Falkland
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Department

Vessel Units

Allowable Effort

Allowable Catch

2017

Part 1

Summary and Recommendations

Contributors

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Contents

1. Foreword

The Licensing Advice 2017 consists of two parts.

The present report (Part 1) contains summaries of licensing advices for all regulated fisheries in Falkland Islands Conservation Zones for 2016 apart from the B-licensed *Illex*-fishery. It has been done using the data collected up to December 2015, and for Falkland calamari and finfish up to April 2016. Summary tables are presented at the end of the report.

The separate addendum (Part 2) contains a more detailed description of main assumptions, methods and stock assessments for those fisheries in 2015, and recommendations for their management in terms of calculated effort (vessel units) and total allowable catch (where applicable).

Doryteuthis (*Loligo*) *gahi* stocks (=Falkland calamari) were in a good shape in the beginning of 2015, with one of the highest biomasses (~36.000 tonnes) revealed prior the first fishing season. Excellent fishery observed in the first 1.5 months of the season was spoiled by an unusual arrival of the predatory squid *Illex argentinus* into the fishing grounds of *D. gahi*. The squid partially consumed smaller *D. gahi*, and dispersed their pre-spawning aggregations. As a result, the biomass of Falkland calamari was depleted causing early closure in both fishing seasons of 2015. The total annual catch attained 30,320 t, making it the 4th lowest annual catch since 1989. However, as this catch is within the boundaries of its variation in the last 10 years, and assuming high reproductive potential of squid populations, it was decided to remain the total amount of fishing effort practically unchanged at 27.02 vessel units for 2017.

Annual catches of rock cod were stable between 2008 and 2012, and then became much more variable since 2013 for various reasons. Analysis of age structures and sizes at maturity in 2008-2015 did not show signs of overexploitation. The results of the biomass dynamic model that used fisheries data supported this conclusion. However, several biomass surveys of rock cod carried out between 2010 and 2016 revealed a significant decreasing trend in biomass estimates, with the rock cod in 2015 and 2016 being only a third of that estimated in 2010. Due to strong controversy of the biomass estimates by two different models, it has been decided to take a precautionary approach for the rock cod fishery, and establish a TAC at 30,000 t for 2017. The vessel unit allocation for finfish licenses will be the same as in 2016, however as soon as the TAC of 30,000 t is achieved, vessels will be instructed not to target rock cod anymore and target other stocks.

Stocks of the Patagonian toothfish remain in a stable condition for the last four years. A series of conservation measures including extension of the protection period for three winter months and significant expansion of the closed area during spawning season, together with decreased TAC have their positive effects on the recovery of this valuable commercial resource. One of the positive indicators was increased biomass of juvenile toothfish on the shelf in 2015. However, long life cycle and slow growth of toothfish still require some time to respond to these conservation measures. As the current $SSB_{current}$:SSB_0 ratio is just below the 0.45 threshold reference point, it is recommended that the TAC for longline fishing will remain in 2017 at its current level of 1,040 tonnes.

The biomass of skates has a positive trend in recent years, attaining ~40,000 tonnes in 2015. It seems that the current exploitation of the total skate assemblage is therefore sustainable in terms of total biomass. However, the current multi-species approach in skate stock assessments continues to be a limitation for management. As more than a half of the total skate catch was taken as bycatch in 2015, the allowable effort for skate licenses must be balanced against the total skate removal in all fisheries that is sustainable for the population. Therefore it is recommended to decrease the allocation of skate vessel units to 25.86 (-12% comparing to 2016).

A total of 2,790 tonnes of southern blue whiting were caught in the Falkland waters in 2015. All these fish was taken as a bycatch mainly during restricted (w-licensed) fishery. The stock of this fish is being recovering, but still a few more years are needed to rebuild it to full commercial exploitation. Scarcity of fishery data with the lack of specialized fishery in 2015 prevented stock assessment of southern blue whiting in 2015.

We are grateful to the scientific observers of the Fisheries Department for data collection and data managing staff for processing catch reports from all fishing vessels. We also thank local and foreign fishing companies for their kind cooperation in getting the reliable fisheries data in time that is much appreciated.

2. *Doryteuthis gahi* (*Loligo*) – Falkland calamari

2.1. Management and stock trends

The targeted fishery for Falkland calamari (*Doryteuthis gahi* – colloquially *Loligo*) is managed through two levels of control: 1) season schedule and 2) total biomass to a minimum escapement threshold per season. Season schedules are currently set as: 1st season (C licence), 64/65 days opening from February 24th to April 28th; 2nd season (X licence), 64 days from July 29th to September 30th. Since 2013 a flexible option also allows vessels to start and end either season as much as 3 days later. In either 1st or 2nd season the minimum escapement threshold is set at 10,000 tonnes biomass (Barton, 2002; Arkhipkin et al., 2008). If in-season depletion models project that calamari biomass will fall below 10,000 tonnes, the fishery may be suspended or stopped before the scheduled end date of the season.

With the use of these controls, actual vessel units (VU) play a nominal role in determining the effort allocation to the Falkland calamari fishery. As long as no significant decline in stock biomass is anticipated, all licensed vessels can expect to fish for the duration of the season (except one vessel for a fixed proportion of the season based on its replacement category; see below). For the past five years, calamari stock biomass estimates have been variable but shown no general declining trend (Table 2.1). In 1st season 2015 the Loligo Box experienced a large ingression of *Illex*, resulting in early closure of fishing allocated to calamari and relatively high failure risk (28.8%) of the escapement threshold (Winter, 2015). In 1st season 2016 most calamari immigration came unusually late (possibly as an after-effect of the conditions of the previous year), resulting in low catches early in the season and abundant biomass remaining at the end of the season (Winter, 2016).

Table 2.1. Catches, estimated biomass, and escapement risks, and VU allocations of Falkland calamari 1st seasons 2012-2016.

Year	1st season calamari catch (t)	1st season calamari biomass (t)[a]	Risk of <10,000 t escapement	Total VU allocation
2012	34,727[b]	73,235[b]	0.010[b]	26.91[c]
2013	19,906[d]	33,833[d]	0.102[d]	26.98[e]
2014	28,117[f]	61,423[f]	0.000[f]	27.07[g]
2015	19,383[h,i]	52,450[h,i]	0.288[i]	26.99[j]
2016	22,616[k]	65,603[k]	0.000[k]	27.01[l]

a: Biomass estimate at the end of the pre-season survey, plus in-season immigration.
b: Winter, 2012 c: Laptikhovsky et al., 2011 d: Winter, 2013
e: Laptikhovsky et al., 2012 f: Winter, 2014 g: FIFD, 2013
h: Calculated only to April 21st, for the duration of allocation to calamari target fishing.
i: Winter, 2015 j: FIFD, 2014 k: Winter, 2016
l: FIFD, 2015

2.2. Vessel units and q-values

Because of the absence of negative trends in calamari biomass, the total VU allocation for 2017 was set as the average of the preceding three years (Table 2.1): 27.02 VU.
As in previous years (e.g., Section 2 in FIFD, 2015), this total VU allocation was partitioned among licensed vessels in proportion to the GRT category-averaged catchability coefficients (q-values). One vessel was licensed as a substitute for a smaller vessel, and its VU allocation was set to the GRT category of the smaller vessel. Catchability coefficients represent the efficiency of a vessel at fishing (Arreguin-Sanchez, 1996), and are calculated as catch per unit effort per available biomass. To smooth variations within seasons, catchability coefficients were averaged over the most recent three years 2014 to 2016 (Table 2.2). The VU allocations per vessel are given in Table 2.3.

Table 2.2. Parameters for average q-value calculations. Trends were visualized for the five years 2012 - 2016; q averages were calculated for the most recent three years 2014 – 2016.

Parameter	GRT category	Year					3-year average
		2012	2013	2014	2015	2016	
Biomass		73,235.0	33,833.0	61,423.0	52,450.0	65,603.0	
Catch (t)	3	1,453.4	1,014.6	1,334.7	1,015.2	1,156.2	
	4	5,387.7	3,328.1	4,398.2	3,292.7	3,648.5	
	5	10,375.3	6,056.1	8,422.4	5,743.7	6,818.6	
	6	12,352.0	6,653.7	9,791.4	6,450.1	7,531.5	
	7	5,158.6	2,854.0	4,170.0	2,881.3	3,462.2	
Fishing days	3	47.0	48.0	54.0	55.0	64.0	
	4	147.0	147.0	163.0	156.0	193.0	
	5	239.0	237.0	269.0	272.0	311.0	
	6	237.0	250.0	274.0	275.0	322.0	
	7	100.0	100.0	112.0	111.0	130.0	
CPUE (t day^{-1})	3	30.9	21.1	24.7	18.5	18.1	
	4	36.7	22.6	27.0	21.1	18.9	
	5	43.4	25.6	31.3	21.1	21.9	
	6	52.1	26.6	35.7	23.5	23.4	
	7	51.6	28.5	37.2	26.0	26.6	
q-values	3	4.22e-4	6.25e-4	4.02e-4	3.52e-4	2.75e-4	3.43e-4
	4	5.00e-4	6.69e-4	4.39e-4	4.02e-4	2.88e-4	3.77e-4
	5	5.93e-4	7.55e-4	5.10e-4	4.03e-4	3.34e-4	4.16e-4
	6	7.12e-4	7.87e-4	5.82e-4	4.47e-4	3.57e-4	4.62e-4
	7	7.04e-4	8.44e-4	6.06e-4	4.95e-4	4.06e-4	5.02e-4

Table 2.3. VU allocations per vessel.

Vessel Callsign	GRT category	GRT avg. q	VU allocation
EHIS	4	3.77e-4	01.498
MSPL9	5	4.16e-4	01.653
ZDLB2	3	3.43e-4	01.366
ZDLC1	4	3.77e-4	01.498
ZDLE1	6	4.62e-4	01.837
ZDLF2	5	4.16e-4	01.653
ZDLO1	6	4.62e-4	01.837
ZDLP1	5	4.16e-4	01.653
ZDLR1	6	4.62e-4	01.837
ZDLT1	4	3.77e-4	01.498
ZDLU1	6	4.62e-4	01.837
ZDLV*	3	3.43e-4	01.366
ZDLX	5	4.16e-4	01.653
ZDLY	7	5.02e-4	01.999
ZDLZ	7	5.02e-4	01.999
ZDLZ1	6	4.62e-4	01.837
			27.023

* ZDLV is a larger vessel that entered the fishery to replace a category 3 vessel, and is restricted to 83% of the season to offset its higher fishing capacity.

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3. Finfish Fisheries based on Rock Cod, *Patagonotothen ramsayi*

3.1 Introduction

The finfish fishery of the Falkland Islands is regulated using both a total allowable catch (TAC) and a total allowable effort (TAE). Various finfish species are exploited by the finfish fleet. The TAC/TAE was firstly based on the southern blue whiting (*Micromesistius a. australis*) stock which was the most important finfish species exploited by the trawlers. However, the decrease of this resource in years 2004–2007 (Laptikhovsky et al., 2013) has led the Directorate of Natural Resources - Fisheries (DNR-F) to rebuild its licensing system based on the rock cod (*Patagonotothen ramsayi*) stock which became, from 2007, the most abundant finfish species.

Fishing activity is known to impact the life history traits and abundance of targeted species. Biological data collected by fishery observers during commercial trips and during research cruises have been used to investigate if targeted trawling has impacted rock cod life history traits. Variation in abundance can be explored using fishery independent and fishery dependent data (Hilborn and Walters, 1992; Maunder and Punt, 2004).

The objective of this report is firstly to present the time series of rock cod catch. Secondly, the analysis of biological data collected by the (DNR-F) to highlight if the targeted trawling fishery that started in 2007 has induced modifications in rock cod life history traits will be summarised. Thirdly, variations in rock cod abundance estimated with fishery independent and fishery dependent data will be described, the latter being used as input data in a biomass dynamic model. Based on these results, recommendations for 2017 will be formulated.

3.2. Historical catches

Reported catches by trawlers operating in Falkland waters increased from 2005 (8,620 t) to 2010 when a maximum of 76,458 t was reached. They then decreased until 2013 when catches reached 32,436 t. Although catches from 2008 to 2012 averaged 63,000 t, the low catches observed in 2013 were the result of a restricted market access leading vessels to avoid rock cod. Catches in 2014 went back to 56,669 t and dropped again in 2015 to 29,037 t when vessels concentrated their effort to target hake.

3.3. Analyses of the life history traits

The biological data collected by observers of the DNR-F were used to derive three indicators of rock cod life history traits; (i) the average total length, (ii), the size–at–maturity and (iii) the age–length relationship. The mean length of catch increased from 2003 to 2008, then decreased until 2013 and finally increased again in 2014–2015. The average total length of 2003 and 2015 were not significantly different. The size–at–maturity varied without trend from 2005 to 2007 and then slightly decreased until 2015. The annual parameters of the von Bertalanffy model fitted to the annual length–at–age data are significantly different from year to year. However, none of the von Bertalanffy parameters exhibited any trend throughout the studied period.

3.4. Stock assessment based on CPUE and biomass dynamic model

One source of information to monitor a stock abundance is fisheries dependent data. These data cannot be used as index of abundance as they are not randomly distributed throughout the finfish zone. However, they have the advantage to cover the entire year unlike survey data which are randomly distributed but available for only a short period of time. To derive an index of relative abundance, reported catch and effort have to be standardized (Hilborn and Walters, 1992; Maunder and Punt, 2004). This index was then used as input data in a biomass dynamic model (Hilborn and Walters, 1992). Results of the model showed that the biomass of rock cod increased from 2005 to 2008, following the same trend as the standardized CPUE. From 2008 to 2015, standardized CPUE varied without trend but exhibited a higher variance than at the start of the modelled period. The model followed the same trend as the standardized CPUE, however it did not reflect the high variation observed in the standardized CPUE.

3.5. Biomass estimation based on survey data

From 2010, a series of surveys has been conducted throughout the finfish area to estimate the rock cod biomass and monitor all the species caught by the bottom trawl used. These surveys were carried out in February 2010, 2011, October 2014, February 2015 and 2016. The same protocol has been applied to ensure that data collections were comparable. The total biomass was estimated using geostatistic methods to take the auto–correlation of the data into account. Rock cod total biomass was shown to be 653,009 t in 2010, increased to 803,955 t in 2011. From 2014 it followed a decreasing trend from 262,415 t to 206,485 t in 2015 and was finally 195,696 t in 2016 (Gras and Lee, 2016).

3.6. Conclusion

Although annual catches of rock cod were stable between 2008 and 2012, they became more variable between 2013 and 2015. Especially in 2013 and 2015, vessels did not target rock cod and catches were on average 30,000 t. Analyses of biological data showed that the rock cod stock does not exhibit any sign of overexploitation. Moreover, the biomass dynamic model which was fitted using the fishery dependent index of relative abundance showed that the rock cod biomass, after experiencing an increase from 2005 to 2008 remained stable until 2015. However, survey data which are the most reliable source of information to monitor a stock abundance, showed that rock cod biomass decreased from 650,000 to less than 200,000 (–70%) between 2010 and 2015. More details about rock cod stock assessment in Falkland waters are shown in Gras and Lee (2016).

3.7. Recommendation

Although two of the three sources of information showed that rock cod abundance was stable since the onset of the fishery in 2007, the most reliable source (fishery independent) showed that biomass in 2015 and 2016 was only 30% of the biomass estimated in 2010. Using this new biomass estimation and the last 5 years of catch and effort (including 2013 and 2015 when vessels did not target rock cod) as input data in the vessel unit months (VUM) estimation led to significant decrease of VUM and significant increase of fishing time, sometimes up to 300%. Allowing such an increase of effort would not be sustainable for the finfish fishery and might lead to an overexploitation of the finfish resources. Following a precautionary approach, the DNR–F decided to reduce the VUM of G, W licences and bycatch by 10%. The VU used to estimate the allocated fishing effort for 2017 are in Table 3.1.

On top of the TAE historically used to regulate the finfish fishery and because the rock cod biomass drop observed in February 2015 was confirmed in February 2016, **a precautionary TAC for rock cod will be set up for 2017 at 30,000 t**. The TAC corresponds to the average of the two lowest annual catches (2013 and 2015) observed since the onset of the fishery in 2007. Vessels will be allowed to target rock cod as long as the total catch of 2017 will be <30,000 t. As soon as the TAC of 30,000 t will be achieved, vessels will be instructed not to target rock cod anymore and target other stocks. The same enforcement will be applied for restricted finfish licensed vessels with hake, i.e. vessels catching more than 10% of rock cod will be instructed to change the fishing area.

Table 3.1. Average annual catches per licence type for the period 2009–2012; 2014 (used for 2016 licence advice), for the period 2011–2015 which was supposed to be used for 2017 licence advice and actual catches of 2015.

Licence Type	Average Year 2009–2012; 2014	Average Year 2011–2015	Year 2015 Actual (t)	Suggested for 2017	
				Allocated (t)	VU
Licence A	11,881	7,905	2,291	12,200	12.2
Licence G	18,253	13,237	12,350	18,000	18
Licence W	26,974	22,438	10,611	20,100	20.1
Bycatch F+C+X+B+E	4,685	3,634	3,833	4,900	4.9
Total	61,793	47,214	29,087	55,200	55.2

Table 3.2. Suggested VUMs for A–, G– and W–licensed vessels by GRT category.

Licence Type	GRT category	Suggested VUM
A	3	0.46
	4	0.46
	5	0.46
	6	0.46
G	3	0.40
	4	0.68
	5	0.96
	6	1.25
W	3	0.31
	4	0.49
	5	0.66
	6	0.84

3.8. References

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4. Toothfish

4.1. Management and stock trends

Patagonian toothfish (*Dissostichus eleginoides*) is allocated to a single quota for target fishing by longline, and managed by total allowable catch (TAC). In addition to longline, important quantities of toothfish are caught in two other fisheries in the Falkland Islands zone: finfish trawl, of which toothfish is not targeted but commercially valuable bycatch, and *Doryteuthis gahi* squid trawl, of which toothfish is also bycatch but individuals caught in this fishery are too small to be commercially valuable (Figure 1). The fisheries access different parts of the toothfish population in different areas: longlining occurs on the slope and in deep water, finfish trawling on the shelf primarily north and west of the Falkland Islands, and *D. gahi* trawling also on the shelf, east of the Falkland Islands.

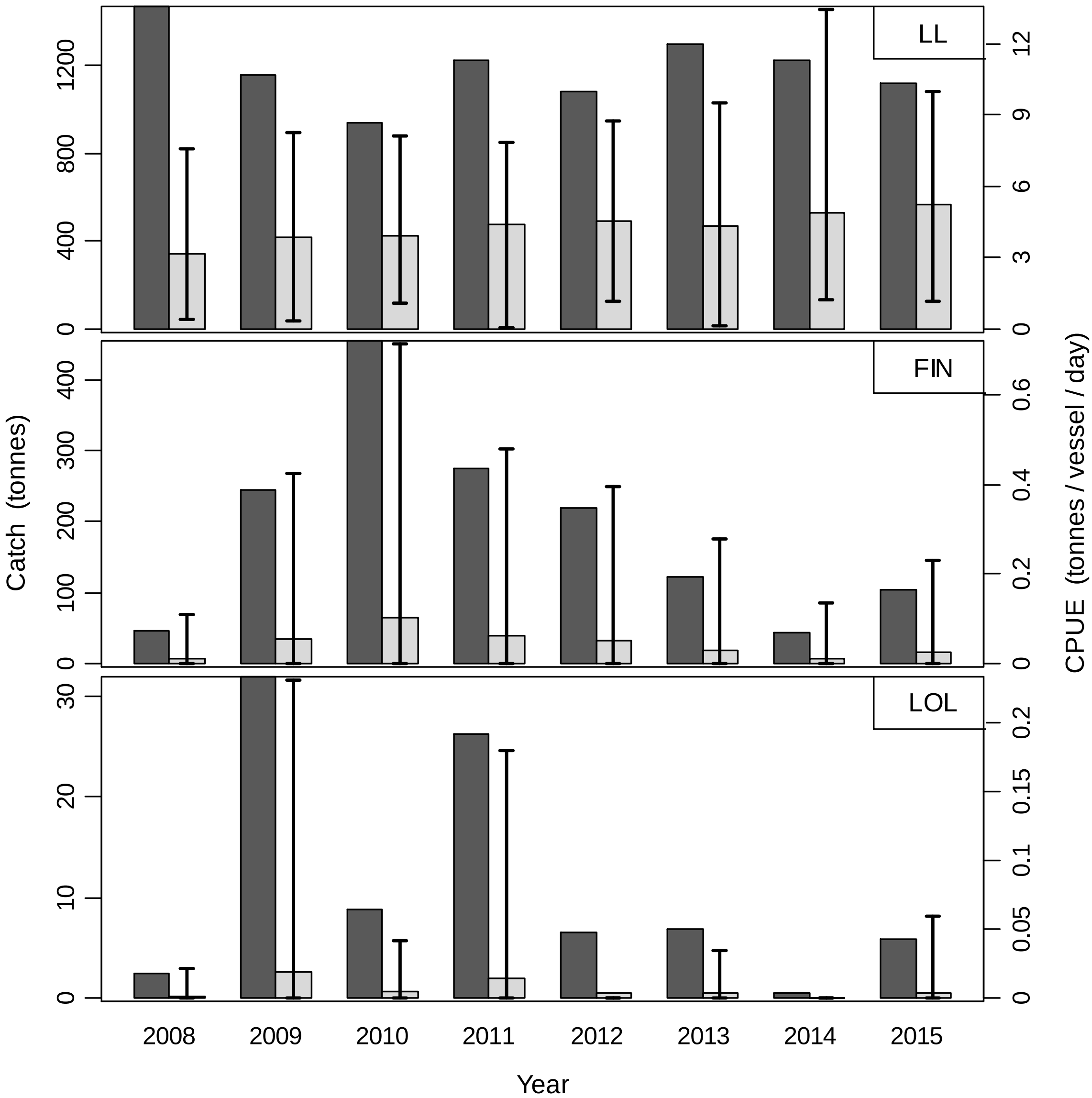

Figure 4.1. Annual catches (tonnes; dark bars) and unstandardized CPUE (tonnes / vessel / day; light bars with 95% intervals) of toothfish in each of the toothfish longline (LL), finfish trawl (FIN) and *D. gahi* trawl (LOL) fisheries since 2008 (first full year of 'umbrella' longlining). From Winter (2016).

Stock assessment of toothfish is calculated as an age-structured production model in CASAL software (C++ Algorithmic Stock Assessment Laboratory; Bull et al. 2012). The stock assessment is based on an objective function comprising one relative annual abundance index (target longline CPUE), and catch-at-age distributions of the longline, finfish trawl (including skate and surimi licenses), and *D. gahi* trawl fisheries. The current stock assessment of Falkland Islands toothfish was calculated with updated catch and effort through 2015, with 679 additional age / size metrics from otoliths sampled in 2014. In 2015, reported toothfish catch totalled 1232.2 tonnes, the lowest since 1997. Of the total toothfish catch in 2015, 91.1% by weight was taken by longline license, 8.4% by finfish trawl, and 0.5% by *D. gahi* trawl. Longline fishing was undertaken during 216 days in 2015, the lowest effort since 1993. Procedures and results of the stock assessment are described in Winter (2016), and summarized below.

4.2. Biomass and MSY

From the age-structured production model, estimated total toothfish biomass in 2015 was 24,243 tonnes with a 95% confidence interval of 19,239 to 58,985 tonnes. Estimated spawning stock biomass in 2015 was 7,079 tonnes with a 95% confidence interval of 5,400 to 16,196 tonnes. The ratio $SSB_{current}$:SSB_0 (current spawning-stock biomass to initial population spawning-stock biomass) was 7,079 tonnes / 15,915 tonnes = 0.445.
Maximum sustainable yield (MSY) calculated by the age-structured production model was 1,579 tonnes. Spawning stock biomass corresponding to MSY was 3,839 tonnes, and corresponding fishing mortality FMSY = 0.35; i.e., the yield-per-recruit slope was 35% of the unfished yield-per-recruit slope. MSY is based on toothfish catch of all fisheries. Allowable catch in the target longline fishery therefore deducts bycatches in the finfish and *D. gahi* trawl fisheries, factored by the loss of future spawning stock biomass from the bycatch in those fisheries. Finfish trawls took 103.1 tonnes toothfish in 2015, incurring a deduction of 103.1 × 2.60 = 268.0 t. *D. gahi* trawls took 6.6 tonnes toothfish in 2015, incurring a deduction of 6.6 × 5.24 = 34.8 t. The multipliers (2.60 and 5.24) represent finfish and *D. gahi* trawls catching smaller, younger toothfish than the longline fishery, thereby removing larger numbers with higher potential for growth per unit catch weight. Based on MSY, maximum toothfish catch allowable to the longline fishery is thus 1,579 – 268.0 – 34.8 = 1,276.5 tonnes.

4.3. Recommendation

The Falkland Islands Fisheries toothfish harvest control rule prescribes $SSB_{current}$:SSB_0 < 0.45 will result in reduction of TAC and increase in conservation measures (FIG 2014). The $SSB_{current}$:SSB_0 ratio of the current stock assessment was 0.445 with 24.9% of the corresponding variability distribution < 0.45 (the distribution being right-skewed). Thus the $SSB_{current}$:SSB_0 ratio is just below the prescribed threshold reference point. However, CPUE in the longline fishery currently shows a steady increasing trend (Figure 1). Based on the evidence of a slowly increasing toothfish stock, the recommendation from this stock assessment is to maintain the TAC for longline fishing at its current level of 1040 tonnes.

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FIG. 2014. Sustainability measures 2014 – 2015. Patagonian toothfish (*Dissostichus eleginoides*). Fisheries Department, Directorate of Natural Resources, Falkland Islands Government. 15 pp.

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5. Skates

5.1. Management and stock trends

Skates (Rajiformes) are since 1994 licensed separately from other groundfish trawl fisheries in the Falkland Islands (F license). The skate fishery is regulated by total allowable effort (TAE) of licensed vessels. However, a large proportion of skate catch is routinely taken in finfish trawls, while skate-licensed vessels may take large amounts of groundfish other than skate. In 2015, 2365.3 tonnes of skate were caught under skate target license, together with 701.8 t hake, 537.6 t rock cod, 84.2 t kingclip, 76.7 t red cod, 68.1 t blue whiting and 64.5 t hoki. Conversely, 4121.9 t skate were caught in 2015 under licenses other than skate target license. Given the wide range of catches, allowable effort for skate license must be balanced against the total skate removal in all fisheries that is sustainable for the population. To evaluate the sustainable skate catch, annual biomass assessments of the population are calculated using a biomass dynamic model (Schaefer production model).

Procedures and results of the biomass assessment are described in Winter (2016). The Schaefer production model estimated a maximum sustainable yield of 6726 tonnes in the northern area (north of 51°S), higher than the total reported skate catch (6487 t). Current exploitation of the total skate assemblage in Falkland waters is therefore sustainable in terms of total biomass, although the absence of individual species data in catch reports continues to be a limitation for management. A review of the skate assemblage (Arkhipkin et al. 2012) has nevertheless noted high population abundance, species diversity, and structure of the habitat with refuge areas from commercial fishing.

5.2. Allowable effort and vessel units

The recommendation for 2017 is therefore to maintain skate target catch under F license at the current level. Corresponding effort allocations were calculated by Vessel Units based on catchability per GRT category, averaged over the preceding three years. Catchability coefficients (q-values) per GRT category were calculated as:

$$Q_i = \text{average}\ [\text{catch}_{\ i}\ (\text{t}) \times \text{effort}_{\ i}^{-1}\ (\text{hrs}) \times \text{biomass}^{-1}\ (\text{t})]_{\ 2013\text{-}2015}$$

where catch and effort of the *i*th GRT category are obtained from vessel reports, and biomass in each year 2013 to 2015 is the north biomass estimate (Table x). Vessel units per month per GRT category were calculated as:

$$VUM_i = Q_i \times \text{biomass}_{\ 2015} \times \text{average}\ [\text{fish hrs}_{\ i} \times \text{fish days}_{\ i}^{-1} /30.5/100]_{\ 2013\text{-}2015}$$

where fishing hours and fishing days of the *i*th GRT category are obtained from vessel reports, 30.5 is the day/month conversion, and 100 is a scaling factor of the vessel units. Vessel unit allocations per GRT category were calculated as:

$$VU_i = VUM_i \times \text{licensed days}_{\ i,2015} / 30.5$$

Table 5.1. Skate fishery parameters 2013 – 2015, used for calculating the 3-year averaged Vessel Unit allocations.

Parameter	GRT category	Year		
		2013	2014	2015
Biomass		36,854	38,431	39,733
Catch	3	1,428	1,823	1,805
	4	399	844	299
	5	0	0	262
	8	396	287	0
Effort Hours	3	2,212	2,620	2,442
	4	1,120	985	934
	5	0	0	606
	8	396	287	0
Licensed Days	3	140	148	139
	4	76	76	76
	5	0	0	44
	8	44	35	0
Fishing Days	3	126	148	138
	4	76	76	68
	5	0	0	43
	8	44	35	0

Fishery parameters for the past three years are summarized in Table 1, and the recommended Vessel Unit allocations are summarized in Table 2. As in previous years (FIFD 2014; 2015) the vessel units per month were equalized between GRT categories. Equalization was implemented because the relatively small scale of this fishery (8 vessels in 2015) and partition between two nations (two Korean category 3 vessels; four Spanish category 4 vessels and two Spanish category 5 vessels) would result in an arbitrary relationship of catch power as a function of GRT category. The total allocation is 25.86 VU, corresponding to an expected skate catch of 2,586 tonnes (in effect, VUs are calibrated so that approximately the same amount should be taken each year as a function of averaged catchability). Notably, compared to the year before the catch by category 4 vessels decreased again to nearer the long-term average (Table 1), and while a category 8 vessel left the skate-licensed fishery (FIFD 2015), two Spanish category 5 vessels entered the fishery.

Table 5.2. Mean catchability coefficients Q and recommended equalized vessel unit allocations by GRT category.

GRT category	Q ($\times 10^{-5}$)	Vessel Units per month	Vessel Unit allocation	Fishing Days allocation
3	2.19	3.05	13.88	107
4	1.73	3.05	7.59	193
5	1.57	3.05	4.39	74
Total			25.86	374

5.3. References

Arkhipkin, A., Brickle, P., Laptikhovsky, V., Pompert, J., Winter, A. 2012. Skate assemblage on the eastern Patagonian Shelf and Slope: structure, diversity and abundance. Journal of Fish Biology 80:1704-1726.

FIFD. 2014. Vessel Units, Allowable Effort, and Allowable Catch 2015. Fisheries Dept., Directorate of Natural Resources, Falkland Islands Government. 54 p.

FIFD. 2015. Vessel Units, Allowable Effort, and Allowable Catch 2016. Fisheries Dept., Directorate of Natural Resources, Falkland Islands Government. 44 p.

Winter, A. 2016. Skate (Rajiformes) stock assessment, 2015. Technical Document, Falkland Islands Fisheries Department. 14 p.

6. Quick reference guide to VUM/GRT Category

6.1. Falkland calamari fishery (C)

VU = 27.02 – allows for a standard fleet of 16 vessels

6.2. Finfish fishery

With the exception of Pelagic (S) and Skate (F) finfish are controlled in terms of effort directed at rock cod. However, some management measures are in effect for the protection of finfish species deemed vulnerable due to overfishing. Whilst vessel units have been held at 2015 levels a precautionary TAC of 30,000 tonnes or 50% of the 2015 TAC is recommended.

6.3. Restricted finfish W

Historical changes in allocated VUMs and fishing times in A–, G– and W–licensed vessels

A licence

Fish. Effort VUM Vessel GRT cat.	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
3				1.87	0.46	0.46	0.45	0.46	0.46	0.46
4				1.87	0.46	0.46	0.45	0.46	0.46	0.46
5				1.87	0.46	0.46	0.45	0.46	0.46	0.46
6				1.87	0.46	0.46	0.45	0.46	0.46	0.46

Fish. Time Month Vessel GRT cat.	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
3				36	28.3	29.3	29.3	26.5	26.6	26.6
4				36	28.3	29.3	29.3	26.5	26.6	26.6
5				36	28.3	29.3	29.3	26.5	26.6	26.6
6				36	28.3	29.3	29.3	26.5	26.6	26.6

G licence

Fish. Effort VUM Vessel GRT cat.	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
3	0.19	0.13	0.13	0.4	0.39	0.42	0.49	0.37	0.4	0.4
4	0.23	0.15	0.15	0.79	0.73	0.79	0.75	0.72	0.68	0.68
5	0.31	0.21	0.21	0.86	1.07	1.17	1.01	1.06	0.96	0.96
6	0.31	0.21	0.21	1.22	1.41	1.54	1.27	1.4	1.25	1.25

Fish. Time Month Vessel GRT cat.	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
3	39.5	38.5	38.5	49.0	54.4	52.6	40.7	53.8	49.7	44.8
4	32.6	33.3	33.3	24.8	29.0	28.0	26.6	27.9	29.3	26.3
5	24.2	23.8	23.8	22.8	19.8	18.9	18.9	18.9	20.7	18.7
6	24.2	23.8	23.8	16.1	15.0	14.4	14.4	14.2	16.1	14.5

W licence

Fish. Effort VUM Vessel GRT cat.	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
3	0.59	0.45	0.45	0.25	0.24	0.24	0.23	0.27	0.31	0.31
4	0.85	0.82	0.82	0.53	0.48	0.51	0.48	0.47	0.49	0.49
5	1.86	1.99	1.99	0.53	0.73	0.78	0.74	0.67	0.66	0.66
6	1.86	1.99	1.99	1.25	0.98	1.04	1.00	0.87	0.84	0.84

Fish. Time Month Vessel GRT cat.	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
3	89.0	105.5	105.5	88.8	98.8	102.9	97.1	81.2	71.0	64.0
4	61.8	57.9	57.9	41.9	48.9	48.4	46.5	47.0	45.7	41.2
5	28.2	23.9	23.9	41.9	32.5	31.7	30.2	33.1	33.7	30.3
6	28.2	23.9	23.9	17.8	24.2	23.8	22.3	25.5	26.7	24.0

6.4. Skate/ray – (F)

VU = 25.86

GRT category	Q ($\times 10^{-5}$)	Vessel Units per month	Vessel Unit allocation	Fishing Days allocation
3	2.19	3.05	13.88	107
4	1.73	3.05	7.59	193
5	1.57	3.05	4.39	74
Total			25.86	374

6.5. Restricted finfish – Pelagic (S)

TAC for southern blue whiting – 2,000 tonnes.

6.6. Toothfish Longlining (L)

TAC – 1,040 tonnes