Stock Status Summary – 2021

NSW Stock Status Summary – Bigeye Ocean Perch
(Helicolenus barathri)

Assessment Authors and Year

Smoothey, A. F. and Johnson, D. 2021. NSW Stock Status Summary 2020/21 – Bigeye Ocean Perch (*Helicolenus barathri*). NSW Department of Primary Industries. Fisheries. 19 pp

Stock Status

Current stock status	On the basis of the evidence contained within this assessment, Bigeye Ocean Perch are currently assessed as **Sustainable** for the NSW component of the stock.

Stock Status Summary

The fishery scientific assessment summarised in this report and considered adequate to meet the legislative requirements for supporting a total allowable catch (TAC) determination for the NSW Bigeye Ocean Perch is that done by the CSIRO, commissioned by the Australian Fisheries Management Authority (AFMA) and published as 'Bigeye Ocean Perch' in the 'Ocean Perch (*Helicolenus barathri*, *H. percoides*)' section of the Fishery Status Reports by the Australian Bureau of Agricultural and Resource Economics and Sciences (Patterson et al. 2020; hereinafter referred to as the Commonwealth assessment).

Information describing uncertainty associated with the scientific assessment and NSW fishery data for Bigeye Ocean Perch, for consideration in the TAC determination is provided in Appendix 1 and 2.

The structure of this stock status summary is consistent with a format to inform a species status determination against criteria for the Status of Australian Fish Stocks (SAFS; www.fish.gov.au/). It does not attempt to replicate the detail of the Commonwealth assessment but sources and cites key information from that assessment. Where data are unavailable or considered insufficient to reliably inform the SAFS criteria the summary has been populated with 'NA', rather than removing the criteria. This format has been maintained to transparently represent the data available and highlight areas where supplementary information, alternate data sources or analyses may be required to improve the assessment and determination of species status into the future.

Biology and stock structure

Ocean Perch are lecithotrophic and viviparous, meaning that egg fertilization and larval development occur inside the female fish. The larvae are released when they reach about 1 mm in length. The Ocean Perch breeding season extends from June to November and a single female can produce between 150,000–200,000 larvae per season. Ocean Perch are ambush predators, rising quickly from the ocean floor to capture prey. Main food sources for Ocean Perch are Royal Red Prawns, squid and smaller fish. Bigeye Ocean Perch is distributed on the upper-slope of the continental slope and more commonly found in 250–800 m.

Within the Commonwealth, Ocean Perch is managed as a single stock that includes two species: the Inshore Ocean Perch (*Helicolenus percoides*) and the Offshore Ocean Perch (*H. barathri*; hereinafter referred to as Bigeye Ocean Perch). Ocean Perch stock structure is uncertain, but there is probably an east–west structuring of stocks (Morrison et al. 2013). Reef Ocean Perch and Bigeye Ocean Perch have been assessed separately in the Commonwealth since 2009, but a single all-areas Commonwealth TAC is set for the two species. Based on the depth of capture and logbook records, most of the landed Ocean Perch is considered to be Bigeye Ocean Perch (Patterson et al. 2020).

Stock Status and assessment method

The Commonwealth assessment for Bigeye Ocean Perch is a Tier 4 assessment (AFMA 2017), i.e. standardised catch per unit effort (CPUE), including discards (Haddon 2013; Haddon and Sporcic 2017). The current Commonwealth assessment of Bigeye Ocean Perch classifies the stock as not overfished and not subject to overfishing (Patterson et al. 2020). Bigeye Ocean Perch was first assessed against the criteria for SAFS in 2018 and stock status was classified as sustainable. The stock status for 2020 is currently under review.

Fishery statistics summary

Fishery statistics presented in this report are restricted to those used to inform the Commonwealth assessment and are summarised here from Patterson et al. (2020) and references therein. The Commonwealth assessment of Bigeye Ocean Perch uses data from the Commonwealth Ocean Trawl Fishery within Commonwealth fishing zones 10 and 20 (south-eastern Australia) and catch records from depths from 200–700 m depth.

Descriptions of NSW fishery statistics are provided within this report and the changes in NSW commercial fishery reporting requirements and sources of NSW commercial fishery data are discussed.

Catch Information

The catch information below is summarised from Patterson et al. (2020).

Bigeye Ocean Perch has been a significant part of trawl catches since the fishery developed in the late 1960s (Morrison et al. 2013). Landed catch of Ocean Perch since the 1970s has generally been between 200 and 400 t, increasing from 200 t in the 1980s to around 400 t from 1995 to 2004, before decreasing again to around 200 t from 2007 to 2016 (Figure 1).

Commonwealth landed catch in the 2019/20 fishing season was 169.1 t, based on CRDs (Figure 2) with 85% of landings offshore Bigeye Ocean Perch and the remaining 15% inshore Reef Ocean Perch. The weighted average discards between 2015-16 and 2018-19 were calculated and used to estimate discards and state catch of 111.2 t and 3.6 t, respectively for Inshore Reef Ocean Perch, and 39.9 t and 14.4 t, respectively for offshore Bigeye Ocean Perch (Burch et al. 2019). Most Inshore Ocean Perch (around 95 per cent in recent years) are discarded because of their small size. For the 2019-20 fishing season, total catch and discards combined were estimates to be 338.2 t. Annual landings by NSW state fishers have been around 15–21 t since 2009.

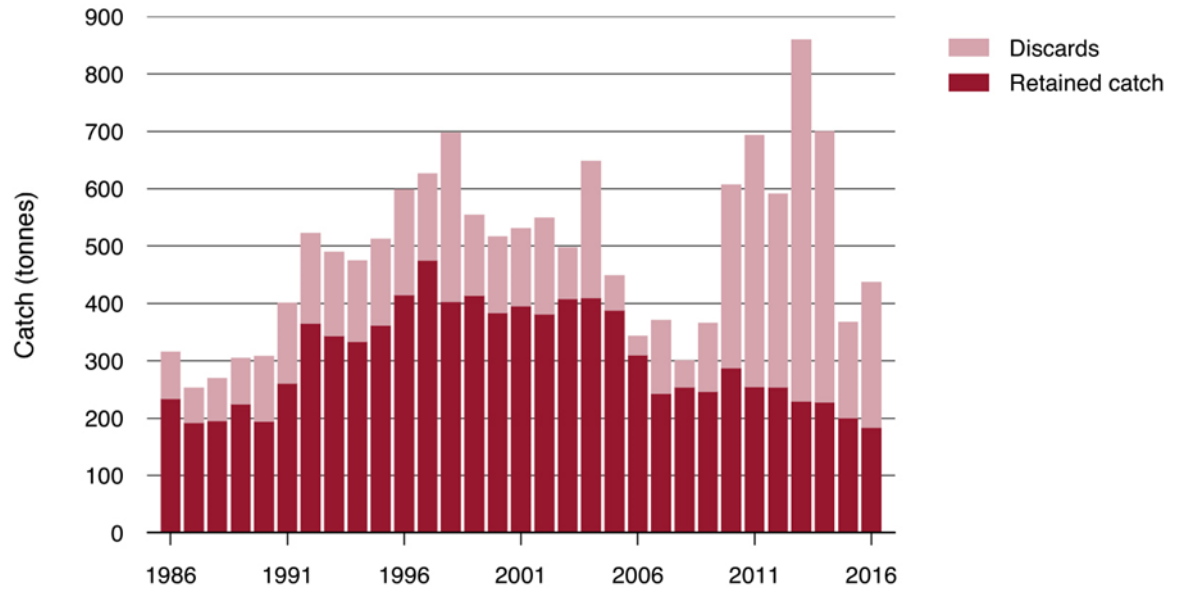

Figure 1. Total Ocean Perch (Reef and Bigeye) annual catches (Commonwealth Trawl Sector, Scalefish Hook Sector and state combined) and discards, 1986 to 2016 (from Patterson et al. 2020, source: Haddon and Sporcic 2017.

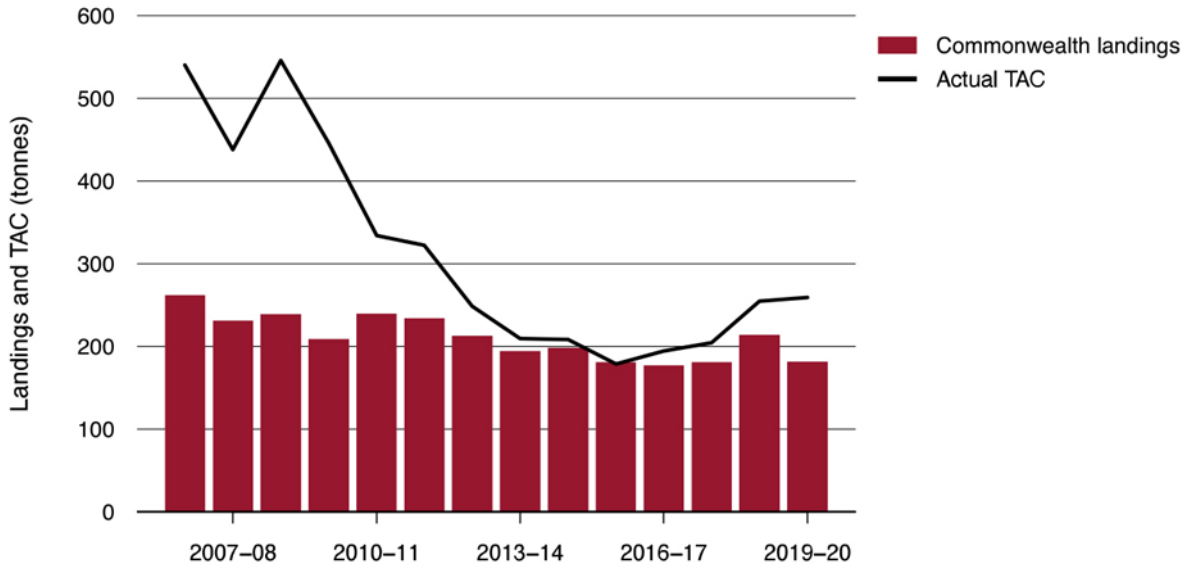

Figure 2. Total Ocean Perch (Reef and Bigeye) seasonal landings (SESSF) and total allowable catches (TACs), 2006-07 to 2019-20 (from Patterson et al. 2020, source: AFMA catch disposal).

Recreational and Indigenous

Recreational catches have not been accounted for in the Commonwealth assessment of Ocean Perch. The inclusion of recreational catch has been raised as an issue for consideration in Commonwealth assessments (SESSF RAG 2017).

Illegal Unregulated and Unreported

The level of Illegal Unregulated and Unreported (IUU) fishing has not been quantified.

Catch rate information

Bigeye Ocean Perch standardised CPUE analyses summarised from Patterson et al. (2020).

> Tier 4 standardised CPUE assessments were last updated in 2017 (Haddon and Sporcic 2017). The CPUE to 2012 for Bigeye Ocean Perch (Haddon 2013) indicates stability in catch rates since 1996, but a decline for two consecutive years since 2013 (Sporcic and Haddon 2016). Standardised CPUE remained above the limit reference point (Figure 3; Sporcic and Haddon 2017).

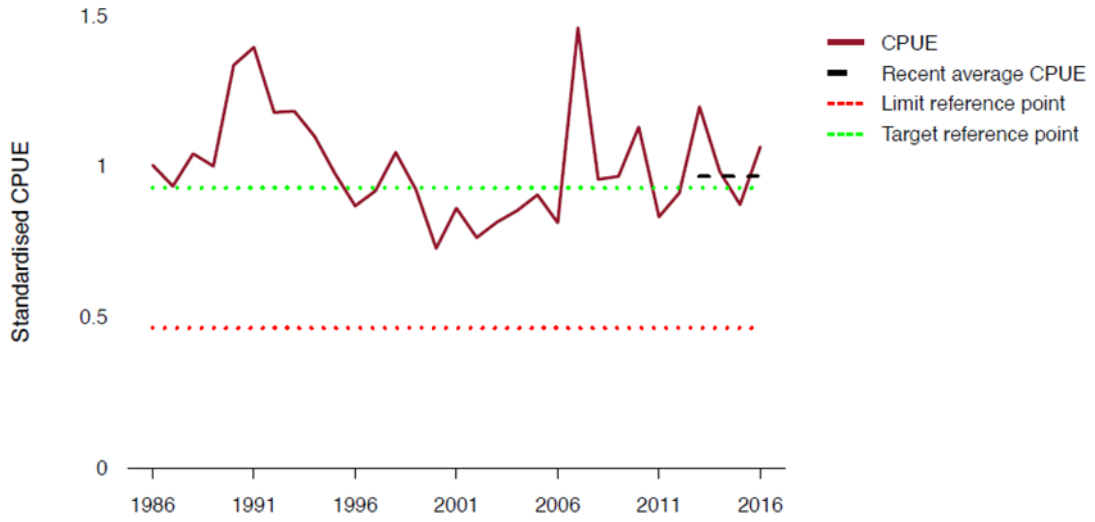

Figure 3. Standardised CPUE, including discards, for Bigeye Ocean Perch, 1986 to 2012 (Source: Haddon and Sporcic 2017 cited in Patterson et al. 2020).

Stock assessment methodology

Year of most recent assessment	2017 (Haddon and Sporcic 2017 in Patterson et al. 2020)
Assessment method	Commonwealth Tier 4, Standardised CPUE (including discards)
Main data inputs	CPUE – Commonwealth Trawl Fishery; zones 10–20; depth 200–700 m Discard rates (Thomson and Upston 2016)
Main data inputs (rank)†	CPUE – (medium quality) – Haddon 2013; Sporcic and Haddon 2017)[1]

	Discard rates: 2 (medium quality) – Thomson and Upston 2016
Key model structure and assumptions	Tier 4 – Standardised CPUE (Commonwealth Harvest Strategy Policy; Commonwealth of Australia 2003, 2017) *Assumptions:* (see Haddon 2016): catch rate provides a relative index of abundance (not subject to hyper-stability or hyper-depletion and not unduly influenced by other factors not accounted for through standardisation); the reference period provides a good estimate of the stock when at a depletion level of 0.48B0; estimates of catch during the target period are accurate.
Sources of uncertainty evaluated	Uncertainty associated with Tier 4 assessment (see Haddon 2013; Haddon and Sporcic 2017). SERAG noted that the high discard rate for Inshore Reef Ocean Perch had made the standardisation and associated tier 4 analyses uncertain. SERAG recommended that Inshore Reef Ocean Perch be removed from the Ocean Perch quota basket and that a catch trigger be set for the species (Patterson et al. 2020)

† Main data inputs (rank)

1 – High quality: data have been subjected to documented quality assurance and peer review processes, are considered representative and robust and provide a high level of confidence to support fisheries management decisions.

2 – Medium quality: data have been subjected to some internal quality assurance processes, have some documented limitations, but are still considered sufficiently accurate and informative to be useful to inform management decisions with some caveats.

3 – Low quality: data have been subjected to limited or no quality assurance processes, may be compromised by unknown or documented limitations that have not been fully explored, but are considered the best available information and require a high level of precaution to be exercised when interpreted to inform management decisions.

Status indicators and limits - Reference levels

Biomass indicator or proxy	Standardised CPUE (AFMA 2017)
Biomass limit reference level	$CPUE_{20}$ (AFMA 2017)
Fishing mortality indicator or proxy	NA Implied from Patterson et al. 2020:

	Catch (including discards) as a proportion of recommended biological catch (RBC) Trend in CPUE
Fishing mortality limit reference level	Implied from Patterson et al. 2020: Catch (plus discards) as a proportion of RBC is <1
Target reference level	A 40% ($0.40SB_0$) target reference point is applied to both species (Morison et al. 2013).

Stock Assessment Results

Biomass status in relation to limit	Not overfished – standardised CPUE (biomass proxy) is above limit (Patterson et al. 2020)
Fishing mortality in relation to limit	**Not subject to overfishing** (Patterson et al. 2020)
Current SAFS stock status	Bigeye Ocean Perch status for 2018 is sustainable

The Tier 4 analyses in 2017 estimated that both species were above their respective target reference points, producing an recommended biological catch of 248 t for Inshore Reef Ocean Perch and 345 t for Offshore Bigeye Ocean Perch. Furthermore, the TAC was based on the RBC for Offshore Bigeye Ocean Perch only and was set at 241 t for the 2019-20 fishing season, the third year of a 3-year multi-year TAC (AFMA 2018).

Haddon and Sporcic (2017) estimated that the recent average standardised CPUE was above the target reference point for biomass for both species and therefore the stock was classified as **not overfished**. Furthermore, the total fishing mortality for Inshore Ocean Perch was estimated (using the catch ratio from the logbook data) to be 140.2 t, which is below the RBC of 248 t. The total fishing mortality for Offshore Bigeye Ocean Perch was estimated to be 198.0 t, which is below the RBC of 345 t. Therefore, total fishing mortality of Ocean Perch was determined to be 338.2 t, which is below the combined RBC of 593 t. Therefore, fishing mortality in 2019-20 would be unlikely to deplete the stock of Ocean Perch to a level below its biomass limit reference point and is therefore classified as **not subject to overfishing**.

Fishery interactions

Interactions between the Commonwealth Trawl and Auto Long Lining Fisheries are described by Sporcic and Haddon (2016); declines in the Trawl sector since the mid-2000s are associated with increased catches in the Auto Long Lining sector. Concurrent with general declines in Trawl

catches are increased and sustained relatively high geometric mean CPUE for the Trawl fishery (Sporcic and Haddon 2016)

The Commonwealth Trawl Fishery interacts with other commercial and non-commercial bycatch and discard marine species, a range of endangered threatened and/or protected species and marine habitats (AFMA 2014; Wayte et al. 2007).

Qualifying Comments

Supplementary information relevant for to the interpretation of the assessment is provided in Appendix 1 and 2.

Discards from the NSW Ocean Fish Trawl Fishery (Northern zone) (OTFN) are well estimated in a recent observer-based survey of the fishery; including more accurate estimates of NSW discard rates would likely result in improved estimates of standardised CPUE and a more reliable index of abundance. Consideration should be given to integrating these NSW data into that provided to the Commonwealth to inform future assessments.

NSW fishery information – Ocean Trap and Line Fishery

Introduction

The stock status summary for Bigeye Ocean Perch summarises information from the Commonwealth assessment for 'Bigeye Ocean Perch' in the 'Ocean Perch (*Helicolenus barathri*, *H. percoides*)' section of Patterson et al. (2020).

Information presented here is intended to supplement that assessment, and includes: i) comment on the Commonwealth assessment to inform NSW TAC determinations and more specifically the Commonwealth Tier 4 analyses of Bigeye Ocean Perch; ii) NSW commercial catch of Bigeye Ocean Perch and catch as a proportion of the total across all fisheries for the period 2009/10 to 2019/20; iii) NSW commercial fishery data for Bigeye Ocean Perch for key fishing methods in the NSW Ocean Trap and Line Fishery – Line East (OTLLE) from 2009/10 to 2019/20; iv) NSW commercial fishery length-frequency data for Bigeye Ocean Perch from 2005/06 to 2011/12; and iv) NSW recreational fishing estimates from the National Recreational and Indigenous Fishing Survey (2000/01; Henry and Lyle 2003) and state-wide surveys (2013/14; West et al. 2015; 2017/18; Murphy et al. 2020).

Ocean Perch (family Sebastidae) are found offshore along the NSW coast but Bigeye Ocean Perch comprise the vast majority of the landings. Bigeye Ocean Perch is an upper-slope species found in 250–800 m depth. Other species including Reef Ocean Perch is distributed across the continental shelf and onto the upper slope in depths of about 80–350 m, and the Deepsea Ocean Perch (*Trachyscorpia capensis*) occurs mostly in mid-slope depths greater than 800 m and, because there is little fishing at such depths off NSW, few Deepsea Ocean Perch are caught.

Bigeye Ocean Perch are being assessed as part of the national Status of Australian Fish Stock reports (SAFS). The scale of the stock structure accepted to be assessed, despite some uncertainty, is that of a biological stock throughout south-eastern Australia, including NSW waters. In 2018 SAFS status determination for Bigeye Ocean Perch was sustainable and at the date of publication of this report the SAFS status determination for Bigeye Ocean Perch 2020 had not yet been made.

Commonwealth assessment

General

The benefits of adopting Commonwealth assessments include the application of processes exposed to broad review, including by management, science and industry representatives within the Commonwealth fishing sector, as well as observers from other stakeholder groups (e.g. NSW DPI Fisheries). However, the Commonwealth assessments have not been developed to provide specific outputs for jurisdictions other than the Commonwealth and do not necessarily include or apply data at resolutions more applicable to alternate jurisdictions. Therefore, applying these assessments to inform NSW total allowable catch (TAC) determinations is done understanding that there are limitations in the data used and the application of the data to a scale other than that to which the assessment was applied.

Bigeye Ocean Perch

The Commonwealth assessments for Bigeye Ocean Perch is a Tier 4 assessment using standardised catch rates, derived from the Commonwealth Trawl Fishery fleet in Commonwealth fishing zones 10 and 20 (south-eastern Australia). The Commonwealth assessment framework, including reference points (target and limit) is described in the Commonwealth Harvest Strategy Policy (Commonwealth of Australia 2003, 2017) and Harvest Strategy Framework for the Southern and Eastern Scalefish and Shark Fishery (SESSF; AFMA 2017). This framework defines stock status with regard to reference levels (target and limit) of standardised catch per unit effort (CPUE) as a proxy for biomass, as defined by Commonwealth criteria, and informs the determination of a recommended biological catch (RBC), for the Commonwealth fishery.

The most recent application of the Commonwealth Bigeye Ocean Perch Tier 4 assessment was that done in 2017 (Haddon and Sporcic 2017). Both Sporcic and Haddon (2016) and Haddon and Sporcic (2017) highlight uncertainty associated with the Tier 4 assessment, including the standard assumptions associated with the Tier 4 assessment method (see above – Key model structure and assumptions), as well as comment on the effects of discards – for Bigeye Ocean Perch sometimes as high as 25–35% of total catch, whilst not substantially effecting the CPUE series through the reference period (1986–1995) has increased average CPUE over the last four years of the assessment and is above the target reference level.

The use of NSW data in the Commonwealth assessment and TAC determination process is generally limited to applying (subtracting) the NSW catch to the Commonwealth RBC resulting in a revised RBC, from which Commonwealth fishery management policy is applied to determine the Commonwealth TAC.

The current Commonwealth assessment of Bigeye Ocean Perch could adequately inform the decision process for a NSW TAC determination, accepting and understanding the limitations and restrictions of the Commonwealth assessment framework and understanding that data collected and analysed at a finer resolution and considered within the NSW jurisdiction could deliver some outcomes inconsistent with the Commonwealth assessment. In particular, it is important to note that the Commonwealth assessment uses data from the Commercial Trawl Fishery, whereas the majority of the NSW Bigeye Ocean Perch catch is reported from the Set/Trotline fishing method in the NSW OTL Fishery (Line Fishing Eastern Zone).

Applying the assessment of Bigeye Ocean Perch from the Commonwealth to inform the status of NSW Bigeye Ocean Perch and reliably inform management decisions for this species assumes (among other issues) that the assessment represents the same population(s) being harvested by these fisheries. Support for this assumption is provided by the 2018 determination of the stock structure of Bigeye Ocean Perch for the 2018 SAFS reports as a biological stock at the scale of

south-eastern Australia, including Commonwealth waters to which the Commonwealth assessment applies and NSW waters.

NSW fishery information

Information presented in figures and tables below is summarised by fiscal year (July–June). Reference to 'year' refers to the first year within a fiscal year unless otherwise stated. For example, 2009 refers to the fiscal year 2009/10.

NSW commercial fishery records have not been consistently reported throughout the history of the fishery (see Appendix 1). Between 1999/00 and 2000/01, management arrangements in the OTL Fishery changed such that endorsements were allocated inside (OTL – Line West (OTLLW)) and outside (OTL – Line East (OTLLE)) the 100 fathom depth contour. Prior to 2009/10 Bigeye Ocean Perch were reported to the multi-species group 'Ocean Perch'. As a result species specific fishery data are unavailable prior to 2009/10. The commercial fishery data presented in this section is limited to data from key fisheries, primarily the OTL Fishery (Eastern Zone) from 2009/10, as contemporary supplementary information to the assessment and to help inform NSW TAC determinations.

From 2009/10 to present, effort (days) is derived from the number of distinct fishing dates entered on daily catch returns for each fisher in each month when the method was used and the species catch for that month was >0, irrespective of whether the species was caught on those specific days that month.

State-wide fisheries catch

Bigeye Ocean Perch are caught predominantly in two fisheries within NSW; the OTL Fishery (Eastern Zone, OTLLE) and the Ocean Fish Trawl – Northern (OTFN) Fishery (Figure 4 & 5). Since 2009/10, the annual catch of Bigeye Ocean Perch across all fisheries has averaged about 15 $t.yr^{-1}$, yet in 2019/20 total catch had declined to 8.24 t. Since 2009/10, the OTLLE Fishery has accounted for an average of 93% (range 69-99%) of the total annual catch of Bigeye Ocean Perch, which has ranged between 8.0 and 20.8 t (Figure 4 & 5). In 2019/20, 8.04 t of Bigeye Ocean Perch were reportedly landed in the OTLLE Fishery (Figure 4). An average of 0.7 $t.yr^{-1}$ (range 0 to 2.8 t p.a.) of Bigeye Ocean Perch has been reported from the Ocean Trawl Fish (Northern Zone; Figure 4). The remaining 'other' catch has averaged
0.4 $t.yr^{-1}$ (range 0.1 to 1.8 t; Figure 4).

Ocean Trap and Line Fishery (Line East) catch and catch rate

Within the OTLLE endorsement, two methods— setline (STD) and dropline (DPL)—account for approximately, 90 and 9.4% of reported landings of Bigeye Ocean Perch, respectively (Figure 6 & 7). Since 2019/10, the average annual catch of Bigeye Ocean Perch from OTLLE-STD gear was 12.5 $t.yr^{-1}$ (range 7.6 to 20.0 t) and in 2019/20, 7.6 t (95%) of Bigeye Ocean Perch were reported against it. Since 2009/10, the average annual catch of Bigeye Ocean Perch from OTLLE-DPL gear was 1.3 t yr^{-1}(range 0.4 to 2.3 t; Figure 6 & 7).

Setline standardised catch rates were predicted from generalised linear models (GLM). The GLM statistical modelling provided an estimate of mean catch rates that were corrected for a variety of variables that bias raw data. The GLM models were fitted using the statistical software packages Cede (Haddon et al. 2018) and R (R Development Core Team 2017). Explanatory model terms considered different catch rates between fishing years, months, zones, individual fisher operations (Authorised fisher ID) and, their transformed fishing effort.

Standardised commercial catch rates (in mean $CPUE_{dy}$ $kg.day^{-1}$) is likely to be the most reliable index of relative abundance for Bigeye Ocean Perch in NSW. For recent data analysed as mean daily catch rates (available from 2009/10 to 2019/20, Figure 8), catch rates have remained relatively stable and fluctuated around the mean from 2014/15 to 2018/19 (Figure 8). The reasons for the decline in standardised and nominal CPUE in 2019/20 require further investigation.

Measures of catch and CPUE are heavily influenced by the reporting behaviour of a small number of fishers (<5 individuals). For example, since 2013/14, fewer than five fishing businesses have been responsible for all of the reported catch of Bigeye Ocean Perch from the OTLLE-STD, and in more recent years the number has reduced to two. The reliance on a small number of operators for fishery dependent data to inform the assessment of this fishery provides additional levels of uncertainty. Small changes to reporting behaviour or errors and misreporting of species catch could have substantial effects on the assessment. There is some anecdotal evidence of potential misreporting of recent historical catches that perhaps would have correctly been reported as Bigeye Ocean Perch. The consequence of which is an underreporting of total Bigeye Ocean Perch catch in the early years after individual species were required to be reported. Finally, although discarding has been highlighted as contributing factor to changes in CPUE in the Commonwealth assessment (see above), the findings of Macbeth and Gray (2005) suggest it is not an issue in the NSW OTLLE Fishery, with 98% of Bigeye Ocean Perch caught being retained.

Recreational and Indigenous catch

The National Recreational and Indigenous Fishing Survey completed in 2000/01 (Henry and Lyle 2003) describes recreational and Indigenous catches restricted to the general category of ‘Scorpionfish/Gurnard’ and reported the national harvest of 146,112 individuals (total 540,788 individuals caught with 73% released). Further, more recent state-wide recreational fishing survey completed in 2013/14 (West et al. 2015) and 2017/18 (Murphy et al. 2020) but did not report on Bigeye Ocean Perch.

Illegal Unregulated and Unreported

The level of Illegal Unregulated and Unreported (IUU) fishing has not been quantified.

NSW fishery-dependent length-frequency data

Commercial catch length-frequency data for Bigeye Ocean Perch have been collected between 2005/06 and 2011/12 as part of the NSW DPI Fisheries resource assessment and monitoring program (Figure 9). Between one and four samples were taken within each year and the number of fish sampled each year ranged between 83 and 389. Average length has not varied substantially through time. No detailed analyses of these data have been attempted.

In addition, there are unpublished analyses of historic (1970s and 1990s) length and age structures of Bigeye Ocean Perch, from samples collected in NSW from multiple sources and locations. The unpublished data has not been assessed for accuracy but is mentioned to flag the existence of historic data that could inform future considerations and assessments. The value of investing further in assessing, and where necessary, reanalysing these data needs to be balanced with consideration of the value of the fishery, the contribution these data may play in any future assessment and competing priorities for fishery assessments.

Information and data limitations and uncertainty

Commercial fishery statistics are sourced from a small number of commercial operators. Variation in the composition of fishers through time can influence differences in measures of fishery-dependent data and their use for inferring fishery performance and stock status such that changes in these measures may not relate to biological performance of the stock.

- Reported landings and measures of CPUE are heavily influenced by the reporting behaviour of a small number of fishers (< 5 individuals).
- Comparisons between observer-based survey of the OTL Fishery (Macbeth and Gray 2015) and reported catch and effort logbooks indicate recent historical misreporting to species other than Bigeye Ocean Perch could substantially influence recent historical catches.
- If using number of hooks as measure of effort, there is a need to understand the accuracy of reporting. There are some instances of consistent reporting of large numbers of hooks that are likely misreporting.

Factors other than fishing, including environmental factors, may affect changes in the abundance and biological functioning of fish stocks through time. Temporal and spatial variations in oceanographic conditions may influence available trophic resources, growth, population connectivity and ultimately recruitment. The East Australian Current has a strong and variable influence on oceanographic conditions and productivity along the NSW coast, with potentially substantial yet unknown consequences for the Bigeye Ocean Perch stock (Suthers et al. 2011). Understanding the interaction of these factors with the effects of fishing will be important in determining the role of fishing on changes in the abundance of Bigeye Ocean Perch.

Future research needs

There are risks to providing greater certainty in future assessments and supplementary information to inform TAC determination of the NSW OTL Fishery (Eastern Zone) – Bigeye Ocean Perch. There is a limited understanding of the future dynamics of the OTL Fishery and interactions between species catches within the OTL Fishery as well as other jurisdictional fisheries (e.g. Commonwealth) under the recent change of management arrangements to TACs and individual transferable state-wide quotas.

There is uncertainty associated with the Commonwealth assessment and the accuracy with which that assessment can inform and support management decisions for the sustainable harvest of the NSW OTL Fishery (Eastern Zone) – Bigeye Ocean Perch. In addition, there is uncertainty regarding ongoing sources of data to inform future assessments or supplementary information to inform stock status and TAC determinations. These risks can be reduced by i) investigating the benefits of further integrating NSW fishery data into the Commonwealth assessment; and ii) developing a harvest strategy to define fishery management goals and performance measures for the NSW OTL Fishery – Bigeye Ocean Perch.

A strategic approach to more confidently informing the future management of this fishery and the resource on which it is based, requires consideration of the value of the commercial fisheries and broader resource together with the likely resources required to provide reliable information on which to base management decisions. Investment of resources into developing a consistent series of historical commercial fishery data and the implications on the continuity of these data amid changing management arrangements should be a priority.

A focus of any review of data should include how NSW fishery data can be further used to inform the Commonwealth assessment, and/or how that assessment or an alternate assessment could be used to improve the performance and value of the NSW OTL Fishery.

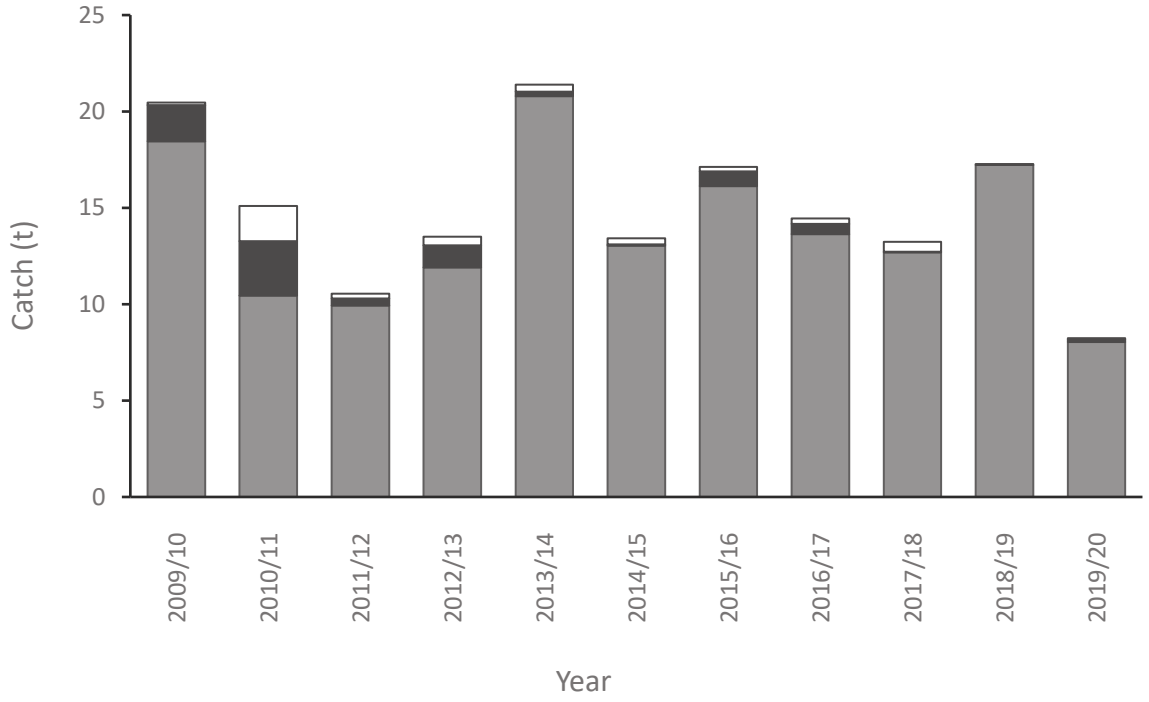

Figure 4. Annual catch (t) of Bigeye Ocean Perch from the NSW Ocean Trap and Line – Line East (grey, OTLLE), Ocean Trawl Fish – Northern (black, OTFN) and Other Fisheries (white) from 2009/10 to 2019/20.

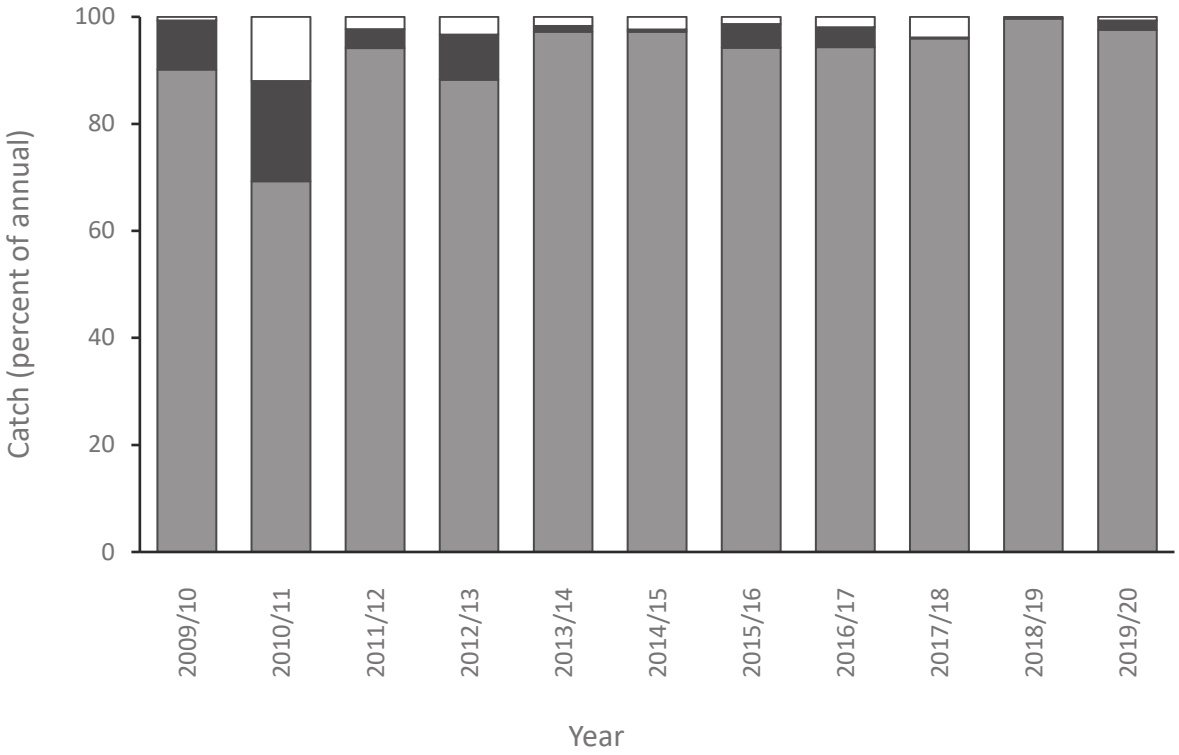

Figure 5. Annual catch of Bigeye Ocean Perch as a percentage of total catch from the NSW Ocean Trap and Line – Line East (grey, OTLLE), Ocean Trawl Fish – Northern (black, OTFN) and Other Fisheries (white) from 2009/10 to 2019/20.

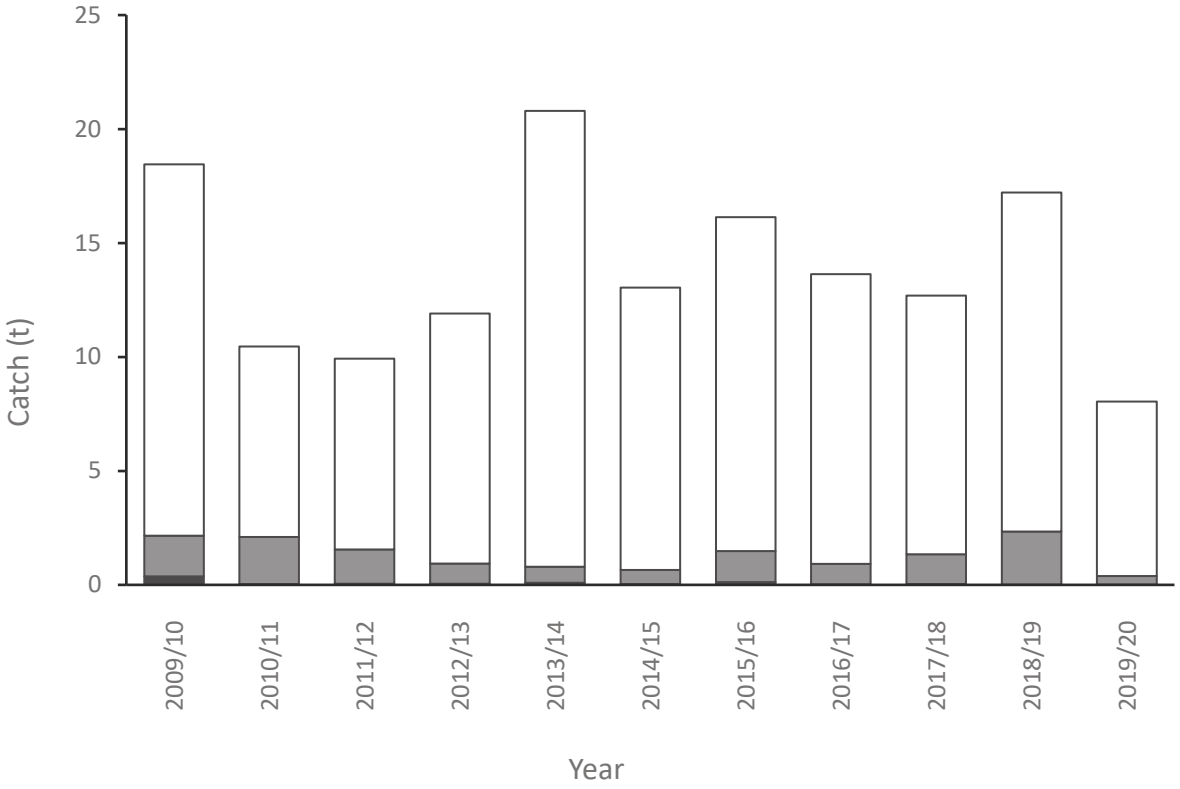

Figure 6. Annual catch (t) of Bigeye Ocean Perch from the NSW Ocean Trap and Line – Line East (OTLLE) Setline demersal (white, STD), Dropline (grey, DPL) and Other methods (black) from 2009/10 to 2019/20.

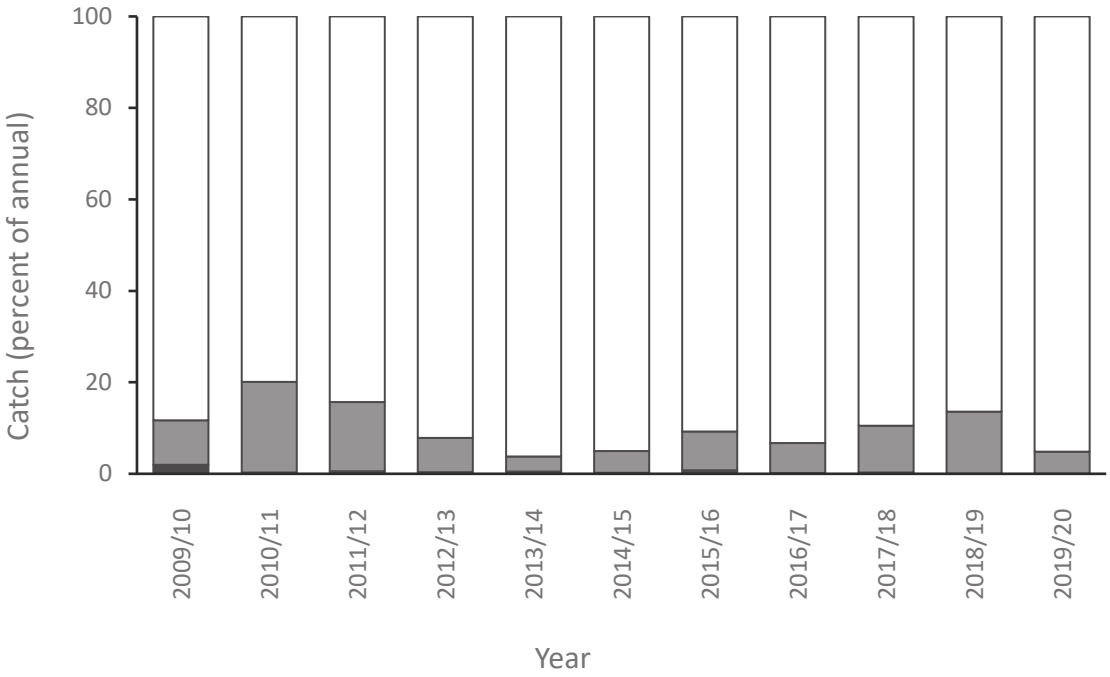

Figure 7. Annual catch of Bigeye Ocean Perch as a percentage of total catch from the NSW Ocean Trap and Line – Line East (OTLLE) Setline demersal (white, STD), Dropline (grey, DPL) and Other methods (black) from 2009/10 to 2019/20.Eastern Australian biological stock

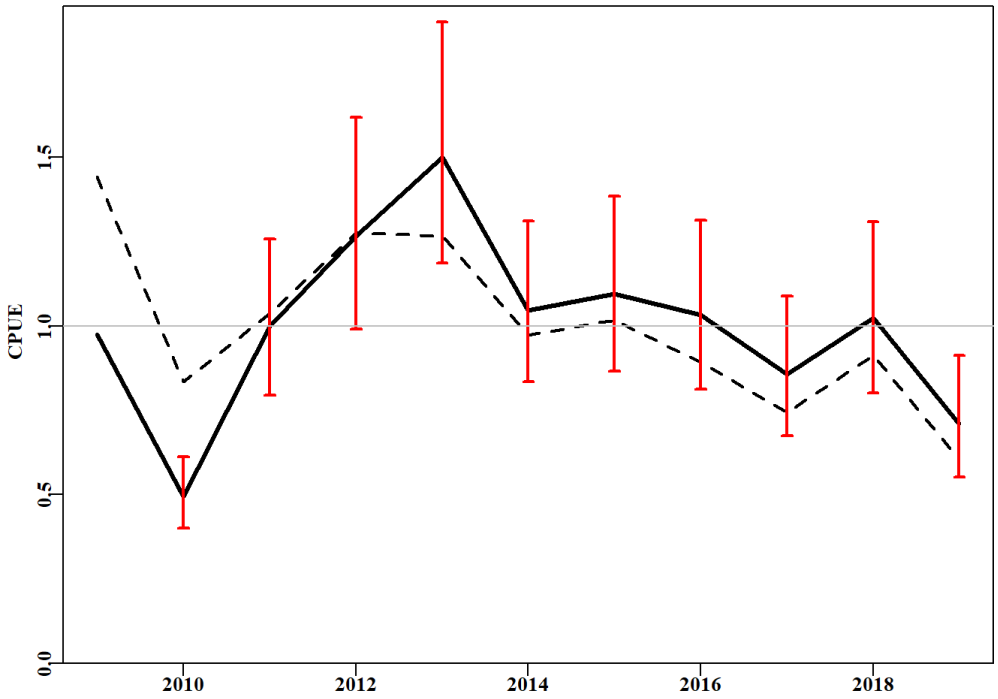

Figure 8. Standardised commercial catch rates ($CPUE_{dy}$ kg.day^{-1} from daily records) of Bigeye Ocean perch for the method of setline. The dashed line is the geometric mean CPUE while the solid line with 95% confidence intervals is the standardised CPUE. The horizontal line represents the average catch rate (2009/10 – 2019/20).

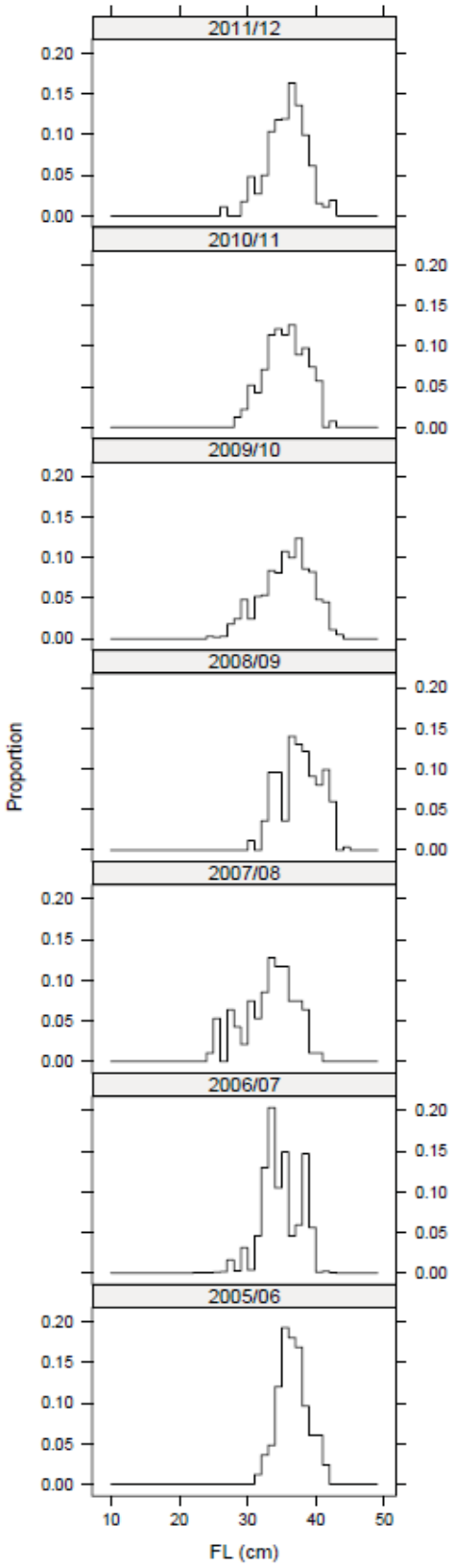

Figure 9 Bigeye Ocean Perch- lLength frequency analysis for Bigeye Ocean Perch 20–50 cm fork length (FL) 2005/06–2012/13 (NSW DPI Fisheries unpublished data).

References

AFMA, 2017. Harvest Strategy Framework for the Southern and Eastern Scalefish and Shark Fishery 2009 (amended March 2017). Australian Fisheries Management Authority, Canberra. www.afma.gov.au/wp-content/uploads/2017/03/SESSF-Harvest-Strategy-Framework-2017-final.pdf

AFMA, 2018. Total allowable catch recommendations for Southern and Eastern Scalefish and Shark Fishery (SESSF) 2019–20 fishing year, Australian Fisheries Management Authority, Canberra.

Burch, P, Althaus, F & Thomson, R 2019, Southern and Eastern Scalefish and Shark Fishery (SESSF) catches and discards for TAC purposes using data until 2018, prepared for the SERAG meeting, 3–4 December 2019, Hobart, CSIRO Oceans and Atmosphere, Hobart. Commonwealth of Australia. 2007. Commonwealth Fisheries Harvest Strategy Policy. Department of Agriculture and Water Resources, Canberra. www.agriculture.gov.au/SiteCollectionDocuments/fisheries/domestic/hsp.pdf

Commonwealth of Australia. 2017. Commonwealth Fisheries Harvest Strategy Policy. Department of Agriculture and Water Resources, Canberra. www.agriculture.gov.au/SiteCollectionDocuments/fisheries/domestic/consultation-draft-harvest-strategy-policy.pdf

Haddon, M. 2013. Tier 4 analyses in the SESSF, including deep water species: data from 1986–2012. CSIRO Marine and Atmospheric Research, Hobart.

Haddon, M. (2018) cede: functions for fishery data exploration and CPUE Standardization. R package version 0.0.4.

Haddon, M. and Sporcic, M. 2017. Tier 4 Assessments for selected SESSF Species (data to 2016). CSIRO Oceans and Atmosphere, Hobart. 52 pp.

Henry, G. W., Lyle, J. M. 2003. The National Recreational and Indigenous Fishing Survey. Fisheries Research and Development Corporation, Canberra.

Macbeth, W. G. and Gray, C. A. 2015. Observer-based study of commercial line fishing in waters off New South Wales. NSW DPI – Fisheries Final Report Series No. 148. Commercial Fishing Trust Fund Project no. FSC2006/179. NSW Fisheries, Port Stephens. 151 pp.

Morrison, A. K., Knuckey, I. A., Simpfendorfer, C. A, and Buckworth, R. C. 2013, South East Scalefish and Shark Fishery: draft 2012 stock assessment summaries for species assessed by GABRAG, ShelfRAG and Slope/DeepRAG. Report for Australian Fisheries Management Authority, Canberra.

Murphy, J.J., Ochwada-Doyle, F.A., West, L.D., Stark, K.E. and Hughes, J.M., 2020. The NSW Recreational Fisheries Monitoring Program - survey of recreational fishing, 2017/18. NSW DPI - Fisheries Final Report Series No. 158.

Patterson, H, Larcombe, J, Woodhams, J and Curtotti, R. 2020. Fishery status reports 2020, Australian Bureau of Agricultural and Resource Economics and Sciences, Canberra. CC BY 4.0. https://doi.org/10.25814/5f447487e6749

SESSF RAG (Southern and Eastern Scalefish and Shark Fishery Resource Assessment Group). 2017. Southern and Eastern Scalefish and Shark Fishery Resource Assessment Group Chair's meeting minutes, 16–17 March 2017. Australian Fisheries Management Authority, Canberra. www.afma.gov.au/wp-content/uploads/2017/05/2017-SESSFRAG-Chairs-Meeting-Minutes-FINAL.pdf

Sporcic, M. and Haddon, M. 2016. Catch rate standardizations for selected SESSF Species (data to 2015). CSIRO Oceans and Atmosphere Flagship, Hobart. 214 pp.

Suthers, I. M., Young, J. W., Baird, M. E., Roughan, M., Everett, J. D., Brassington, G. B., Byrne M., Condie, S. A., Hartog, J. R., Hassler, C. S., Hobday, A. J., Holbrook, N. J., Malcolm H. A., Oke, P. R., Thompson, P. A., and Ridgway K. 2011. The strengthening East Australian Current, its eddies and biological effects—an introduction and overview. Deep Sea Research Part II: Topical Studies in Oceanography 58:538–546.

Thomson, R. and Upston, J. 2016. SESSF catches and discards for TAC purposes, 9 November 2016, report prepared by CSIRO Wealth from Oceans Flagship for Australian Fisheries Management Authority, Canberra.

Wayte, S., Dowdney, J., Williams, A., Bulman, C., Sporcic, M., Fuller, M., Smith, A. 2007. Ecological risk assessment for the effects of fishing: Report for the otter trawl sub-fishery of the Commonwealth trawl sector of the Southern and Eastern Scalefish and Shark Fishery. Australian Fisheries Management Authority, Canberra.

West, L. D., Stark, K. E., Murphy, J. J., Lyle, J. M., Ochwada-Doyle, F. A. 2015. Survey of recreational fishing in New South Wales and the ACT, 2013/14. Fisheries Final Report Series No. 149. NSW Department of Primary Industries, Wollongong.

Appendix 1

Reliability and Relevance of the Commonwealth Assessment to assessment of stock status in NSW

1. Because the stock of Bigeye Ocean Perch fished in Commonwealth and State jurisdictions is considered a single biological stock, it is reasonable that NSW use the Commonwealth assessment as the basis for determining stock status in NSW.

2. The commercial landings data used in the model include landings data from NSW.

3. The Commonwealth assessment does not consider recreational or Aboriginal catch. The model is conditioned on commercial catch data alone. Neither does the process by which the Commonwealth TAC is calculated from the RBC account for recreational/Aboriginal catch. Surveys of the catches in NSW by NSW-resident recreational fishers during 2013/14 and by 1-3 year licence holders in 2017/18 did not detect any catches of Bigeye Ocean Perch (West et al, 2015; Murphy et al., 2020). The interpretation of this result is that catches of Bigeye Ocean Perch by recreational fishers in NSW are negligible, relative to the magnitude of commercial catches. Thus, the omission of recreational and Aboriginal catch from the model and Commonwealth assessment has little effect on the assessment outcome of the Bigeye Ocean Perch stock.

4. Uncertainty associated with Tier 4 assessment (see Haddon 2013; Haddon and Sporcic 2017). SERAG noted that the high discard rate for Inshore Reef Ocean Perch had made the standardisation and associated tier 4 analyses uncertain. SERAG recommended that Inshore Reef Ocean Perch be removed from the Ocean Perch quota basket and that a catch trigger be set for the species (Patterson et al. 2020).

Appendix 2

Additional information relevant to TAC setting in NSW

1. The Bigeye Ocean Perch TAC for the May 2018-April 2019 fishing season was set at the 8-year maximum catch of 21.1 tonnes (BN18/5302).

2. The IAP recommended that the initial allocation of quota shares for Bigeye Ocean Perch be calculated based on 20% on the proportion of access shares held + 80% on recorded landings for an individual fishing business in the Ocean Trap & Line – Line East Share Class over the selected criteria period 2009/2010 to 2016/2017 (inclusive), but with the "worst catch year" for each business removed (https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0009/832464/Ocean-Trap-and-Line-IAP-Final-Report.pdf).

3. Statistics describing landings of Bigeye Ocean Perch from NSW commercial fisheries may inform determination of a NSW TAC that is consistent with the development an inter-jurisdictional resource sharing policy.

4. Landings (quota usage) of 10.15 t were reported against a TAC of 21.1 t in 2019/20 which suggests that the current TAC was not constraining total catches.

5. In 2019/20 approximately 6.3 t of quota was held by fishing business that reported nil landings of Bigeye Ocean Perch.

6. 4.3 t (20.2%) of the 2020-21 Bigeye Ocean Perch TAC (21.1 t) was taken at 16th November 2020 (55% of season complete).

7. SESSF TAC recommendation for 2021-22 was 304 t, which was a 65 t increase on the 2020-21 TAC (239 t, https://www.afma.gov.au/sites/default/files/sessf_tac_recommendations_2021-22_-_for_concession_holders.pdf).