulsory. The Echebastar fleet has exclusively used non-entangling FADs since 2014 in order to reduce the impact on bycatch species. While the IOTC has expressed concern about the declining abundance of silky and short fin mako sharks, it does not manage the species and specific conservation measures are not in place (IOTC 2018).

**Proposed actions:** FADs are not adequately managed in the fishery and a tangible strategy to reduce silky shark bycatch is not in place in the area. However, only a non-verifiable recommendation was set by the assessment team for the FAD issue and no conditions were set for ETP species management.

**Action implementation:** Echebastar has implemented their own policies and compliance is monitored by the observers. However, management measures to protect silky and shortfin mako sharks have not been implemented at the regional level. A FAD management plan for the fishery is still not in place.

3.6.4 Trends in bycatch and population sizes

Trends in bycatch in the Echebastar fishery cannot be evaluated as only three years of data are available and average estimates are shown in the assessment report.

The IOTC is concerned about the state of silky sharks and shortfin mako shark, although no assessments for these species have been undertaken. As stated in case studies above, these species are considered vulnerable and their populations are decreasing (Rigby et al., 2017), (Cailliet et al., 2009). Bull shark is listed as near threatened (Simpfendorfer & Burgess 2009).

Bourjea et al. (2014) investigated the catch of sea turtles by Spanish purse seine vessels in the Indian Ocean from 1995-2011. The reported interaction rate for FAD sets was 0.047 per set. Based on this study, the expected annual interaction rate for the Echebastar fishery is around 56 sea turtles, which
is much higher than the current interaction rate. So, it appears that the implemented measures have successfully reduced sea turtle bycatch.

Bycatch trends cannot be evaluated. Silky and shortfin mako shark populations are decreasing.

Turtle bycatch has been reduced, though this occurred pre-certification.

Scores received by the fisheries during the first certification and re-certification processes are shown in table 8 below:

Table 8 Scores obtained by the fisheries during the MSC certification assessments (numbers in red represent the scoring issues which scored less than 80, which represents “global best practice” level).

<table>
<thead>
<tr>
<th>PI</th>
<th>The PNA Western and Central Pacific unassociated purse seine skipjack tuna and yellowfin tuna fishery</th>
<th>Tri Marine Western and Central Pacific skipjack and yellowfin tuna</th>
<th>Solomon Islands Skipjack and Yellowfin Tuna Purse Seine</th>
<th>Talley’s New Zealand skipjack Tuna Purse Seine</th>
<th>North-eastern Tropical Pacific (PAST) Purse Seine yellowfin and skipjack tuna fishery</th>
<th>Echebastar Indian Ocean purse seine skipjack tuna</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FAD</td>
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<td>Dolphin</td>
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*In parenthesis, the scores given by the team in the Public consultation draft report (PCDR)*

**In the re-assessment for the Echebastar fishery separate scores were given for the both types of set: FAD and FSC. However, as these two units have the same scores for the bycatch related P.I., only the scores in the FAD element are shown here.*
## Results

### Table 9 RAG summary table for tuna purse seine fisheries

<table>
<thead>
<tr>
<th>Name of the fishery</th>
<th>Evidence from the fisheries</th>
</tr>
</thead>
<tbody>
<tr>
<td>The PNA Western and Central Pacific unassociated purse seine skipjack tuna and yellowfin tuna fishery</td>
<td><strong>Bycatch – baseline:</strong> This fishery reports moderate to high levels of bycatch of silky sharks, whale sharks and manta rays. At least six species of marine mammal, including false killer whales and Risso’s dolphins, and five species of sea turtle are reported as bycatch.</td>
</tr>
<tr>
<td>Data quality</td>
<td>Proposed actions</td>
</tr>
<tr>
<td>Green (2)</td>
<td>Red (0)</td>
</tr>
</tbody>
</table>

**Justification:**

**Data quality:** Bycatch data is obtained from fishing logbooks and observer data which covers 100% of the trips. Some concerns around compliance in this fishery have been raised by stakeholders, although the quality of observer data seems to be improving.

**Proposed actions:** The impact on manta rays was not taken into account during the first certification of the fishery and no actions were required. During re-certification, sets associated with whale shark were still considered to be unassociated, despite the assessment team in the first certification period raising questions over the validity of including these sets. Whale sharks are still reported as bycatch by the certified fishery (Blyth-Skyrme et al., 2017).

**Action implementation:** A strategy to address bycatch of manta and devil rays still needs to be developed. Measures to reduce the bycatch of silky sharks were introduced under the first certification. According to the assessment team, the impact of this fishery on cetaceans and sea turtles could not be evaluated.

**Bycatch trends:** Silky sharks and oceanic whitetips are, respectively, overfished and depleted in the area. Whale sharks are endangered. Giant mantas have suffered a severe decline in recent years and are considered vulnerable, as are Chilean devil rays. Trends in bycatch indicate the impact on silky sharks, ocean whitetip sharks and whale sharks has been reduced whilst it has increased for false killer whales.

<p>| Tri Marine Western and | Bycatch – baseline: The impact of the fishery on oceanic whitetip sharks, devil rays, giant mantas and whale sharks seems to be moderate. Low numbers of sea turtles are reported | |
|------------------------|---------------------------------------------------------------------------------| |</p>
<table>
<thead>
<tr>
<th>Central Pacific skipjack and yellowfin tuna</th>
<th>as bycatch. Unlike other fisheries in the area, interactions with marine mammals have not been found.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Data quality</strong></td>
<td><strong>Proposed actions</strong></td>
</tr>
<tr>
<td>Green (2)</td>
<td>Red (0)</td>
</tr>
</tbody>
</table>

**Justification:**

**Data quality:** Bycatch data come from 100% observer coverage of the fleet. Discrepancies in the data have not been reported.

**Proposed actions:** Key bycatch species were not considered: measures for manta rays were not discussed and silky sharks were not considered protected species.

**Action implementation:** Management measures have been implemented to minimise the impact on sharks, but the efficacy of these measures could not be evaluated.

**Bycatch trends:** As in the previous fishery, silky sharks and oceanic whitetips are, respectively, overfished and depleted in the area. Whale sharks are endangered. Giant mantas have suffered a severe decline in recent generations and are considered vulnerable, as are Chilean devil rays. The state of the turtle species affected by the fishery range from vulnerable to critically endangered. No trends in bycatch are identified.

<table>
<thead>
<tr>
<th>Solomon Islands Skipjack and Yellowfin Tuna Purse Seine Anchored FAD, Purse Seine Unassociated, and Pole and Line</th>
<th>Bycatch – baseline: This fishery interacts with silky sharks, whale sharks, devil and manta rays, though numbers caught are moderate. Green turtle, olive ridley turtle, Risso’s dolphin and harbour porpoise also interact with the fishery in low numbers. Bycatch impacts appear to be higher in aFADs.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Data quality</strong></td>
<td><strong>Proposed actions</strong></td>
</tr>
<tr>
<td>Green (2)</td>
<td>Amber (1)</td>
</tr>
</tbody>
</table>

**Justification:**

**Data quality:** Observer coverage is high, at 100% in recent years. The quality of the bycatch information is considered adequate although some improvements are required.

**Proposed actions:** No references to mobula or manta species were made in the assessment of the fishery despite the existence of local regulations prohibiting the retention of these species.
### Talley's New Zealand skipjack Tuna Purse Seine

**Bycatch – baseline:** Spine-tailed devil ray is the main bycatch of this fishery. Other bycatch species are reported in very low numbers.

<table>
<thead>
<tr>
<th>Data quality</th>
<th>Proposed actions</th>
<th>Action implementation</th>
<th>Bycatch trends</th>
<th>Final score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green (2)</td>
<td>Green (2)</td>
<td>Amber (1)</td>
<td>Amber (1)</td>
<td>Green (6)</td>
</tr>
</tbody>
</table>

**Justification:**

**Data quality:** Observer coverage in international waters represents 100% of the trips. In NZ waters, it decreases to around 18-19%. However, this level of coverage is considered adequate to assess the impact on bycatch species.

**Proposed actions:** Very few stakeholder comments were received during the assessment process. Conditions set by the assessment team were adequately addressed by the client action plan.

**Action implementation:** A code of practice is being developed and management measures are being implemented, although they are not still in place for mobulid species, which constitute the main bycatch of this fishery.

**Bycatch trends:** Trends in bycatch in the fishery cannot be evaluated. Spinetail devil and manta ray, the two main species affected by the fishery, have a moderate and large population size in New Zealand respectively. Spinetail devil ray is listed as near threatened on the IUCN red list.

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### North-eastern Tropical Pacific Purse Seine

**Bycatch baseline:** Fourteen species of shark are caught in this fishery in moderate numbers. Three species of dolphin, including spinner dolphins, pantropical spotted dolphin and short-beaked common dolphin are also regularly caught by the fishery. Sea turtles also interact with purse seines in the area.

<table>
<thead>
<tr>
<th>Data quality</th>
<th>Proposed actions</th>
<th>Action implementation</th>
<th>Bycatch trends</th>
<th>Final score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amber (1)</td>
<td>Red (0)</td>
<td>Amber (1)</td>
<td>Amber (1)</td>
<td>Amber (3)</td>
</tr>
</tbody>
</table>

**Justification:**

**Data quality:** In this fishery, observers cover all fishing trips, with 50% of the coverage conducted by the IATTC (Hinton et al., 2014). However, only animals that remain on the deck after the completion of a set are recorded (Hinton et al., 2014).

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**Action implementation:** Management measures have been implemented in the area to minimise the impact on shark species. A national plan for sharks has been developed in the Solomon Islands.

**Bycatch trends:** Trends in bycatch cannot be evaluated. Silky sharks and oceanic whitetips are overfished and depleted respectively in the area.
This leads to uncertainties in some species identifications and underestimates of numbers of individuals caught. Dolphin mortalities are also thought to be systematically under-reported by PNAAPD observers compared to IATTC observers (Morgan et al., 2015).

**Proposed actions:** A large number of conditions were set by the assessment team to clarify conflicting national regulations and develop a strategy to reduce bycatch. Dolphin mortality data shown in the assessment was potentially underestimated and conditions set by the team were vague and did not address this issue.

**Action implementation:** A series of regulations are in place to address the impact of the fishery on bycatch species, including a recent IATTC resolution prohibiting the retention of mobulid rays and Dolphin Mortality Limits (DMLs). However, according to the assessment team, evidence of the implementation of these measures was not provided at the time of the certification.

**Bycatch trends:** Bycatch of silky sharks and dolphins in this fishery have decreased since the nineties but the population of dolphins affected does not show signs of recovery.

### Echebastar
Indian Ocean
purse seine
skipjack tuna

**Bycatch – baseline:** the impact of this fishery on elasmobranch species seems to be moderate to high, particularly silky sharks in FAD sets. Very low numbers of other species are reported.

<table>
<thead>
<tr>
<th>Data quality</th>
<th>Proposed actions</th>
<th>Action implementation</th>
<th>Bycatch trends</th>
<th>Final score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amber (1)</td>
<td>Red (0)</td>
<td>Red (0)</td>
<td>Amber (1)</td>
<td></td>
</tr>
</tbody>
</table>

**Justification:**

**Data quality:** Observer coverage has increased to 100% since 2014. However, only three years of data and 30% of the observer reports were available at the time of the assessment. More than three years of information is considered necessary to measure trends and support a strategy to manage impacts on ETP species.

**Proposed actions:** The assessment of this fishery has used a pilot simplified process with has created some uncertainties. Data from the fishery was not provided on time to stakeholders involved in the fishery.

**Action implementation:** Echebastar has implemented their own policies and compliance is monitored by the observers. However, management measures to protect silky and shortfin mako sharks have not been implemented at the regional level. A FAD management plan for the fishery is not still in place.
| **Bycatch trends:** | Bycatch trends cannot be evaluated. Silky and shortfin mako shark populations are decreasing. Turtle bycatch has been reduced, though this occurred pre-certification. |
**Case study 4. Southern Hemisphere trawl fisheries**

**Introduction**

This case study examines the bycatch performance of four MSC certified trawl fisheries. These fisheries occur in the Southern Hemisphere, within the EEZs of Argentina, South Africa and New Zealand and the main target species are hakes (*Merluccius australis*, *M. capensis*, *M. paradox*) and hoki *Macruronus magellanicus*. Although the South African fishery is certified as a single fishery, we scored it as two separate segments for the offshore and inshore parts of the fleet, as these received different conditions.

In terms of non-target bycatch, trawl fisheries in these latitudes primarily interact with seabirds (predominantly Procellariiformes, including albatrosses, petrels and shearwaters through net entanglements and collisions with trawl and netsonde (third wire) cables), demersal and pelagic sharks, skates and some marine mammals. In this case study, the impact of these fisheries on these three groups is evaluated.

The name of each fishery (as shown on the MSC website), year of first certification and re-certification, and version of the MSC standard they were certified under are shown in table 10.

<table>
<thead>
<tr>
<th>Name of the fishery</th>
<th>Date of the first certification</th>
<th>Version of the MSC standard</th>
<th>Date of the re-certification</th>
<th>Version of the MSC standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>16. South Africa hake trawl (inshore) – added to the certification in May 2015</td>
<td>May 2012</td>
<td>v.1.0</td>
<td>September 2017</td>
<td>v.2.0</td>
</tr>
<tr>
<td>17. Argentine hoki bottom and mid-water trawl fishery</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18. New Zealand Deepwater Group hake, hoki, ling and southern blue whiting</td>
<td>November 2001</td>
<td>FAM v.1.0</td>
<td>In assessment</td>
<td>v.2.0</td>
</tr>
</tbody>
</table>

*a Some of these fisheries have been recertified several times. This date refers to the last recertification.

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12 Although some of these certified fisheries include other certified gears, only the trawl component is reviewed in this case study.

13 The recently combined New Zealand deepwater fishery also targets other demersal species such as Ling *Genypterus blacodes* and blue whiting *Micromesistius poutassou*. 
This hoki fishery was first certified in 2001 and recertified again in 2007 and 2012. The New Zealand hake and southern blue whiting fisheries were first certified in 2012. Finally, the ling fishery was certified in 2014. All these fisheries are currently being recertified as a combined group.

4.1 South Africa hake trawl

This fishery incorporates two fleet segments of different scales – an ‘offshore’ segment comprised of larger vessels and ‘inshore’ segment comprised of smaller vessels. Although they are certified under a single certificate, we score them separately here as the management approach to bycatch has differed between these fleet segments.

4.1.1 Bycatch baseline

When this fishery was first certified in 2004, an estimated 9,300 seabirds were killed annually through cable strikes, of which ∼7,200 were albatrosses (Maree et al., 2014), including shy-type *Thalassarche cauta* (43% of all birds killed) and black-browed albatrosses *Thalassarche melanophris* (37%), with smaller numbers of white-chinned petrels *Procellaria aequinoctialis* (10%), cape gannets *Morus capensis* (7%) and sooty shearwaters *Ardenna grisea* (3%) (Watkins et al., 2008). Very few bycatch species apart from fish and seabirds are reported by this fishery.

**Offshore**

This fishery reported very high levels bycatch of seabird species, including shy-type and black-browed albatrosses.

**Inshore**

Bycatch in the inshore fishery is unknown due to the lack of adequate data.

4.1.2 Data quality on bycatch

A pilot observer program started in this fishery in 1995, and a comprehensive scientific observer programme, funded by the government, was fully implemented from 2002 to 2006. At that time observers were deployed throughout the deep sea and inshore trawl fleets and hake trawler coverage overall covered 15-20% of all trips (Powers et al., 2004). In 2006, the industry (SADSTIA) started a self-funded observer program to substitute the national observer program which stopped that year. From 2002 to 2010, around 7.3% of the trawls were monitored by observers (Andrews et al., 2015). Information collected related to fishing practice, gear types, biological measurements of target and non-target species as well as estimates of discard proportions. Interactions between trawl vessels and seabirds were monitored by observers from BirdLife South Africa’s Albatross Task Force (ATF) between
April 2006 and May 2011 (Maree et al., 2014). In the last surveillance report, the assessment team noted that the industry-funded observer coverage in the deep water trawl fishery was adequate, but that observer coverage in the inshore trawl fishery was at a low level. It generated a new recommendation to ensure that there is adequate information available for the inshore fleet.

**Offshore**

Data used to estimate bycatch in this fishery came from independent sources and is considered adequate.

**Inshore**

The current industry-funded observer programme does not include a representative proportion of the inshore trawl fishing activity.

4.1.3 Scores, conditions and management measures implemented

This fishery was awarded an MSC certificate in April 2004 and re-certified in 2010 and 2015. In 2004, a condition was set to develop a monitoring plan within 12 months of certification to evaluate the impact of the fishery on seabird species and implement the appropriate mitigation measures if necessary (Powers et al., 2004). Interestingly, at the time of that first certification, the impact of this fishery on seabirds was considered insignificant. However, research undertaken by Birdlife (Albatross Task Force) in response to this condition identified a significant fishery-seabird interaction and measures to address this problem were identified and implemented (i.e. use of bird scaring lines (BSLs) – also known as tori lines) and the condition therefore closed at the fourth surveillance audit, although the assessment team pointed out that the efficacy of these measures should be periodically monitored (Tingley et al., 2008).

In 2010, the fishery received a condition built upon a previous, similar condition raised in the initial assessment on information related to bycatch species (Powers et al., 2010). A comprehensive review of significant bycatch species (including sharks) was sponsored by the industry, a bycatch working group created and several measures (including upper catch limits (PUCL)), ‘move on’ rules and closed areas were implemented. This review identified declining trends in the spiny dogfish but it appears that the management measures implemented focus on fish species and measures for dogfish/other elasmobranch species were not implemented (Andrews et al., 2014).

In 2015, during the second re-assessment, a condition on ETP Information was received by the fishery in order to gather more data on seabird mortality in the inshore segment of the fleet (Andrews et al., 2015). A review of the impact of the fishery has already been carried out by Birdlife (Mashao et al,
2016), alongside preliminary monitoring of interactions at sea and data analysis by the South East Coast Inshore Fishing Association (SECIFA) Scientific Observer Programme, which identified interactions with white chinned petrels and cape gannets (Smith, 2016b). However, during the 2017 surveillance visit, the condition was considered to be behind target because no observer trips to monitor impacts on birds had been carried out in the preceding year due to insufficient funds and cooperation from SECIFA (as well as legal disputes in the inshore fleet) (Andrews & Pawson 2017).

All hake trawl vessels fishing offshore (>110m depths or beyond 20nm) are required to use bird scaring lines as part of their licence conditions; inshore fishing permits fishing within the inshore zone do not need to use BSLs. These BSLs are proven to significantly reduce bird mortality. All vessels are also prohibited from using “sticky” warps\(^1\), again with the express purpose of minimising bird mortality. These measures have been developed by regulators in collaboration with the Responsible Fisheries Alliance (RFA), a partnership of environmental NGOs and the fishing industry. The vessels working on offshore grounds are also required to manage the discharge of offal from the vessels and to carry vessel-specific Bird Mitigation Plans to further reduce impacts on birds (Andrews & Pawson 2017). A strategy to manage bycatch for the hake trawl fishery is being developed (Andrews et al., 2015) but it seems that these measures are species-specific (such as the PUCLs that have been set for monkfish, kingklip and horse mackerel) and do not cover other potentially impacted elasmobranch species.

**Offshore**

\(\text{Proposed actions: At the beginning of the assessment process, the impact on seabirds was considered insignificant. However, actions to reduce seabird bycatch were included during subsequent assessments.}\)

\(\text{Action implementation: Successful management measures (offal discharge management, bird-scaring lines) have been implemented to reduce the impact of the fishery on seabirds as a consequence of the certification process.}\)

**Inshore**

\(\text{Proposed actions: The inshore segment of the fleet was incorporated into the certification in 2015, raising new conditions around seabird bycatch data collection and bycatch reduction.}\)

\(\text{Action implementation: The inshore fleet is not currently engaged in fully implementing the proposed action on seabird bycatch. Management measures in the inshore fishery have not been}\)

\(\text{\(^1\) This relates to the use of grease on the trawl warps, as substantial numbers of seabird mortalities have been attributed to the “sticky warp” phenomenon.}\)
fully tested. Specific management measures to address the potential impact on elasmobranch species are not in place.

4.1.4 Trends in bycatch and population sizes

According to Maree et al., 2014, estimated total mortality in this fishery in 2010 was 990 seabirds, of which 83 were albatrosses, a reduction in mean albatross deaths of 99% compared to 2004-2005. This reduction in bycatch was delivered by both the use of bird-scaring lines and a reduction in fishing effort of 50% between 2004 and 2010. However, a shift in risk from large birds (albatrosses) to smaller species was identified, particularly noticeable for pintado petrels Daption capense and some concerns remain for other vulnerable species, including white-chinned petrels and cape gannets (Maree et al., 2014). No information about other species has been found.

Shy and white-capped albatross were among the main species affected by the fishery at the beginning of the certification, both of which are presently listed as Near Threatened on the IUCN red list (Birdlife International 2016). Baker et al (2007) highlighted that mortality for shy-type albatrosses was primarily in trawl rather than longline fisheries (75% of reported cases), mostly in South Africa, Namibian and New Zealand waters. The population of black-browed albatross, also affected by this fishery, has an extremely large range and it is currently increasing. The species was down-listed on the IUCN red list from vulnerable in 2012 to least concern in 2017 (Birdlife International 2017d). However, birds found in South African waters originate from South Georgia, where the population is declining (Pardo et al. 2017). The white-chinned petrel global population has been recently estimated at approximately three million individuals. Although no reliable estimates of historical populations exist, the species is assessed as vulnerable on the IUCN red list because of suspected rapid declines (Birdlife International 2017c). Cape gannets breed only in South Africa and Namibia. The species has suffered a large population reduction over the past three generations and is projected to continue to decline rapidly over the next three generations. For this reason, it has recently been up-listed on the IUCN red list and is now endangered (Birdlife International 2017b). Sooty shearwaters are globally abundant, breeding on islands off New Zealand, Australia and Chile, and the Falkland Islands but despite their large global population, this species is thought to have undergone a moderately rapid decline and is classified as near threatened (Birdlife International 2017a).

Offshore

Implementation of management measures led to a seabird bycatch reduction of >90% overall, increasing to 99% for albatrosses. Some concerns remain for other species such as white-chinned petrels and cape gannets.
Inshore

The inshore fishery has been certified very recently and trends in bycatch cannot be evaluated.

4.2 Argentine hoki trawl fishery

4.2.1 Bycatch baseline

Tamini et al. (2016) monitored the impact of warp cables and the netsonde cable from the 4 midwater trawl vessels working in this fishery between November 2012 and October 2014. Over 144 observed hauls in this period, the mortality of 18 black-browed and 11 southern royal albatrosses *Diomedea epomophora*, 6 southern *Macronectes giganteus* and 1 northern *Macronectes halli* giant petrel was recorded on the netsonde cable. In addition, 2 black-browed albatrosses and 1 cape petrel *Daption capense* were killed through net entanglement and a single black-browed albatross through collision with the warp cables. (Tamini et al. 2016). The coverage of this study corresponded to less than 10% of trawls with the third cable in use, which is the component with have the highest impact on seabirds. The number of individuals caught in the study translates to a bycatch rate of 0.25 birds per trawl, but this was not extrapolated to the fleet-wide scale to obtain an overall estimate of mortality (Morsan et al., 2017).

At least three species of sharks, including porbeagle, spiny dogfish and narrownose smoothhound *Mustelus schmitti*, and a number of rays and skates, including Magellan *Rhinoraja magellanica*, darkbelly *Bathyraja meridionalis*, graytail *Bathyraja griseocauda* and southern thorny *Amblyraja doellojuradoi* (among others), are caught by the fishery (Morsan et al., 2017). However, information on the exact number of individuals or volumes caught by the fishery are not reported.

Mandiola & Rodriguez (2013) provided a preliminary report indicating that the interaction of marine mammals with the fishery is insignificant. The only recorded interaction was with a South American fur seal *Arctocephalus australis*, which was caught and successfully released. However, it seems that observers are not required to inform on marine mammal interactions in this fishery (Prenski et al., 2014).

The impact of the fishery on albatrosses has been high. A high number of rays and skates are caught by the fishery, but the impact is unknown.

4.2.2 Data quality on bycatch

National legislation (CFP Resolution N° 22/2012) requires all vessels working in the Argentine hoki fishery to carry an observer on board. Identification and quantification of ETP species are systematically carried out by this National Institute for Fisheries Research and Development (INIDEP)
observer program, and additionally by the authorities during landing (Morsan et al., 2017). Data on bycatch in this fishery was obtained from these sources and from INIDEP research surveys, logbooks and NGO research (i.e. BirdLife’s Albatross Task Force). However, not all observers record bycatch of ETP species or compliance with mitigation measure requirements.

Observer coverage is 100% in this fishery and independent data (i.e. Albatross Task Force) were also used by the assessment team to estimate the bycatch of ETP species. However, not all observers record bycatch of ETP species or compliance with mitigation measure requirements, and are not required to report marine mammal bycatch.

4.2.3 Scores, conditions and management measures implemented

During the first assessment of the fishery in 2012, the RBF methodology was used for four PI: 2.1.1, 2.2.1, 2.4.1 and 2.5.1 which were scored as 75 in the PCDR. However, these scores were changed to 80 in the FCR with no apparent reason. Finally, the fishery received conditions for 2.2.2, 2.3.1, 2.3.2. These referred to the need to provide evidence that the strategy for managing bycatch species (specifically for cape petrel Daption capense and yellownose skate), was being successfully implemented; to develop a program to measure the impact of the fishery on ETP species and to implement mitigation measures to mitigate the impact of the fishery on seabirds, chondrichthyes and marine mammals in line with the National Plans for these taxa (Prenski et al., 2012). However, it is unclear why the cape petrel was included in these conditions as the impact of the fleet on this species is considered low (Tamini pers. comm.). Throughout surveillance visits, progress of milestones related to these PIs were identified by the assessment team as behind target. However, in the final surveillance report, all these conditions were closed (Morsan et al., 2016).

During the re-certification process in 2017, no conditions or recommendations were made by the assessment team (Morsan et al., 2017). Aves Argentinas lodged an objection to the certification of the fishery due to the absence of any reference to the considerable levels of seabird mortality on the third cable used by some vessels in this fishery. As a result of this objection, P.I. 2.3.2 was re-scored to 75 and a new condition included (OIA 2017). The client action plan stated that by the 3rd annual surveillance the most effective available method for minimizing the mortality of ETP seabirds will be being used, and the performance of this method will be assessed by independent observers, including INIDEP (OBO program) and Aves Argentinas (Leo Tamini pers. comm.).

The observer program conducted by INIDEP is currently monitoring the impact of the fishery on different chondrichthyan species, particularly yellownose skate, spiny dogfish and narrownose smoothhound. The impact on some species, such as porbeagle, spiny dogfish and yellownose skate,
has already been evaluated (Cortes & Waessle, 2016, Massa et al., 2015, Cortés & Cueto 2015) and appears to be low. A series of modifications to avoid the capture of chondrichthyes by vessels have been suggested by Puliafito & Massa (2016). INIDEP has worked with crews to improve on-board handling and post-capture survival of sharks and to test mitigation measures (Morsan et al., 2016). A national action plan for chondrichthyes was developed in 2009 and it has been reviewed several times in recent years to assess the efficacy of the mitigation measures proposed (Morsan et al., 2017). However, some of the measures suggested by Puliafito & Massa (2016) were considered inoperable by industry and it is unclear if any new measures have been implemented to avoid the catch of these species.

The recently adopted seabird bycatch regulations (Resolution N° 3/2017) include several measures and actions to protect and minimise the impacts of fishing activities on seabirds, such as the implementation of two bird scaring lines on bottom trawlers. However, this measure only became mandatory in May 2018, and does not cover the third wire/netsonde cable in the midwater trawl fleet (which was the basis of Aves Argentinas’ objection to certification) (CFP Resolution N° 3/2017) (Morsan et al., 2017).

Proposed actions: During the certification process in 2012, some scores were changed to 80 in the FCR for no apparent reason. In the 2017 certification, a new condition on ETP management was set as a result of an objection lodged by Aves Argentinas.

Action implementation: Measures to address the impact of the fishery on seabirds are under investigation but not yet in place. Measures to minimise the catch of chondrichthyes have been tested but not implemented.

4.2.4 Trends in bycatch and population sizes.

Due to the lack of specific information shown in the reports of this assessment, trends in bycatch in this fishery cannot be evaluated.

The status of black-browed albatrosses is covered under the previous fishery. Southern royal albatross only breeds on 4 islands in New Zealand, although 99% of the total population is confined to Campbell Island. The population on this island was estimated at 7,800 breeding pairs in 2004-2008 (ACAP 2009). Due to this very small breeding range, the species is listed as vulnerable (Birdlife International 2017h).

Southern and northern giant petrel Macronectes halli have large breeding ranges, including Argentina, the Falkland Islands (Islas Malvinas), South Georgia, South Africa, Australia. For the southern giant petrel, recent analysis of trend data for the global population over the past three generations give a best case estimate of a 17 % increase in the population (Birdlife International 2017i). The northern
giant petrel population has shown a significant increase during the last two decades (Birdlife 2017)). Both species are listed as least concern on the IUCN red list.

Of the elasmobranch species caught by this fishery, the catch trends of porbeagle seems to be stable and they are limited to some critical areas (Cortés & Waessle 2014). A recent risk assessment for this species in the Southern Hemisphere, focused on pelagic longline fisheries, was prepared for the Western and Central Pacific Fisheries Commission (Hoyle et al., 2017). Results indicate low fishing mortality rates and low risk from commercial pelagic longline fisheries to porbeagle shark over the spatial domain of the assessment. This a trawl fishery but it seems that these results are consistent with the trends observed in catch rate indicators over the entire Southern Hemisphere range of the porbeagle shark population, which in most cases show stable or increasing catch rates (Hoyle et al., 2017). The species is listed as vulnerable on the IUCN red list although this information needs to be updated (Steven et al., 2006).

Spiny dogfish, another species affected by the fishery, is one of the species of shark more vulnerable to over-exploitation by fisheries because of its biological characteristics (late maturity, low reproductive capacity, etc.) The South American subpopulation is decreasing and is listed as vulnerable (Fordham et al., 2006a). Narrownose smoothhound is subject to intensive fishing across its entire distribution. In Argentinean waters its biomass has decreased by 22% and it is listed as endangered (Massa et al., 2016). Graytail skate is decreasing due to the impacts of fishing and is listed as endangered (McCormack et al., 2007a). Joined fins, cuphead, Patagonian and multispine skates are all listed as near threatened (McCormack 2007b, c, d and e). Whitedotted and yellownose skate populations are also decreasing due to the impact of fishing and both species are listed as vulnerable (McCormack 2007f, Kyne et al., 2007).

**Bycatch trends in this fishery cannot be evaluated. Except southern royal albatross, which is listed as vulnerable, the other albatross species affected by the fishery are considered to be least concern. However, many of the elasmobranch species impacted by the fishery are listed as endangered or threatened.**

### 4.3 New Zealand hake/hoki trawl fishery

#### 4.3.1 Bycatch baseline

In the most recent assessment, the large-vessel trawl fishery targeting hoki had 9.58% of all observed seabird captures in New Zealand (Abraham et al., 2017). 389 albatrosses and 461 “petrels and other birds” were captured in the fishery between the 2002-03 and the 2015-2016 fishing seasons (corresponding to around 2.5 birds per hundred tows), including 272 sooty shearwaters, 165 Salvin's
albatrosses *Thalassarche salvini*, 111 southern Buller’s albatrosses *Thalassarche bulleri*, 98 white-chinned petrels, 89 New Zealand white-capped albatrosses *Thalassarche steadi*, 26 cape petrels, 21 westland petrels, 9 snares cape petrels and 9 Campbell albatrosses (Dragonfly Data Science 2018). This represents an estimated catch of 142 albatrosses and 187 petrels per year, of which around 32% were sooty shearwaters, 19% Salvin’s albatross, 13% southern Buller’s albatross, 11.5% white-chinned petrels and 10% New Zealand white-capped albatross (Dragonfly Data Science 2018). In the hake, ling and southern blue whiting fishery, bycatch numbers of seabirds were lower than in the hoki fishery, with 35, 31 and 23 observed captures of albatross and 35, 45 and 60 of petrels respectively in the same period. The highest bycatch numbers corresponded to:

- sooty shearwaters and Salvin’s albatross in the hake fishery;
- sooty shearwater and New Zealand white-capped albatross in the ling fishery;
- grey petrel and Salvin’s albatross in the southern blue whiting fishery (Dragonfly Data Science 2018).

Elasmobranchs caught include spiny dogfish with an annual catch per year of 217.8 t. over the period 2006-2011, shovelnose dogfish *Deania calcea* with 39.7 per year, smooth skate *Dipturus innominatus* with 18.7 t. per year, seal shark *Dalatias licha* with 9 t. per year and porbeagle with 4 t. per year. Other species caught by the fishery include longnose velvet dogfish *Centroselachus crepidater*, leafscale gulper shark *Centrophorus squamosus* and a number of chimaeras, such as pale ghost shark *Hydrolagus pallidus*. Fifty observed captures of basking sharks have also been reported in the hoki fishery since 1994-95 (Akroyd et al., 2012).

The hoki fishery kills several hundred New Zealand fur seals annually, with 242 individuals estimated caught in the 2012-2013 fishing season. 26, 15 and 11 captures of fur seals were estimated in the southern blue whiting, ling and hake fishery respectively in the same fishing season (Abraham et al., 2016). This represents a cumulative catch for all these fisheries of 294 individuals in 2012/13. In addition, 21 sea lions were observed captured by vessels targeting southern blue whiting near Campbell Island in 2013 (Abraham et al., 2016). Impacts on common, dusky *Lagenorhynchus obscurus*, Hector’s *Cephalorhynchus hectori* and Maui dolphins *Cephalorhynchus hectori maui* have been also suggested by several authors (Robertson & Meyer 2016; Slooten et al., 2018).

177 albatrosses and 233 “petrels and other birds” are caught per year in the combined New Zealand trawl fisheries. Several hundred fur seals are also caught annually.

4.3.2. Data quality on bycatch
Government observers working aboard commercial fishing vessels record captures of protected species, including seabirds and marine mammals and information on the mitigation measures used (Abraham & Richard 2017). Commercial fishing vessels return a record of all fishing effort on each trip to MPI through a Trawl Catch Effort Return (TCER). This form requires the recording of the latitude and longitude of fishing effort which gives a greater spatial detail of fishing effort and bycatch rates by area. According to Abraham & Richard (2017), 26.2%, 19.4%, 16.5% and 48.4% of the fishing events were observed in the hake, hoki, ling and blue whiting New Zealand trawl fisheries respectively between 2003 and 2014, which represent an average of 21.5% of all fishing events. Since 2014, 100% observer coverage in the southern blue whiting fishery became mandatory (Akroyd et al., 2016). Good observer coverage and reporting within these fisheries mean that the effects of the fishery can be estimated with a degree of confidence, in terms of bycatch of ETP species and implementation of mitigation measures. Observers identify and photograph all protected species landed dead and some of them are sent for expert identification onshore (Akroyd & Pilling 2014).

Observer coverage represents an average of 21.5% of fishing events. The quality of the bycatch information is considered adequate.

4.3.3 Scores, conditions and management measures implemented

During the first assessment of the hoki fishery, a series of corrective action requests (CARs) were set by the team as they considered that the risk of the fishery on seals had not been adequately considered (Aalders et al., 2001). Bird and seal bycatch in this fishery was then reviewed (Baird 2004), bird bafflers and seal excluding devices tested (Robertson & Blezard 2004, Cawthorn 2004) and the Hoki Fishery Management Company (HFMC) prepared a code of practice (COP) for mitigating bird and seal bycatch. This CAR was closed out during the fourth surveillance audit (Hilbrands et al., 2004).

During the first re-assessment of the hoki fishery in 2007, three conditions were set for the fishery (Akroyd et al., 2007). One required the client to establish an Environmental Risk Assessment (ERA) methodology to assess the impact of the fishery on bycatch species and introduce management measures to reduce it. An ERA workshop was then undertaken, the main bycatch issues identified, and the condition was closed during the fourth surveillance audit. However, the assessment team recommended regular review of the assigned risk levels in the ERA (Akroyd et al., 2011). A second condition required the client to develop an offal management system to reduce seabird bycatch in the hoki fishery. Across the deepwater trawl fleet managed by the Deep Water Group (DWG), vessels >28m now have Vessel Management Plans in place, which document their fish waste management.

15 This fishery was certified in 2001, using an earlier version of the MSC standards and the process in which the conditions were set was a bit different to the current process
procedures (DWG 2009). The implementation of these plans is audited by onboard observers and DWG staff when vessels are in port, but notably, these plans are not publicly available and compliance levels are not reported. By law, trawlers over 28 m in length fishing in New Zealand waters are required to use one of three specified devices to reduce seabird interactions with trawl warps: paired streamer lines, a bird baffler, or a warp scarer (New Zealand Gazette 2010, Akroyd et al., 2012), though compliance records are not made public (K. Baird, pers. comm). The third condition was set to develop targets for the numbers of fur seals bycaught in order to reduce the impact that the fishery had in the recovery of this species (Hilbrands et al., 2012). Baker, et al. (2009) completed a survey of fur seal populations and an initial potential biological removal (PBR) level of 1,863 fur seals was estimated. It was therefore considered that the impact of the fishery was below a level that would give rise to concern for the rebuilding of the fur seal population and this condition was closed (Punt et al., 2010).

The Royal Forest and Bird Protection Society (RFBPS) and WWF submitted objections to the certification of this fishery based on several issues: unjustified increases in the scores of some indicators in the final report which resulted in the re-certification of the fishery; inadequate assessment of the impacts on fur seals, basking sharks and seabirds (based on a study conducted in the squid fishery (Abraham 2005) it was considered that seabird warp strike mortality could be ten times more frequent than the estimated number); inadequate observer coverage to assess the impact on ETP species; and inadequate accepted limits to estimate the impact on seabirds (Akroyd et al., 2007). However, no substantial changes were made by the CAB with regard to bycatch issues and the fishery was finally recertified.

During the 2nd re-assessment of the hoki fishery, no conditions but four recommendations were made in relation to P2 issues. These recommendations related to work towards quantitative measures of direct impact on all ETP species, to evaluate knowledge of pale ghost shark to increase confidence that this species was within biological limits in all areas, to continue to implement discharge management measures, and incorporate newly available information in practices described in vessel management plans (VMPs) and other measures intended to reduce ETP impacts and increase understanding of ecological impacts of the hoki fishery (Akroyd et al., 2012).

No conditions were given either to the hake or the ling fisheries certified in 2012 and 2014 respectively. However, a recommendation was made by the assessment team in both fisheries for vessels smaller than 28 m to present a voluntary code of conduct, examine interactions with ETP species and consider appropriate mitigation measures if necessary (these small vessels are excluded from the requirement to implement bird interaction mitigation methods) (Akroyd et al., 2014). The blue whiting fishery received one condition under ETP management strategy because of the impact
that this fishery has on sea lions (Medley et al., 2012). Following the 2013 season, when 21 sea lion captures were recorded in the fishery, the use of sea lion exclusion devices (SLEDs) became a requirement for all SBW vessels, along with 100% observer coverage, although SLEDs were not used in all the observed tows (Abraham 2016). A series of procedures were also developed to reduce the fleet’s interactions with sea lions and the condition was closed during the first surveillance visit in 2013 (Akroyd & Pierre 2013). A series of recommendations were made in 2013 and 2014 to further investigate the impact of the fishery on these species and to test the efficacy of the use of the SLEDs. It is unclear why this condition was closed so quickly and raised the question as to whether these recommendations should have been set as conditions.

A national plan of action to reduce the incidental catch of seabirds (NPOA) in New Zealand Fisheries was launched in 2004, including provisions that were specific to the hoki fishery (Hilbrands et al., 2004) but it was later withdrawn and published again in 2013. The 2013 iteration is currently under review.

The hoki fishery has also had a voluntary code of practice to reduce fur seal deaths in the fishery since 1989, but there are no regulations defining mitigation approaches for marine mammal interactions. The use of SLEDs is not required in this fishery. The DWG document *Operating Procedures: Marine Mammals* (OPMM, DWG 2011) describes measures vessel operators are required and recommended to take to minimise marine mammal bycatch. In 2017 the first iteration of a New Zealand Marine Mammal Risk Assessment (NZMMRA) was completed (Abraham et al. 2017).

Risk assessments were conducted during 2010 and 2011 to assess the risks of the hoki fishery on ETP species including sharks and seabirds (Boyd 2011, Rowe 2010, Richard et al. 2011). The 2010 ERA (Boyd 2011) concluded that impacts on deepwater sharks and rays were negligible-minor and deepwater dogfish was minor-moderate although the confidence in this conclusion was ‘low’. A NPOA-sharks has been in place since 2008, subsequently superseded by the NPOA-Sharks 2013 (Ministry for Primary Industries 2013). However, it seems that no specific measures have been introduced to minimise interactions with elasmobranchs in this fishery. Spiny dogfish and pale ghost shark are included in the Quota Management System (QMS) which limit the total quantity of fish taken (Akroyd et al., 2012).

**Proposed actions.** Although bycatch species were considered during the certification process, some of the scores given during the first re-certification of the hoki fishery were increased without apparent justification. Although bycatch levels have not decreased over time, successive re-certifications have not called for more independent public scrutiny of compliance.

**Action implementation.** Management measures to address the impact of the fishery on bycatch species have been implemented and the impact of the fishery on these species is regularly
reviewed. Compliance with the management measures is assessed by the authorities, but this information is not publicly available and ongoing bycatch levels suggest compliance issues. Specific measures to minimise the impact on elasmobranch species have not been put in place. It is also considered that the conditions set in 2012 to reduce the impact of the blue whiting fishery on sea lions were closed too early.

4.3.4 Trends in bycatch and population sizes.

Total captures of seabirds in all trawl fisheries decreased from 3,201 in 2002–03 to 1,695 in 2015–16. Although this represents a 49% reduction in estimated captures over the 13-year period, decreases are a result in reductions in effort and not changes in bycatch rates overall. Moreover, total capture estimates have not changed substantially since 2007-2008 (MPI 2018). Species that did not show a clear decrease were Salvin’s albatross, white-chinned petrel and sooty shearwater (Abraham et al., 2017). In hoki trawl fisheries, there appears to have been an increase in the capture rate of albatrosses, with the mean capture rates from 2011–12 to 2013–14 higher than the mean capture rates in any year between 2005–06 and 2010–11 (Abraham et al., 2017). In 2015-2016, captures of albatrosses in this fishery decreased again (MPI 2018).

Buller’s albatross, Salvin’s albatross and New Zealand white-capped albatross, are all endemic to New Zealand. The estimated annual breeding population of the Buller’s albatross is around 32,134 pairs. The species is restricted to a small area when breeding, although the population is stable and the islands on which it breeds are moderately widespread. The species is listed as near threatened (Birdlife International 2017f). Salvin’s albatross breeds only on the Bounty Islands and the Western Chain of The Snares (AEBAR 2017). Baker et al. (2014) conducted an aerial survey of the Bounty Islands in October 2013 and estimated the total annual breeding pairs at 39,995 compared to the corrected estimate for 2010 of 31,786, which represents 99% of the global population. However, as a biannual breeding species data over a longer time period is needed to assess trends. The species is listed as vulnerable on the IUCN red list (Birdlife International 2017e). The population of white-capped albatross is estimated at around 100,000 pairs. The population trend of this albatross remains poorly known and the species is listed as near threatened given the uncertainty over its trend and because it may be declining at a moderately rapid rate (Birdlife International 2017g).

Clear trends in the capture of elasmobranch species in these fisheries are not identified. Catches from 2006-2007 to 2013-2014 from some of these species seem to variable (Akroyd et al., 2012, AEBAR 2017).
In New Zealand, stock assessments are not available for any of the four stocks of spiny dogfish, the main elasmobranch species affected by the fishery. However, a stock assessment plenary in 2011 concluded that the stock was close to the natural level (Ministry of Fisheries 2011). Spiny dogfish is globally considered as vulnerable due to over-exploitation, although the Australasia population of this species is listed as least concern (Fordham et al., 2016). Smooth skate is widespread throughout New Zealand, though due to low productivity and vulnerability to capture before reaching maturity, it is listed as near threatened on the IUCN red list (Francis 2003). Seal sharks are low in abundance but relatively common with no exchange between different populations. This species is listed as near threatened on the IUCN red list (Blasdale et al., 2009). Porbeagle is a wide-ranging, coastal and oceanic shark, again with apparently little exchange between adjacent populations. Its low reproductive capacity and high commercial value makes this species highly vulnerable to over-exploitation and population depletion. New Zealand has conducted indicator analyses for longline-caught porbeagle shark assessing trends in distribution, catch composition, abundance, size and sex ratios (Francis & Large 2017). Although there was some inconsistency among trends identified for the species, the indicators suggested that the porbeagle population around New Zealand has been stable or increasing since 2005. The species is globally listed as vulnerable (Stevens et al., 2006). The leafscale gulper shark population is decreasing due to the impact of fishing and the species is currently listed as vulnerable (White 2003). Other species impacted by the fishery, such as shovelnose and longnose velvet dogfish are listed as least concern (Dagit & Clarke 2007, Stevens 2003a and b) but the information about these species needs to be updated. Basking sharks may be in decline around New Zealand, given the lack of reported sightings in recent years. Work is underway to review knowledge on these species (DOC 2011).

In the 2012-2013 season, 242 fur seals were caught, which represents a 40% decrease with respect to 2005 (Abraham et al., 2016). Since the use of sea lion exclusion devices (SLEDS) became a requirement for all SBW vessels, the number of sea lions captured in this fishery has subsequently remained at a low level, with 2 and 6 sea lions recorded captured in 2014 and 2015 respectively, and 3 in the 2016/17 fishing season (DWG 2016).

Presently, the majority of New Zealand fur seal populations are increasing, and there is no evidence for sustained declines anywhere within their range (Chilvers & Goldsworthy 2015). However, the West Coast seal colonies have been declining, and nationally the fur seal population is less than 10% of what it was in 1800. New Zealand Sea Lions have a highly restricted distribution for a marine mammal. The main threats to this species are fishing related mortality, climate/nutritional stress and disease. The species is listed as endangered on the IUCN red list (Chilvers 2015).
Capture rates of seabirds in all trawl fisheries in New Zealand have not changed substantially since 2007-2008. In the hoki fishery, there appeared to have been an increase in the capture rates of albatrosses. Many of the species are endemic to New Zealand and are listed as threatened. The number of fur seals and sea lions caught has decreased although sea lion populations are declining and are listed as endangered.

Scores received by the fisheries during the first certification and re-certification processes are shown in table 11.

Table 11 Scores obtained by the fisheries during the MSC certification assessments (numbers in red represent the scoring issues which scored less than 80, which represents “global best practice” level).

<table>
<thead>
<tr>
<th>PI</th>
<th>South Africa hake trawl</th>
<th>Argentine hoki bottom and mid-water trawl fishery</th>
<th>New Zealand Deepwater Group hake, hoki, ling and southern blue whiting</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Scores</td>
</tr>
<tr>
<td></td>
<td>Hoki</td>
<td>Hake</td>
<td>Blue whiting</td>
</tr>
<tr>
<td>2.1.1</td>
<td>NA**</td>
<td>NA 80</td>
<td>100</td>
</tr>
<tr>
<td>2.1.2</td>
<td>NA</td>
<td>NA 95</td>
<td>80</td>
</tr>
<tr>
<td>2.1.3</td>
<td>NA</td>
<td>NA 85</td>
<td>80</td>
</tr>
<tr>
<td>2.2.1</td>
<td>NA</td>
<td>NA 80 (75)</td>
<td>75 (60)</td>
</tr>
<tr>
<td>2.2.2</td>
<td>NA</td>
<td>NA 80</td>
<td>75</td>
</tr>
<tr>
<td>2.2.3</td>
<td>NA</td>
<td>NA 85</td>
<td>80</td>
</tr>
<tr>
<td>2.3.1</td>
<td>NA</td>
<td>NA 80</td>
<td>75</td>
</tr>
<tr>
<td>2.3.2</td>
<td>NA</td>
<td>NA 85</td>
<td>75</td>
</tr>
<tr>
<td>2.3.3</td>
<td>NA</td>
<td>NA 70</td>
<td>80</td>
</tr>
<tr>
<td>2.4.1</td>
<td>NA</td>
<td>NA 80</td>
<td>80 (75)</td>
</tr>
<tr>
<td>2.4.2</td>
<td>NA</td>
<td>NA 70</td>
<td>80</td>
</tr>
<tr>
<td>2.4.3</td>
<td>NA</td>
<td>NA 85</td>
<td>75 (80)</td>
</tr>
<tr>
<td>2.5.1</td>
<td>NA</td>
<td>NA 100</td>
<td>80 (75)</td>
</tr>
<tr>
<td>2.5.2</td>
<td>NA</td>
<td>NA 90</td>
<td>90 (85)</td>
</tr>
<tr>
<td>2.5.3</td>
<td>NA</td>
<td>NA 95</td>
<td>85</td>
</tr>
</tbody>
</table>

*In parenthesis, the scores given by the team in the Public consultation draft report (PCDR)
** These fisheries were certified using a previous version of the MSC standards. Therefore, the scores cannot be compared
### 4.4 Results

Table 12: RAG summary table for southern hemisphere trawl fisheries

<table>
<thead>
<tr>
<th>Name of the fishery</th>
<th>Evidence from the fisheries</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>South Africa hake trawl</strong></td>
<td></td>
</tr>
<tr>
<td><strong>A. Offshore fishery. Bycatch baseline:</strong> In 2004, an estimated 9,300 seabirds were killed annually through cable strikes in this fishery, of which ~7,200 were albatrosses.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Fishery</th>
<th>Data quality</th>
<th>Proposed actions</th>
<th>Action implementation</th>
<th>Bycatch trends</th>
<th>Final score</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Offshore fishery</td>
<td><strong>Green (2)</strong></td>
<td><strong>Amber (1)</strong></td>
<td><strong>Green (2)</strong></td>
<td><strong>Green (2)</strong></td>
<td><strong>Green (7)</strong></td>
</tr>
</tbody>
</table>

**Justification:**

**Data quality:** Data used to estimate bycatch in this fishery came from independent sources and is considered adequate.

**Proposed actions:** At the beginning of the assessment process, the impact on seabirds was considered insignificant. However, actions to reduce seabird bycatch were included during subsequent assessments.

**Action implementation:** Successful management measures (offal discharge management, bird-scaring lines) have been implemented to reduce the impact of the fishery on seabirds as a consequence of the certification process.

**Bycatch trends:** Implementation of management measures led to a seabird bycatch reduction of >90% overall, increasing to 99% for albatrosses. Some concerns remain for other species such as white-chinned petrels and cape gannets.

| **B. Inshore fishery. Bycatch baseline:** Bycatch in the inshore fishery is unknown due to the lack of adequate data. |

<table>
<thead>
<tr>
<th>Fishery</th>
<th>Data quality</th>
<th>Proposed actions</th>
<th>Action implementation</th>
<th>Bycatch trends</th>
<th>Final score</th>
</tr>
</thead>
<tbody>
<tr>
<td>B. Inshore fishery</td>
<td><strong>Red (0)</strong></td>
<td><strong>Amber (1)</strong></td>
<td><strong>Red (0)</strong></td>
<td><strong>Amber (1)</strong></td>
<td><strong>Red (2)</strong></td>
</tr>
</tbody>
</table>

**Justification:**

**Data quality:** The current industry-funded observer programme does not include a representative proportion of inshore trawl fishing activity.
**Proposed actions:** The inshore segment of the fleet was incorporated into the certification in 2015, raising new conditions around seabird bycatch data collection and bycatch reduction.

**Action implementation:** The inshore fleet is not currently engaged in fully implementing the proposed action on seabird bycatch. Management measures in the inshore fishery have not been fully tested. Specific management measures to address the potential impact on elasmobranch species are not in place.

**Bycatch trends:** The inshore fishery has been certified very recently and trends in bycatch cannot be evaluated.

**Proposed actions:** During the certification process in 2012, some scores were changed to 80 in the FCR for no apparent reason. In 2017, a new condition on ETP management was set as a result of an objection lodged by Aves Argentina.

**Action implementation:** Measures to address seabird bycatch on the third wire are under investigation but not yet in place. Measures to minimise the catch of chondrichthyes have been tested but not implemented.

**Bycatch trends:** Trends in bycatch cannot be evaluated. Southern royal albatross is listed as vulnerable, while the other albatross species affected by the fishery are considered as least concern. Many of the elasmobranch species impacted by the fishery are listed as endangered or threatened.

**Justification:**

**Data quality:** Observer coverage is 100% in this fishery and independent data (i.e. Albatross Task Force) were also used by the assessment team to estimate the bycatch of ETP species. However, not all observers record bycatch of ETP species or compliance with mitigation measure requirements, and are not required to report marine mammal bycatch.

**Proposed actions:** The impact of the fishery on albatrosses is high. A high number of rays and skates are caught by the fishery, but the impact is unknown.

**Bycatch baseline:** The impact of the fishery on albatrosses is high. A high number of rays and skates are caught by the fishery, but the impact is unknown.

**Justification:**

**Data quality:** There are observers in this fishery with 100% observer coverage. Albatross Task Force data were also used to estimate the bycatch of ETP species. However, not all observers record bycatch of ETP species or compliance with mitigation measure requirements, and are not required to report marine mammal bycatch.

**Proposed actions:** The inshore segment of the fleet was incorporated into the certification in 2015, raising new conditions around seabird bycatch data collection and bycatch reduction.

**Action implementation:** The inshore fleet is not currently engaged in fully implementing the proposed action on seabird bycatch. Management measures in the inshore fishery have not been fully tested. Specific management measures to address the potential impact on elasmobranch species are not in place.

**Bycatch trends:** The inshore fishery has been certified very recently and trends in bycatch cannot be evaluated.

**Proposed actions:** During the certification process in 2012, some scores were changed to 80 in the FCR for no apparent reason. In 2017, a new condition on ETP management was set as a result of an objection lodged by Aves Argentina.

**Action implementation:** Measures to address seabird bycatch on the third wire are under investigation but not yet in place. Measures to minimise the catch of chondrichthyes have been tested but not implemented.

**Bycatch trends:** Trends in bycatch cannot be evaluated. Southern royal albatross is listed as vulnerable, while the other albatross species affected by the fishery are considered as least concern. Many of the elasmobranch species impacted by the fishery are listed as endangered or threatened.

**Justification:**

**Data quality:** Observer coverage is 100% in this fishery and independent data (i.e. Albatross Task Force) were also used by the assessment team to estimate the bycatch of ETP species. However, not all observers record bycatch of ETP species or compliance with mitigation measure requirements, and are not required to report marine mammal bycatch.
**southern blue whiting**

**Data quality:** Observer coverage represents an average of 21.5% of fishing events. The quality of the bycatch information is considered adequate.

**Proposed actions:** Although bycatch species were considered during the certification process, some of the scores given during the first re-certification of the hoki fishery were increased without apparent justification. Although bycatch levels have not decreased over time, successive re-certifications have not called for more independent public scrutiny of compliance.

**Action implementation:** Management measures to address the impact of the fishery on bycatch species have been implemented and the impact of the fishery on these species is regularly reviewed. Compliance with the management measures is assessed by the authorities, but this information is not publicly available and ongoing bycatch levels suggest compliance issues. Specific measures to minimise the impact on elasmobranch species have not been put in place. It is also considered that the conditions set in 2012 to reduce the impact of the blue whiting fishery on sea lions were closed too early.

**Bycatch trends:** Capture rates of seabirds in all trawl fisheries in New Zealand have not changed substantially since 2007-2008. In the hoki fishery, there appeared to have been an increase in the capture rates of albatrosses. Many of the species are endemic to New Zealand and are listed as threatened. The number of fur seals and sea lions caught has decreased although sea lion populations are declining and are listed as endangered.
Case study 5. North Sea mixed fisheries

Introduction

This case study examines the bycatch performance of four MSC certified fisheries in the North Sea. These fisheries use a wide range of gears, including gillnets, demersal and midwater trawls to target species such as cod, sandeel, sprat, Norway pout, plaice and sole.

In terms of non-target bycatch, these fisheries interact with elasmobranchs (demersal sharks and skates/rays), marine mammals and seabirds.

The name of each fishery (as shown on the MSC website), year of first certification and re-certification, and version of the MSC standard they were certified under are shown in table 13 below.

<table>
<thead>
<tr>
<th>Name of the fishery</th>
<th>Date of the first certification</th>
<th>Version of the MSC standard</th>
<th>Date of re-certification</th>
<th>Version of the MSC standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>19. Osprey Trawlers North Sea twin-rigged plaice</td>
<td>September 2010</td>
<td>FAM v2</td>
<td>May 2016</td>
<td>v.1.3</td>
</tr>
<tr>
<td>20. DFPO Denmark North Sea plaice</td>
<td>March 2011</td>
<td>v.1.0</td>
<td>Certification extended a</td>
<td>NA</td>
</tr>
<tr>
<td>21. DFPO and DPPO North Sea, Skagerrak and Kattegat sandeel, sprat and Norway pout</td>
<td>March 2017</td>
<td>v.1.3</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>22. Scottish Fisheries Sustainable Accreditation Group (SFSAG) North Sea cod</td>
<td>July 2017</td>
<td>v.2.0</td>
<td>NA</td>
<td>NA</td>
</tr>
</tbody>
</table>

a This fishery is currently being re-certified together with a group of other DFPO North Sea fisheries and the re-certification process has been delayed to allow for a joint re-assessment.

5.1 Osprey Trawlers North Sea twin-rigged plaice

5.1.1 Bycatch - baseline

Several studies of catch composition and discarding have been carried out in this fishery in recent years (Wijsman et al., 2014; Cefas, 2015; van der Reijden et al., 2015). A range of bycatch has been reported in this fishery: demersal sharks, including spiny and lesser spotted dogfish Scyliorhinus canicula, nursehound Scyliorhinus stellaris, common Mustelus mustelus and starry smoothhound Mustelus asterias, tope Galeorhinus galeus and common thresher shark Alopias vulpinus; skates, including starry Amblyraja radiata and long nose skates Dipturus oxyrinchus, thornback Raja clavata, spotted Raja montagui, blonde Raja brachyura, cuckoo Leucoraja naevus, undulate Raja undulata,
small eyed *Raja microocellata*, fullers *Leucoraja fullonica* and marbled torpedo *Torpedo marmorata* rays as well as common stingray *Dasyatis pastinaca*. In 2014, 3,559 kg of rays were landed by the fishery, which were mainly discarded (Andrews et al., 2016). Wijsman et al. (2014) reported catch rates per haul of 8.67 kg and 0.25 kg for spiny dogfish and starry ray, respectively. The assessment team calculated an annual catch of around 63 t. of starry ray per year for the fishery (Andrews et al., 2016). Total catches per year for other species were not reported and cannot be evaluated.

**The fishery interacts with several demersal sharks and skates/rays. Total bycatch rates cannot be evaluated due to the lack of specific data**

5.1.2 Data quality on bycatch

The fishery has had a catch monitoring programme in place since 2013, with a crew member nominated to take samples from commercial catches and to record the species composition, including the presence and abundance of species listed under national legislation and binding international agreements (cod, sharks, rays, etc.). Training in species identification has been provided to crew members, and all vessels are equipped with ID guides to assist identification of non-target species (Andrews et al., 2016). This fishery is conducted over both the Dutch and UK EEZs. The Dutch Government has established a discard self-sampling programme in order to meet the information gathering requirements of the European Commission’s Data Collection Framework. This information is collected aboard a reference fleet of 23 vessels. In addition, 10 observer trips are carried out aboard vessels to validate its findings. This data is analysed by the Institute for Marine Resource and Ecosystem Studies (IMARES) in the Netherlands and raised to the fleet level to provide an indication of discarding rates for key species (Andrews et al., 2016). The Centre for Environment, Fisheries and Aquaculture Science (CEFAS) has also conducted some bycatch studies aboard Osprey trawlers (CEFAS 2015).

Data used to estimate bycatch in this fishery includes self-reported and independent data (CEFAS, IMARES). The quality of the data seems to be adequate, but on-board observer coverage is low.

5.1.3 Scores, conditions and management measures implemented

This fishery was first certified in 2010 and received three conditions\(^\text{16}\) related to bycatch (Millner et al., 2010). Conditions on information performance indicators (2.2.3 and 2.3.3) required data collection to support the harvest strategy (included retained, discarded and ETP species) by including some of

\(^{16}\)This fishery also received a condition for 2.1.1 but it referred to retained species (cod) and it is out of the scope of this review
the vessels of the client group in the IMARES discard sampling and observer programmes. Due to limitations in this programme, the fishery put in place its own self-sampling programme (described in 5.1.2) (Miller et al., 2010). Bycatch data was recorded, analysed and presented to the assessment team in the third and fourth surveillance audits (Agonus 2013 and 2015). Some specific research surveys were also undertaken in collaboration with IMARES. These conditions were subsequently closed during the first and second surveillance audits (Andrews et al., 2015). The condition received by the fishery on management of ETP species (2.3.2) referred specifically to the impact of the fishery on ocean quahog *Arctica islandica*, a shellfish species not relevant to this review. However, complementary to this condition, the Osprey group collaborated with government agencies to develop management plans for the fishery within Natura 2000 SACs (Dogger Bank). The fishery also set some voluntary closed areas to avoid impacts on protected species and sensitive habitats. A series of technical measures, such as the use of semi-pelagic trawl doors and different arrangements of rubber discs on the footrope of the gear, were also implemented by the fleet. This condition was also closed during the first certification period (Andrews et al., 2015).

During the re-assessment, the fishery received two conditions for ETP outcome and information performance indicators, both directly related to starry rays (Andrews et al., 2016). At the first surveillance audit, the Osprey group provided a research plan that has been prepared by Wageningen Marine Research (WMR, formerly IMARES) at the request of three Dutch MSC-certified fisheries (this one, the CVO North and the Ekofish Group North Sea Twin-Rigged Otter Trawl Plaice Fishery) to investigate the direct effects of these fisheries on starry ray. This project involves on-board observers monitoring catches and assessing the post-survival rate of starry ray in the entire Dutch twin-rig fleet; and estimates stock status and population trends to assess the impact of these fisheries on the species. This information will be used to support a full strategy to manage the impact on this and other ETP species (Andrews & Millner 2017).

Proposed actions: The initial certification did not adequately address impacts on starry ray, resulting in conditions being set in re-certification.

Action implementation: A series of management measures (voluntary closed areas, technical measures, etc) aimed at reducing the impact on ETP species and habitat have been implemented by the fishery and a research plan to assess the impact on starry ray is being carried out.

5.1.4 Trends in bycatch and population sizes

Trends in bycatch cannot be evaluated due to the lack of specific data. Spiny dogfish, the main species affected by the fishery, is vulnerable to over-exploitation by fisheries because of its biological
characteristics (late maturity, low reproductive capacity, etc.). Fisheries stock assessments report a decline in total biomass of >95% from baseline in the northeast Atlantic, where catch effort is effectively unlimited (Fordham et al., 2016). The northeast Atlantic subpopulation of spiny dogfish is therefore listed as critically endangered (Fordham et al., 2016). Abundance indices for starry ray, the second most caught bycaught species, indicate that the stock has decreased steadily since the 90s with a 47% decrease in average abundance in 2010/11 compared with the average for the previous five years (ICES 2012c). The species is globally listed as vulnerable although it is an abundant species in the North Sea and it is listed as least concern in the northeast Atlantic region (Kulka et al., 2009).

Longnose skate has declined by nearly 30% over the past 30 years (Ellis et al., 2015a). Considering the status of similar species in the northeast Atlantic, the low catch levels and the slow life history of this species, it is listed as near threatened on the IUCN red list (Ellis et al., 2015a). Thornback ray is widespread, although there is some limited evidence of a decline in landings in the northern part of the east Atlantic range and the species is currently listed as near threatened (Ellis 2016). Blonde skate is endemic to the northeast Atlantic and western Mediterranean Sea. Although it is locally abundant in some areas, survey data indicate that marked declines have occurred, as in similar medium sized skates. Due to these declines, its life history characteristics and intensive fishing pressure, the species is also listed as near threatened (Ellis 2009). Undulate skate has a patchy distribution in the northeast and eastern central Atlantic, with discrete areas where it may be locally common, although available data suggest that in these areas declines have occurred. This medium-bodied skate also has limiting life-history characteristics that make it more vulnerable to exploitation than smaller skate species. Due to these factors, the species is assessed as endangered on the IUCN red list (Coelho et al., 2009).

Common smooth hound is assessed as data deficient in the northeast Atlantic due to the lack of species-specific information. However, the species is vulnerable globally based on continuing declines over three generations and may prove to meet the criteria for a higher category in the future (Serena et al., 2009a). Tope is also listed as data deficient in the northeast Atlantic due to lack of specific data for the species. Globally, it is listed as vulnerable (Walker et al., 2009).

Starry smooth hound, spotted and cuckoo skates and lesser spotted dogfish are all listed as least concern (Serena et al., 2009b, Ellis 2007, Ellis et al., 2015b, Ellis et al., 2009). Spotted torpedo and common stingray are data deficient (Notarbartolo di Sciara et al., 2009, Serena et al., 2009).

 Trends in bycatch cannot be evaluated due to the lack of specific data. Spiny dogfish, the main bycatch species affected by the fishery, is listed as critically endangered. Some endangered, near threatened and vulnerable skates and rays (including longnose, blonde and undulate skates and thornback and starry rays), are also affected by the fishery.
5.2 DFPO Denmark North Sea plaice [set net and trawl]

5.2.1 Bycatch - baseline

Bycatch numbers of elasmobranch species in this fishery come from the last surveillance report, published in 2018 (Gaudian et al., 2018). In 2016, 4,327 kg of dogfish, 665 kg of porbeagle, and 92 kg of lesser spotted dogfish were caught by certified vessels. In addition, 195 kg of blue skate, 149 kg of Thornback ray, 77 kg of starry, 40 kg of spotted and 30 kg of blonde ray were also reported, primarily by trawl gear.

Marine mammals are regularly captured by the fishery. An annual catch of approximately 800 harbour porpoises was estimated from Danish vessels fishing with setnets in the North Sea during the certification of this fishery in 2011 (Southall et al., 2011). In 2012, 80 seals and 35 harbour porpoises were reported in logbooks by this specific fishery (Gaudian et al., 2018). Approximately 30 seabirds/waterfowl combined were also recorded as being captured in the fishery in 2011, although specific species were not reported (FCI 2013).

**Total bycatch rates of demersal sharks and skates/rays in trawlers are reported to be low. The gillnet element of this fishery reports catches of marine mammals, including harbour porpoises, common and unidentified seals.**

5.2.2 Data quality on bycatch

As part of the DFPO Code of Conduct (CoC), all certified vessels have a copy of an ETP logbook on board and completing it is a mandatory requirement to sell certified fish. The vessels have a copy of the DFPO guide to protected species with images, descriptions, identification tips and handling guidelines for 86 species/groups of marine mammals, sharks, rays, birds, protected fish and corals/sea sponges (Gaudian et al., 2018). The level of observer coverage/independent data used to assess the impact of the fishery on ETP species is not specified in any of the surveillance reports consulted. Concerns have been raised by some NGOs about the decrease in the number of fishing trips inspected by Danish authorities in recent years (Hubbard 2017).

**Data used to estimate bycatch in this fishery appears to include only self-reported data. The level of independent observer coverage is unknown.**

5.2.3 Scores, conditions and management measures implemented

During certification, the gillnet element of the fishery received conditions for all the discard and ETP species performance indicators. Conditions required the client to assess the impact of the fishery on diving birds and design a strategy to manage this (Southall et al., 2011). A code of conduct to record
bycatch and reduce the impact of the fishery was implemented and, based on the low (self-reported) impact of this fishery on diving birds, these conditions were closed during the surveillance audits in 2013 and 2014 (FCI 2014). In the case of ETP species, the conditions focused on harbour porpoise (Southall et al., 2011). The porpoise bycatch rate was calculated and the conditions closed, despite the fact that the combined incidental capture of harbour porpoise in all North Sea fisheries was considered unsustainable (FCI 2015) and no remedial actions (such as seasonal avoidance of high density areas, changes to fishing techniques and application of mitigation technologies, e.g. acoustic deterrent devices) were implemented in this fishery.

For the trawl fishery, three conditions were set for all the ETP species performance indicators. These conditions focused on common skate and spurdog (Southall et al, 2011). A code of conduct for responsible fishing was implemented by the fishery, which explicitly included electronic reporting systems to report ETP interactions and identification guides were distributed to DFPO vessels. Landings of these species were eliminated and detailed data on the catches of spurdog and skate was provided to the assessment team during the respective surveillance audits and the conditions closed (FCI 2014). However, a recommendation was raised by the assessment team during the last surveillance audit in 2018 to analyse the available ETP data to show trends over time (Gaudian et al., 2018) as it seems that these data have not been evaluated in recent years.

**Proposed actions:** Conditions were put in place for discarded and ETP species, including requirements to improve monitoring and assessment/testing of mitigation techniques.

**Action implementation:** Codes of conduct for responsible fishing were implemented by the fishery and monitoring of bycatch species improved, though data were primarily self-reported. No specific remedial actions were put in place to reduce the impact on ETP species. Conditions were closed in spite of cumulative fishery impacts on harbour porpoise.

### 5.2.4 Trends in bycatch and population sizes

Only two years of bycatch data (2016 and 2017 for January-October) are adequately reported by the fishery to allow comparisons. Catches of spiny dogfish and porbeagles, the two main shark species caught by the trawl element of the fishery, increased from 2016 to 2017 by at least 30 and 40% respectively. Catches of blue skate and starry ray increased by around 90% for both species. Some species of elasmobranch, such as common and starry smoothhound, nursehounds and Norwegian skate, were not reported in previous years, but were caught in 2017 (Gaudian et al., 2018). It is unclear if these increases are due to higher bycatch rates or due to better reporting by the fishery.
In 2014, 37 porpoises were estimated to be caught by the setnet part of the fishery (Acoura Marine 2014). Estimated bycatch of this species increased to 80 in 2017 (Gaudian et al., 2018). Seal bycatch increased from 77 in 2016 to 102 in 2017. White-beaked and bottlenose dolphins were also reported as bycatch during 2017 (Gaudian et al., 2018).

The status of some of the species affected by the fishery, including spiny dogfish and starry ray, have been indicated in the Osprey twin-rig trawler section above.

In 2009, the SCRS attempted an assessment of the four porbeagle stocks in the Atlantic Ocean (ICCAT, 2010). For the northeast stock, an exploratory assessment indicated that biomass is below BMSY and that recent fishing mortality is near or above FMSY. Recovery of this stock to BMSY under no fishing mortality is estimated to take ca. 15-34 years (Espino et al., 2016). The European stock is listed as critically endangered on the IUCN red list (Stevens et al., 2006). *Dipturus batis* complex species (which includes common, blue and flapper skate) were traditionally important commercial species in northern European seas. Fisheries data indicates that populations of common skate have suffered a large contraction in geographical range over the latter half of the 20th century, although they remain a bycatch species in trawl and net fisheries (ICES 2016). The species has been extirpated from most of the North Sea and it is assessed as critically endangered on the IUCN red list (Dulvy et al., 2006).

The population of harbour porpoise in the North Sea was covered by aerial surveys as part of the SCANS-III survey in 2016 (NAMMCO 2016). This was the third in a series of large-scale surveys for cetaceans in European Atlantic waters initiated in 1994 in the North Sea and adjacent waters (Hammond et al., 2017). This survey estimated the population of this species in the area to be around 345,373 individuals, though this is further split into smaller management units. The overall population appears to have been stable since the mid-1990s (Hammond et al., 2017), but this does not account for changes within the smaller management units. The observed distribution of bottlenose dolphins in this survey was similar to that observed in previous surveys (Hammond et al., 2013; CODA 2009). The estimate of abundance for 2016 of 27,700 individuals was smaller than that from 2005/07 of 35,900 (WGMME 2016) but a direct comparison between estimates should not be made because the areas surveyed were not equivalent (Hammond et al., 2017). The observed distribution and abundance of white-beaked dolphins in 2016 was similar to that observed in previous surveys (Hammond et al., 2017, 2013 and 2002) showing no changes in abundance trends since 1994 (Hammond et al., 2017). Both common and grey seal North Sea populations are stable or increasing and they are listed as least concern on the IUCN red list (Lowry 2016, Bowen 2016) although some North Sea populations are declining (SCOS 2017).
Catches of elasmobranch species and marine mammals in the fishery have increased in recent years. Some of the species affected by the fishery, such as spiny dogfish, porbeagle and the *Dipturus batis* complex are critically endangered.

5.3 Scottish Fisheries Sustainable Accreditation Group (SFSAG) North Sea cod [trawl]

5.3.1 Bycatch - baseline

Elasmobranch species are regularly caught by the fishery. Landings data in the public certification report for this fishery shown an average annual catch of 141 t. for cuckoo ray, 86.6 t. for spotted ray, 44.2 t. for thornback ray and 44.9 t. for lesser spotted dogfish for the period 2013-2015 (Sieben et al., 2017). Other species reported by the fishery are spiny dogfish, common, blue *Dipturus flossada* and flapper skate *Dipturus intermedia* and starry ray (Sieben et al., 2017). Six-gilled shark *Hexanchus griseus* and porbeagle are also caught by the fishery in low numbers. The only marine mammal reported as interacting with the fishery is grey seal, also in low numbers (Sieben et al., 2017).

This fishery reports moderate levels of bycatch of demersal sharks, skates and rays.

5.3.2 Data quality on bycatch

Two sources of data were available to assess the impact of this fishery on bycatch species: Marine Scotland data on declared landings during the period 2013-15, which contains some misidentified specimens (a couple of skate species shown in this data are not present in the North Sea); and the data collected by trained observers under the protected, endangered, threatened (PET) bycatch recording scheme (covering 47 trips in 2014 and 105 in 2015) which records both retained and discarded species (Sieben et al., 2017). However, this equates to less than 1% observer coverage. In 2016, the Scheveningen control experts’ group considered that 8 out of the 12 demersal segments in the North Sea had a high to very high risk for non-compliance with the landing obligation. The two main concerns were illegal discarding and mis-recording of legal discards.

Data used to estimate bycatch in this fishery includes landings and independent data provided by Marine Scotland. However, less than 1% of the trips are monitored by observers.

5.3.3 Scores, conditions and management measures implemented

The fishery was first certified in 2017. It received three conditions for all the ETP species performance indicators. These conditions focused on starry ray and common skate to demonstrate that the strategy to reduce the impact on these species is working and the fishery does not create unacceptable impacts (Sieben et al., 2017). No recommendations were made by the assessment team.
A series of initiatives have been put in place to record the impact on ETP species, such as the PET bycatch recording scheme and the distribution of skate and ray identification cards to member vessels (Sieben et al., 2017). Elasmobranch species in the North Sea are protected under EU Regulation 2017/127, which prohibits retention and landing of various species, including starry ray, common skate, porbeagle and spiny dogfish, among others. When accidentally caught, species should not be harmed and should be promptly released. ICES advise that catches of all four of these species should be avoided where possible. However, as stated in the assessment report, individuals are usually dead or injured on arrival on board, and it is not clear that the requirement to discard promptly has any benefit for these species (Sieben et al., 2017). It appears that alternative management measures such as seasonal and/or area closures or technical measures have not been explored or implemented by the fishery.

Proposed actions: Three conditions were put in place for ETP species to assess the scale and demonstrate the efficacy of measures to reduce bycatch. However, the assessment team did not include specific reference to the type of data necessary (self-reported and independent data) to adequately assess the impact of the fishery on rays.

Action implementation: The EU has prohibited the retention on board of some of the species affected by this fishery, but no mitigation measures (including spatial/temporal closures) have been implemented.

5.3.4 Trends in bycatch and population sizes

Only three years of landing data (2013-2015) are provided in the public certification report. Landings of lesser spotted dogfish, cuckoo, spotted and thornback rays have increased over this period but are all considered commercial species. Landings of common skate and spiny dogfish are low, and no clear trends are observed. The data provided by the PET bycatch recording scheme shows decreases in the number of starry ray, spiny dogfish and common skate complex (flapper, common and blue skates) caught by the fishery (Sieben et al., 2017)

The status of common skate, starry ray and spiny dogfish populations have been highlighted under the other fisheries in this case study.

Slight decreases in bycatch of some species are observed in this fishery, others show no trend. Some of the species affected are listed as critically endangered.

Scores received by the fisheries during the first certification and re-certification processes are shown in table 14 below:
Table 144 Scores obtained by the fisheries during the MSC certification assessments (numbers in red represent the scoring issues which scored less than 80, which represents “global best practice” level).

<table>
<thead>
<tr>
<th>PI</th>
<th>Osprey Trawlers North Sea twin-rigged plaice</th>
<th>DFPO Denmark North Sea plaice</th>
<th>Scottish Fisheries Sustainable Accreditation Group (SFSAG) North Sea cod</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Set net</td>
<td>Trawl</td>
<td></td>
</tr>
<tr>
<td>2.1.1</td>
<td>75</td>
<td>80</td>
<td>85</td>
</tr>
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<tr>
<td>2.1.3</td>
<td>85</td>
<td>80</td>
<td>85</td>
</tr>
<tr>
<td>2.2.1</td>
<td>80</td>
<td>80</td>
<td>75</td>
</tr>
<tr>
<td>2.2.2</td>
<td>80</td>
<td>80</td>
<td>75</td>
</tr>
<tr>
<td>2.2.3</td>
<td>70</td>
<td>80</td>
<td>75</td>
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<td>70</td>
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<td>60</td>
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<td>90</td>
</tr>
<tr>
<td>2.5.3</td>
<td>90</td>
<td>90</td>
<td>90</td>
</tr>
</tbody>
</table>
### 5.5 Results

#### Table 15 RAG summary table for North Sea Mixed fisheries

<table>
<thead>
<tr>
<th>Name of the fishery</th>
<th>Evidence from the fisheries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Osprey Trawlers North Sea twin-rigged plaice</td>
<td><strong>Bycatch – baseline:</strong> The fishery interacts with several demersal sharks and skates/rays. Total bycatch rates cannot be evaluated due to the lack of specific data.</td>
</tr>
<tr>
<td><strong>Data quality</strong></td>
<td><strong>Proposed actions</strong></td>
</tr>
<tr>
<td>Amber (1)</td>
<td>Amber (1)</td>
</tr>
</tbody>
</table>

**Justification:**

**Data quality:** Data used to estimate bycatch in this fishery includes self-reported and independent data (CEFAS, IMARES). Data quality appears adequate, but on-board observer coverage is low.

**Proposed actions:** The initial certification did not adequately address impacts on starry ray, resulting in conditions being set in re-certification.

**Action implementation:** A series of management measures (including voluntary closed areas and technical measures) aimed at reducing impacts on ETP species and habitats have been implemented by the fishery and a research plan to assess the impact on starry ray is being carried out.

**Bycatch trends:** Trends in bycatch cannot be evaluated due to the lack of specific data. Spiny dogfish, the main bycatch species affected by the fishery, is listed as critically endangered. Some endangered, near threatened and vulnerable skates and rays (including longnose, blonde and undulate skates and thornback and starry rays) are also affected by the fishery.

| DFPO Denmark North Sea plaice | **Bycatch – baseline:** Total bycatch rates of demersal sharks and skates/rays appear to be low. The gillnet element of this fishery reports catches of marine mammals, including harbour porpoises, common and unidentified seals. |
| **Data quality** | **Proposed actions** | **Action implementation** | **Bycatch trends** | **Final score** |
| Red (0) | Green (2) | Red (0) | Red (0) | Red (2) |

**Justification:**

**Data quality:** Data used to estimate bycatch in this fishery appears to include only self-reported data. The level of independent observer coverage is unknown.
Proposed actions: Conditions were put in place for discarded and ETP species, including requirements to improve monitoring and assessment/testing of mitigation techniques.

Action implementation: Codes of conduct for responsible fishing were implemented by the fishery and monitoring of bycatch species improved, though data were primarily self-reported. No specific remedial actions were put in place to reduce the impact on ETP species. Conditions were closed in spite of cumulative fishery impacts on harbour porpoise.

Bycatch trends: Catches of elasmobranch species and marine mammals in the fishery have increased in recent years. Some of the species affected by the fishery, such as spiny dogfish, porbeagle and the Dipturus batis complex are critically endangered.

<table>
<thead>
<tr>
<th>Scottish Fisheries Sustainable Accreditation Group (SFSAG) North Sea cod</th>
<th>Bycatch – baseline: This fishery reports moderate levels of bycatch of demersal sharks, skates and rays.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Data quality</strong></td>
<td><strong>Proposed actions</strong></td>
</tr>
<tr>
<td>Red (0)</td>
<td>Amber (1)</td>
</tr>
</tbody>
</table>

**Justification:**

**Data quality:** Data used to estimate bycatch in this fishery includes landings and independent data provided by Marine Scotland. However, it appears that less than 1% of the trips are monitored by observers.

**Proposed actions:** Three conditions were put in place for ETP species to assess the scale and demonstrate the efficacy of measures to reduce bycatch. However, the assessment team did not include specific reference to the type of data necessary (self-reported and independent data) to adequately assess the impact of the fishery on rays.

**Action implementation:** A series of initiatives have been put in place to record the impact on ETP species, such as the PET bycatch recording scheme and the distribution of skate and ray identification cards to member vessels. The EU has prohibited the retention of some of the affected species, but it appears that there are no specific measures in place, such as closed fishing areas, to avoid the bycatch of skates and rays.

**Bycatch trends:** Slight decreases in bycatch of some species are observed in this fishery, others show no trend. Some of the species affected are listed as critically endangered.
Case study 6. Northwest Atlantic snow crab and lobster trap fisheries

Introduction

Along the Canadian and US Atlantic coasts, a number of snow crab *Chionoecetes opilio* and American lobster *Homarus americanus* trap fisheries have been certified in recent years. These fisheries have been known to entangle whale species, including humpback, minke, fin *Balaena physalus* and of greatest concern, North Atlantic right whales (NARW) *Eubalaena glacialis*, one of the most endangered marine mammals in the world. It is challenging to attribute entanglements of baleen whales to a particular geographic location, gear type or specific fishery. Therefore, this case study evaluates the impact of these MSC certified fisheries on baleen whale species at collated Canadian (incorporating 4 similar fisheries) and US (incorporating 2 similar fisheries) scales. This is a more meaningful scale, as management is broadly consistent at the national level.

The name of each fishery (as shown on the MSC website), year of first certification and re-certification, and version of the MSC standard they were certified under are shown in table 16.

<table>
<thead>
<tr>
<th>Name of the fishery</th>
<th>Date of the first certification</th>
<th>Version of the MSC standard</th>
<th>Date of the re-certification</th>
<th>Version of the MSC standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>23. Gulf of St. Lawrence snow crab trap fishery</td>
<td>September 2012</td>
<td>v.1.0</td>
<td>May 2016&lt;sup&gt;9&lt;/sup&gt;</td>
<td>v.1.3</td>
</tr>
<tr>
<td>23. Scotian Shelf snow crab trap fishery</td>
<td>July 2012</td>
<td>v.1.0</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>23. Bay of Fundy, Scotian Shelf and Southern Gulf of St Lawrence lobster trap fishery</td>
<td>May 2015</td>
<td>v.1.3</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>23. Newfoundland &amp; Labrador snow crab fishery</td>
<td>April 2013</td>
<td>v.1.2</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>24. Maine lobster trap fishery</td>
<td>February 2013</td>
<td>v.1.0/v.1.3</td>
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<td>NA</td>
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</tbody>
</table>

<sup>9</sup> For reasons of both space and consistency with previous case studies, a representative number of fisheries have been selected for this example. MSC certified fisheries in the area also include the Eastern Canada offshore, Prince Edward Island, Iles-de-la-Madeleine and Gaspésie lobster trap fisheries.
This fishery was suspended in 2017

It seems that the Gulf of Maine lobster fishery was first certified in February 2013 as Maine lobster trap fishery and the name was later changed.

6.1 Canadian fisheries (Gulf of St. Lawrence snow crab trap fishery/ Bay of Fundy, Scotian Shelf and Southern Gulf of St Lawrence lobster trap fishery/ Scotian Shelf snow crab trap fishery/ Newfoundland & Labrador snow crab fishery)

6.1.1 Bycatch - baseline

Almost 800 incidents involving 19 cetacean species were reported by marine mammal response networks in Atlantic Canada from 2008-2014. Incidents involving mysticetes (NARW, humpback, minke, fin, sei, blue Balaena musculus and bowhead whales Balaena mysticetus) were the most commonly reported; of these, 95% of the NARW incidents and 85% of the humpback incidents were reported as interactions with fishing gears. Gear could not be identified in 78% of the interactions with NARW and in about half of the interactions with other species of baleen whales (DFO 2016). However, the annual relative risk of lethal NARW entanglements in snow crab and lobster traps was estimated by Brilliant et al., (2017) to be <2.6% and <7.1% respectively, lower than in other gears such as herring gillnet (<10.1%), groundfish gillnet (<12.7%) and groundfish longline (66.1<%). Notably, however, this was prior to shifts in right whale distribution (Davis et al., 2017; Hayes et al., 2018). A review of scars detected on NARW over a period of 30 years (1980-2009) identified that 83% of the individuals were entangled at least once, and almost half of them more than once (Knowlton et al, 2012). In 61 entanglement events analysed by Johnson et al., (2005), 89% of the entanglements were attributed to pot and gill net gear, buoy lines and groundlines were the most common gear components involved. According to DFO (2016), from 2008 to 2014 the NARW annual mortality rate and annual injury rate attributed to fishing gear interactions was estimated at 0.43 animals and 1.57 animals per year respectively. For humpback whale, the annual mortality and injury rates due to fishing gear interactions were 2.57 and 6.43 animals per year respectively. Robbins (2011, 2012) estimate a 3% annual mortality rate to Gulf of Maine humpbacks due to entanglement meaning an

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18 Incident refers to fishing gear entanglements, collisions, strandings or carcasses and reported deaths for unknown reasons
19 It is necessary to be cautious about bycatch data previous to 2010 because it seems that NARW have changed their distribution in the area and the reasons are unclear.
average of 25 killed per year. However, the observed number of mortalities caused by fishing gear entanglements is considered a minimum estimate, because not all the individuals affected are observed. Entangled right whales can suffer long-term injury leading to poor health, decreased reproduction, and shorter life which is likely to limit population recovery (DFO 2016b).

The annual relative risk of lethally entangling NARW in snow crab and lobster traps is estimated at <2.6% and <7.1% respectively. However, these estimates were done prior to the shift in right whale distribution which began around 2010. The total number of baleen whale mortalities is unknown because not all the individuals affected are observed. Entanglement in crab/lobster traps is likely to be limiting NARW population recovery.

6.1.2 Data quality on bycatch

Canadian vessels are required to report catch and interaction with species listed under Species at Risk Act (SARA) regulation in a logbook. This includes the recording of information on species hooked or entangled, condition upon release and whether the gear was removed or not (Devitt et al., 2012). There are also several marine mammal response networks that operate throughout Atlantic Canada which collect information on the species, type of incident, location and causes of injury, and provide annual reports to the DFO National Marine Mammal Response Program (MMRP) (i.e. opportunistic data). Canada’s At-Sea Observer Program places certified private-sector observers aboard fishing vessels to monitor fishing activities, collect scientific data and monitor industry compliance with fishing regulations and licence conditions, including measures on bycatch, gear restrictions, spatial/temporal closures and ETP species occurrences (DFO 2017). At-sea observer coverage varies by Crab Fishing Area (CFA) but in 2018 it represented between 15 and 20% of fishing trips (DFO 2018). In 2016, DFO identified that increased at-sea observer coverage was required to calculate fishery-specific bycatch rates and estimates of uncertainty (DFO 2016a).

Data used to estimate bycatch in this fishery includes self-reported, observer and opportunistic data. Observer coverage of 15-20% is in place. In 2016, DFO identified that increased at-sea observer coverage was required to calculate fishery-specific bycatch rates and estimates of uncertainty.

6.1.3 Scores, conditions and management measures implemented

No conditions or recommendations of relevance for this review were given for any of the fisheries included in this group, either during the first assessment processes (Garforth et al., 2012a and b, Addison et al., 2013, Criquet et al., 2015) or the re-assessment of the Gulf of St Lawrence snow crab fishery (Mateo et al., 2017a). During the public consultation period of the Scotian shelf fishery, some
scores were reduced for ETP performance indicators, but they did not result in any conditions set, as the final scores for these P.I. were higher than 80 (Mateo et al., 2017b). However, during the re-assessment of the Gulf of St. Lawrence snow crab fishery, a high mortality episode of NARW occurred and an expedited audit was undertaken by the CAB. It resulted in the suspension of this fishery as the assessment team considered that the ETP outcome and management P.I. did not reach the 60 guidepost (Criquet & Knapman 2018).

In Canada, all SARA Schedule 1 species have recovery strategies developed that include short-term and long-term goals for protection and recovery. Action plans are also required within a year of a species being listed as ‘endangered’ and two years for threatened or extirpated species.

The NARW was listed as endangered under the Species at Risk Act (SARA) in 2003. A Recovery Potential Assessment (RPA) for the NARW was developed in 2007 and it states there is no scope for allowable human-induced mortality, since the population abundance is estimated as critically low and the population appears to be declining toward extinction (Hayes et al., 2018). Therefore, a zero-take national limit was set (DFO 2017). Two critical habitat areas for the species, Roseway Basin and Grand Manan, were identified and fishing was restricted in these areas. However, this measure was implemented before the NARW population changed its distribution. In 2014, the recovery strategy was amended to provide a more detailed description of the features, functions and attributes of the critical habitat (DFO 2014). Basic training is provided to DFO officers and volunteer fishermen through the active Maritimes Marine Animal Response Network (MMARN). Voluntary programs have been implemented to avoid entanglement of NARW in fishing gear. In 2016, an “Action plan for the NARW in Canada: Fishery Interactions” was proposed by DFO (DFO 2016). However, it seems that specific measures were not implemented until the 2017 mortality event (Criquet & Knapman 2018). New measures for the snow crab fishery, including static and dynamic closures, a reduction in the length of float ropes, gear marking, identification of buoys and reporting of lost gear were introduced in 2018 (DFO 2018). The report on the progress of recovery strategy implementation for the NARW in Canada states that: “Limited efforts have also been made to reduce the incidence and severity of entanglements, but these events remain a major cause of injury and mortality” (Fisheries and Oceans Canada 2016).

**Proposed actions:** No conditions were set for any of these fisheries during the assessment process despite the potentially high impact of the fishery on the NARW population.

**Action implementation:** Limited efforts had been made in Canadian waters to reduce the incidence and severity of entanglements until the 2017 NARW mortality event. New management
measures were announced for 2018, but later lifted. No commitment has been made to any specific measures for 2019.

6.1.4 Trends in bycatch and population sizes

Throughout its range in both Canada and the U.S., the North Atlantic right whale is subject to human-related mortality. Vessel strikes and entanglements in fishing gears are the primary causes of mortality (Hayes et al., 2018). The Gulf of St Lawrence has been used more regularly in recent years by the NARW population, though the reasons for this are unclear (Dauost et al., 2017), it appears to coincide with ecosystem changes related to a changing climate (Hayes et al., 2018). There has been an increase in the number of incidents reported since 2015 in the area and at least 4 mortality and 9 entanglement incidents were linked to snow crab gears (NOAA 2018d). In 2017, an unprecedented NARW mortality event occurred in the Gulf, with 12 NARWs found dead and five live-entanglements documented. Two of these mortalities were linked to the Gulf of St. Lawrence snow crab fishery. The goal of the recovery strategy for the NARW is “to achieve an increasing trend in population abundance over three generations” (60 years). During the time period reported in the recent progress report for this strategy (2009-2014), the NARW population increased from 438 to 522. However, more recent data indicate that the species has been in decline since 2010 (Pace et al 2017). The species is listed as endangered on the IUCN red list (Reilly et al., 2012).

The overall North Atlantic population of humpback whale, the other baleen species most affected by the fishery, was estimated to be 4,894 males and 2,804 females (Palsbøll et al. 1997). The species is listed as least concern on the IUCN red list (Reilly et al., 2008).

Since 2015, there has been an increase in the number of reported NARW entanglement incidents. A high mortality event occurred in 2017, in which 12 individuals were known to be killed or entangled in Canada; four of these mortalities were linked to snow crab gears. The NARW population is in decline and the species is listed as endangered.

6.2 U.S. fisheries (Gulf of Maine lobster fishery/ Maine Lobster Trap Fishery)

6.2.1 Bycatch - baseline

The Northeast/Mid-Atlantic American Lobster Trap/Pot Fishery is listed by NOAA as category 1 fishery according to the level of interactions that result in incidental mortality or serious injury of NARW (Western North Atlantic [WNA] stock), humpback whales (Gulf of Maine stock) and minke whales (Canadian East Coast stock). For NARW, mortality resulting from entanglement exceeds 50% of the species’ PBR level (NOAA 2018f). For the period 2011 to 2015, the minimum rate of annual human-caused mortality and serious injury to right whales averaged 5.36 per year, of which incidental fishery
entanglement represented 4.55 per year (NOAA 2017b). For the Gulf of Maine humpback whale stock, it averaged 9.05 animals per year, of which 7.25 were fishery interaction records (Henry et al. 2017). All these mortalities cannot be attributed to these specific fisheries, but real mortality is probably underreported as not all the individuals affected are recovered. Potential biological removals for NARW and Gulf of Maine humpback whales are calculated at 1 and 13 whales, respectively.

The fishery is listed as a category 1 fishery because of the annual level of serious injury and mortality of NARW. For this species, mortality in this fishery exceeds 50% of the Potential Biological Removal (PBR) level.

6.2.2 Data quality on bycatch

According to US Marine Mammal Protection Act (MMPA) regulations, any vessel owner, operator, or fisherman working in a Category I, II, or III fishery must report all incidental deaths or injuries of marine mammals during commercial fishing to NOAA. Fishermen working in a Category I or II fishery must also accommodate observers onboard their vessels upon request (NOAA 2018c). NOAA maintains a sightings advisory system for right whales (NOAA 2018e). The Federal Standardised Bycatch Reduction (FSBR) program managed by NMFS began obtaining bycatch data from Maine lobster boats in 2015 but it only covers a portion of the Maine lobster fleet, about 150 boats fishing in federal waters (Mateo et al., 2016). However, observer coverage in the lobster fishery appears to be non-existent (NOAA 2018g), and irrespective, it is rare to have a whale anchored in the gear for an observer to report (Knowlton et al., 2016).

Data used to estimate bycatch in this fishery includes only self-reported data. Observer coverage in this fishery appears to be non-existent.

6.2.3 Scores, conditions and management measures implemented

No conditions or specific recommendations were set for any of these fisheries during the assessment process (Mateo et al., 2016).

In the U.S. all marine mammals are protected under the MMPA which prohibits, with certain exceptions, the “take” of marine mammals in U.S. waters and on the high seas. As a Category I fishery, fishermen must comply with the MMPA requirements, including taking an observer aboard the fishing vessel when requested by NOAA Fisheries Service, reporting all injuries and deaths of marine mammals and compliance with all applicable take reduction plans, gear modifications, and emergency

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20 Condition on 2.2.3 for the Gulf of Maine fishery refers to main bycatch species, namely cod, tusk Brosme brosme, yellowtail flounder Pleuronectes ferruginea and witch flounder Glyptocephalus cynoglossus. The other P2 conditions are for habitat management, all of which are out of the scope of this review.
regulations that apply to the fishery. The Endangered Species Act (ESA) provides for the conservation of species that are endangered or threatened. Recovery plans have been developed in the area for North Atlantic right, humpback, fin, blue, sei and sperm whales (Mateo et al., 2016). The Atlantic Large Whale Take Reduction Plan (ALWTRP) is in place for managing fishery impacts on large whales. Under the ALWTRP, a series of measures to reduce impacts of fisheries (including the lobster fishery) on large whales were put in place, including requirements for no floating lines at the surface, for breakaway links on vertical lines, for sinking groundlines and mandatory gear marking. However, 70% of the state of Maine’s waters, where the majority of the lobster fishery operates, are exempted from most of the ALWTRP measures, including gear marking and sinking ground lines (Asmustis-Silva 2009; NOAA 2018d). The plan was last modified in 2014 and 2015 to include new requirements on gear markings and minimum number of traps per trawl requirements but again this area was not included. The ALWTR team members include fishermen’s associations (such as the Maine Lobstermen’s Association), conservation groups, fishery management organisations and scientific groups (NOAA 2018a). NOAA maintains a network of personnel trained in disentanglements in the area.

Action plan: No conditions or specific recommendations were set during the assessment process despite the potential high impact of the fishery on NARW.

Action implementation: Codes of conduct for responsible fishing were implemented by the fishery and monitoring and recording of bycatch species improved. Technical measures have been put in place to reduce the impact of the fisheries in the area on whales but the Gulf of Maine fishery is exempted from some of them.

6.2.4 Trends in bycatch and population sizes

Based on entanglement scarring rates and mortality of large whales, Knowlton et al. (2012) and van der Hoop et al. (2012) concluded that efforts (beginning in 1997) to reduce NARW entanglement had not worked: across all 8 species of large whales, there was no detectable change in causes of anthropogenic mortality over time. Pace et al. (2014) analysed entanglement rates and serious injuries due to entanglement during 1999-2009 and found no support that mitigation measures that were implemented prior to 2009 were effective at reducing takes due to commercial fishing. From 2010 to 2014, 24 records of mortality or serious injury of large whales (including records from both U.S. and Canadian waters, pro-rated to 23.25 using serious injury guidelines) involved entanglement or fishery interactions (NOAA 2017b). The western NARW was estimated by NOAA to be at least 440 individuals in 2012. However, examination of the minimum number alive (calculated from the individual sightings database for the years 1990–2012) suggests that abundance of the species declined in that period (NOAA 2017b). The North Atlantic right whale is considered one of the most endangered populations
of large whales in the world (Clapham et al., 1999) and is listed as endangered on the IUCN red list (Reilly et al., 2012). The most serious current threat to the species is death or injury from entanglements in fishing gear and collisions with ships (Reilly et al., 2012, Kraus et al., 2016, Hayes et al., 2018).

As noted above, the overall North Atlantic population of humpback whale is estimated to be 4,894 males and 2,804 females (Palsbøll et al. 1997). The minimum population estimate in the Gulf of Maine for this species is set to the 2008 mark-recapture based count of 823 animals (Robbins 2009, 2010 and 2011). The species is listed as least concern on the IUCN red list (Reilly et al., 2008) but is a protected species under the US MMPA.

Entanglement of large whales has not decreased in recent years. The NARW population is in decline and the species is listed as endangered.

Scores received by the fisheries during the first certification and re-certification processes are shown in table 17 below:

Table 17: Scores obtained by the fisheries during the MSC certification assessments (numbers in red represent the scoring issues which scored less than 80, which represents “global best practice” level).

<table>
<thead>
<tr>
<th>PI</th>
<th>Gulf of St. Lawrence snow crab trap fishery</th>
<th>Scotian Shelf snow crab trap fishery</th>
<th>Bay of Fundy, Scotian Shelf and Southern Gulf of St Lawrence lobster trap fishery</th>
<th>Newfoundl and Labrador snow crab fishery</th>
<th>Gulf of Maine lobster fishery</th>
<th>Maine Lobster Trap Fishery</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1.1</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td><strong>70</strong>***</td>
<td>80</td>
</tr>
<tr>
<td>2.1.2</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td><strong>70</strong></td>
<td>100</td>
</tr>
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<td>2.1.3</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>90</td>
<td>85</td>
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<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
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<tr>
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<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>80</td>
<td>100</td>
</tr>
<tr>
<td>2.2.3</td>
<td>90</td>
<td>100</td>
<td>90</td>
<td>100</td>
<td><strong>70</strong></td>
<td>100</td>
</tr>
<tr>
<td>2.3.1</td>
<td>100</td>
<td>80 (&lt;60)**</td>
<td>100</td>
<td>80 (100)</td>
<td>85</td>
<td>100</td>
</tr>
<tr>
<td>2.3.2</td>
<td>95</td>
<td>80 (&lt;60)</td>
<td>95</td>
<td>85 (100)</td>
<td>85</td>
<td>85</td>
</tr>
</tbody>
</table>
2.3.3 | 85 | 80 | 85 | 80 (100) | 80 | 85 | 80 | 85
2.4.1 | 90 | 100 | 80 (90) | 100 | 80 | 80 | 80 | 80
2.4.2 | 95 | 100 | 95 | 100 | 95 | 80 | 60 | 60
2.4.3 | 95 | 95 | 95 | 95 | 90 | 85 | 80 | 80
2.5.1 | 100 | 100 | 100 | 100 | 100 | 90 | 80 | 90
2.5.2 | 100 | 100 | 100 | 100 | 100 | 80 | 80 | 90
2.5.3 | 100 | 100 | 100 | 100 | 85 | 95 | 85 | 90

*In parenthesis, the scores given by the team in the Public consultation draft report (PCDR)

**These scores refer to the expedited audit published in 2018 where the fishery has been suspended

***Several units of certification were assessed in this fishery and the scores for P2 issues are a bit variable although the same conditions were set. In this table only the score referring to UoC1 are shown

6.3 Results

Table 186 RAG summary table for northwest Atlantic snow crab and lobster trap fisheries

<table>
<thead>
<tr>
<th>Name of the fishery</th>
<th>Evidence from the fishery</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bycatch baseline:</strong> The annual relative risk of lethally entangling NARW in snow crab and lobster traps is estimated at &lt;2.6% and &lt;7.1% respectively. However, these estimates were done prior to the shift in right whale distribution which began around 2010. The total number of baleen whale mortalities is unknown because not all the individuals affected are observed. Entanglement in crab/lobster traps is likely to be limiting NARW population recovery.</td>
<td></td>
</tr>
<tr>
<td><strong>Data quality:</strong></td>
<td><strong>Proposed actions</strong></td>
</tr>
<tr>
<td>Green (2)</td>
<td>Red (0)</td>
</tr>
</tbody>
</table>

Justification:

**Data quality:** Data used to estimate bycatch in these fisheries includes self-reported, observer and opportunistic data. Observer coverage of 15-20 percent coverage is in place. In 2016, DFO considered that increased at-sea observer is required to calculate fishery-specific bycatch rates and estimates of uncertainty.

**Proposed actions:** No conditions were set for any of these fisheries during the assessment process despite the potentially high impact of the fishery on the NARW population.
**U.S. lobster trap fisheries (Gulf of Maine lobster fishery/ Maine Lobster Trap Fishery)**

<table>
<thead>
<tr>
<th>Data quality</th>
<th>Proposed actions</th>
<th>Action implementation</th>
<th>Bycatch trends</th>
<th>Final score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red (0)</td>
<td>Red (0)</td>
<td>Red (0)</td>
<td>Red (0)</td>
<td>Red (0)</td>
</tr>
</tbody>
</table>

**Bycatch baseline:** These fisheries are listed as ‘category 1’ by NOAA because of the annual level of serious injury and mortality of NARW. For this species, mortality in this fishery exceeds 50% of Potential Biological Removal (PBR) level.

**Justification:**

**Data quality:** Data used to estimate bycatch in this fishery includes only self-reported data. Observer coverage in this fishery appears to be non-existent.

**Proposed actions:** No conditions or specific recommendations were set during the assessment process despite the potential high impact of the fishery on NARW.

**Action implementation:** Codes of conduct for responsible fishing were implemented by the fishery and monitoring and recording of bycatch species improved. Technical measures have been put in place to reduce the impact of fisheries in the area on whales, but the Gulf of Maine fishery is exempt from some of them.

**Bycatch trends:** Entanglement of large whales has not decreased in recent years. The NARW population is in decline and the species is listed as endangered.
References


AEBAR (Aquatic Environment and Biodiversity Annual Review) 2017. A summary of environmental interactions between the seafood sector and the aquatic environment.


CMM 2011-03: Conservation and Management Measure to address impact of purse seine fishing activity on cetaceans.


COUNCIL REGULATION (EU) No 40/2013 of 21 January 2013 fixing for 2013 the fishing opportunities available in EU waters and, to EU vessels, in certain non-EU waters for certain fish stocks and groups of fish stocks which are subject to international negotiations or agreements.

Criqueut, G., Bréthes, J-C. and Allain, R.J. 2015. Bay of Fundy, Scotian Shelf and Southern Gulf of St Lawrence lobster (Homarus americanus) Trap Fisheries. SAI Global. 533 pp.


Dragonfly Data Science 2018. Available at: https://www.dragonfly.co.nz/data/


Henry, A.G., Cole, T.V.N., Garron, M., Ledwell, W., Morin, D. and Reid, A. 2017. Serious injury and mortality a determination for baleen whale stocks along the Gulf of Mexico, United States East


IOTC 2018. Compliance committee. Available at: http://www.iotc.org/compliance


Morales-Yokobori, Marcelo L.; Minte Vera, Carolina V.; Bridi, R. Jorge; Landa, Pedro; Di Giacomo, Edgardo; Perier, Maríà; Rey Sosa, Miguel A. 2011. Argentinean Hoki (*Macrouronus magellanicus*) Bottom and Semi-pelagic trawl net Fishery. MSC Public Comment Draft Report. OIA. 705 pp.


NOAA 2018a. Greater Atlantic Region. Atlantic large whale reduction plan. Available at: https://www.greateratlantic.fisheries.noaa.gov/protected/whaletrp/


