Updated conversion ratios for beche-de-mer species in Torres Strait, Australia

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Abstract

As part of the newly endorsed Torres Strait Beche-de-mer Harvest Strategy, conversion ratios for commercial beche-de-mer species were reviewed. Accurate conversion ratios are required to determine total catches in a standard unit (e.g. wet gutted or landed weight) from data that records catch weight in several different processing stages. These values are useful for stock assessment, management and monitoring of the beche-de-mer fishery in Torres Strait, and elsewhere in Australia.

Key words: beche de mer, conversion ratios, sea cucumber, Torres Strait, fisheries

Introduction

Total allowable catch

Total allowable catch (TAC) is considered by the European Union Common Fisheries Policy to be a cornerstone conservation measure (Karagiannakos 1996). TAC represents the amount of fish of a species that can be taken from a fishery in a prescribed period. A TAC is set for a species and managed through a range of mechanisms.

Torres Strait beche-de-mer fishery

The Torres Strait beche-de-mer (BDM) fishery is a multispecies, wholly commercial, traditional inhabitant fishery (Skewes et al. 2000; Skewes et al. 2004). Twenty-three commercial sea cucumber species have been recorded in Torres Strait (Murphy et al. 2019). The fishery has undergone closures and reduced catch limits for important fishery species (Skewes et al. 2010) for a number of years. However, the implementation of recent management measures, such as revised species TACs (Plaganyi et al. 2020), along with a shift in focus from historically high-value to medium-value species, has maintained the fishery as a potentially significant source of income for local Torres Strait islander communities.

A newly endorsed multi-tier harvest strategy (Torres Strait Beche-de-mer Harvest Strategy[2]) has been implemented since January 2020 for the fishery. It incorporates modern management strategies, traditional fisheries practices, and community decision-making processes (Plaganyi et al. 2020). Precautionary evidence-based methods for reviewing and setting TAC levels for species are used. New TACs were set for species of hairy blackfish (*Actinopyga miliaris*), deepwater redfish (*A. echinites*), greenfish (*Stichopus chloronotus*) and curryfish (*S. herrmanni* and *S. vastus*). Previously, these species were grouped in a multi-species "basket", although increased fishing pressure as a result of increased market value required the species to be monitored individually (Plaganyi et al. 2020).

Conversion ratios

Catch data for the Torres Strait BDM fishery are recorded in a number of different processed states, such as live, wet gutted, salted, boiled and salted, and fully processed (dry) (Skewes et al. 2004). It is important that the relationship between the measurement of sea cucumbers in different stages of processing, from live product to dried and ready for market be determined. This allows data from different processing states to be converted by applying species-specific conversion ratios, with results used for tracking quotas for individual species.

Compulsory catch reporting was introduced to the Torres Strait BDM fishery in 2017. Fishers are required to record catch information on Torres Strait catch disposal records (TDB02) as part of the mandatory Fish Receiver System (PZJA 2017). This includes reporting the total mass of each species landed, as well as the processing method, so that conversion ratios can be used to convert all reported catch to a standard weight (i.e. wet weight gutted) for the fishery (Plaganyi et al. 2020).

As part of the Torres Strait Beche-de-mer Harvest Strategy and the inclusion of new individual TACs for some species, conversion ratios for 18 commercial BDM species in Torres Strait were reviewed and updated.

Methods

Locally relevant conversion ratios for the Torres Strait BDM fishery – which are suitable for converting weights available from abundance surveys and fishery data to the required management weight metric (wet weight gutted) – were originally compiled by Skewes et al. (2004). The study found

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[2] https://www.pzja.gov.au/the-fisheries/torres-strait-beche-de-mer-fishery

the majority of conversion ratio information available in the literature was for values for whole live weight to dry weight (Conand 1989; Preston 1990). Intermediate processing stages such as boiled or salted were found to be sparse, with many ratios estimated from oven-dried specimens (Harriot 1985), or using experimental methods that were not fully defined (Skewes et al. 2004). Processing methods, and resulting yields, were also found to be variable (Preston 1990).

A hierarchical approach was therefore used, with species conversion ratio values updated first using data from previous Torres Strait studies (Skewes et al. 2004) and raw data from Prescott et al. (2015), second from literature reviews, and third by the use of conservative proxies to fill gaps for processing state information for species (Purcell et al. 2009; Ngaluafe and Lee 2013; Prescott et al. 2015; Ram et al. 2016). Ratio decisions were based on current processing methods, average value calculations and the removal of outliers (Table 1).

Results

Conversion ratios for total whole fresh weight from wet to dry product (including values from other studies) were noted from Ngaluafe and Lee (2013; Table 1 and Table 3), with whole fresh weights also noted from Purcell et al. (2009; Table 2). Inverse values for gutted to salted and dried to gutted, were derived from Skewes et al. (2004) and Prescott et al. (2015). Empirical values were calculated for gutted to salted, gutted to dried, salted to dried, salted to gutted and dried to gutted, from Purcell et al. (2009). Calculations from raw data provided by Dr Shijie Zhou were used for live to gutted, live to dried, gutted to dry and dried to gutted (Prescott et al. 2015). Averages were taken where multiple values existed for species and processing state. Proxy values using the most conservative value for species for processing state, were used to fill in gaps for species (Table 1).

Discussion

Updated conversion ratios for BDM species are currently the best estimator for converting pooled catch data from one processed state to another, where the size frequency of the catch is not known. For example, for converting catches in gutted weight to processed weight for comparison with export data, and for tracking the TAC for individual species. These values are useful for stock assessments and are important for management and monitoring of the Torres Strait BDM fishery and other BDM fisheries in Australia.

Conversion ratios also provide an insight to the efficiency of BDM processing methodologies, and for assessing the effect of any future changes in processing techniques.

This review, and information from fishers and management agencies, shows that a critical conversion ratio information gap now occurs for curryfish species, a newly targeted species group for Torres Strait that require specialised processing upon collection due to their tendency to easily disintegrate. This involves an early boil and then salting of the animal before it can be weighed. The new curryfish processing stage will require a new conversion ratio to be determined (i.e. wet-boiled and salted) so that fishery catch data can be converted to standard (wet gutted) weight for the application of management rules.

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Table 1. Torres Strait beche-de-mer species and conversion ratio values for each processing state.

Common name and species	Live to gutted	Live to salted	Live to dried	Gutted to salted	Gutted to dried	Salted to dried	Salted to gutted	Dried to gutted
Deepwater redfish *Actinopyga echinites*	0.692[3]	0.652[h]	0.088[av13]	0.964[h]	0.152[f3]	0.309[h]	1.706[h]	6.579[f3]
Stonefish *Actinopyga lecanora*	0.894[c1]	0.652[c1]	0.154 [cv12*]	0.729[1]	0.158[v12*]	0.253[1]	1.372[1]	6.329[1]
Surf redfish *Actintopyga mauritiana*	0.684[2*]	0.652[h]	0.084 [av12*]	0.873[4]	0.187[v2*4]	0.286[4]	1.145[d]	5.347[egv2*4]
Hairy blackfish *Actinopyga miliaris*	0.480[4]	0.652[h]	0.067[av14]	0.964[4]	0.209[4]	0.217[4]	1.037[d]	4.785[e]
Deepwater blackfish *Actinopyga palauensis*	0.818[cv13]	0.593[cv13]	0.175[abv1]	0.728[fv13]	0.190[fv13]	0.262[fv13]	1.374[fv13]	5.263[fv13]
Burrowing blackfish *Actinopyga spinea*	0.544[3]	0.375[3]	0.073a[1]	0.689[f3]	0.135[f3]	0.195[f3]	1.449[f3]	7.424[f3]
Leopardfish *Bohadschia argus*	0.665 [cv12]	0.572[c1]	0.115 [cv12]	0.777[1]	0.171[v12]	0.233[1]	1.286[1]	5.841[gv12]
Brown sandfish *Bohadschia vitiensis*	0.735[c1]	0.612[c1]	0.116[c1]	0.834[1]	0.157[1]	0.189[1]	1.199[1]	6.337[1]
Lollyfish *Holothuria atra*	0.436[cv12*]	0.236[c1]	0.063[abcv12*]	0.586[1]	0.150[12*]	0.256[1]	1.706[1]	6.289g[12*]
Elephant trunkfish *Holothuria fuscopunctata*	0.519[4]	0.652[h]	0.133[abv14]	0.911[4]	0.242[4]	0.263[4]	1.097[d4]	4.132[e4]
White teatfish *Holothuria fuscogilva*	0.627[cv2*4]	0.593[c]	0.137[abv12*]	0.775[1]	0.237[1v2*]	0.309[1]	1.290[1]	4.219[gv12*]
Golden sandfish *Holothuria lessoni*	0.645[3]	0.526[3]	0.098[a]	0.815[f3]	0.152[f3]	0.186[f3]	1.226[f3]	6.588[f]
Sandfish *Holothuria scabra*	0.496[4]	0.355[4]	0.049 [av14]	0.758[4]	0.094[4]	0.125[4]	1.319[d]	10.638[e4]
Black teatfish *Holothuria whitmaei*	0.677[v2*34]	0.529[3]	0.108 [av12*3]	0.824[f4]	0.177[fv2*3]	0.220[f]	1.213 [f4]	5.649[fgv2*3]
Greenfish *Stichopus chloronotus*	0.894[h]	0.652[h]	0.175[h]	0.964[h]	0.242[h]	0.309[h]	1.382[h]	11.364[h]
Curryfish (common) *Stichopus herrmanni*	0.651[2]	0.652[h]	0.036[av1]	0.964[h]	0.114[2]	0.309[h]	1.706[h]	8.772[g2]
Curryfish (vastus) *Stichopus vastus*	0.894[h]	0.652[h]	0.175[h]	0.964[h]	0.242[h]	0.309[h]	1.706[h]	11.364[h]
Prickly redfish *Thelenota ananas*	0.667 [cv4]	0.481[c]	0.055[abv14]	0.736[14]	0.088[v14]	0.118[v14]	1.358[dv14]	11.364[ev14]

Superscripts denote derived value source and reference: a) Table 3 (Ngaluafe and Lee 2013), b) Table 1 (Ngaluafe and Lee 2013), c) Table 2 (Purcell et al. 2009), d) inverse gutted to salted (Skewes et al. 2004), e) inverse dried to gutted (Skewes et al. 2004), f) empirical calculation (Purcell et al. 2009), g) inverse dried to gutted (Prescott et al. 2015), h) proxy value, v) average of multiple values; References: 1) Ngaluafe and Lee 2013, 2) Prescott et al. 2015, 2* Calculation from raw data provided by S. Zhou (Prescott et al. 2015), 3) Purcell et al. 2009, 4) Skewes et al. 2004.