



Gladstone Healthy  
Harbour Partnership



# Fish condition health indicators for the Gladstone Harbour Report Card 2023



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This report has been prepared by Infofish Australia Pty Ltd for the Gladstone Healthy Harbour Partnership. Infofish Australia have taken all steps to ensure the information contained in this publication is accurate at the time of publication. This report pertains to the period of study, new information will be added on the subject matter over time and will be available in subsequent reports.

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Cover images – Releasing fish from the BTHU live weigh-in at the Bray Park boat ramp (top) and Pikey Bream tagged and measured at the BTHU live weigh-in (bottom).

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## SUMMARY

Fish condition (FC) health assessments in the Gladstone Harbour study area for the 2023 Report Card were based on a combination of Visual Fish Condition (VFC) and Fish Body Condition (FBC). Owing to fish movement FC is scored at the harbour level rather than at the individual monitoring zones level.

Fish images were used for VFC, and length-weight data were used to assess FBC based on activities 1-4 listed below. Images were collected from 1-4 while length-weight were collected from 2.

1. Images from the Australian Bass Tournament (ABT) Bream tournament in the Gladstone area using the Trackmyfish (TMF) app (September 2022).
2. Images and length-weights from the live weigh-in section of the Boyne Tannum HookUp (BTHU) fishing competition using TMF (April 2023).
3. Images from Suntag taggers including Gladstone Sportfishing Club members using TMF during normal fishing trips (July 2022-June 2023).
4. Images from the ABT Barramundi tournament in Lake Awoonga using the TMF app (September 2022).

### VISUAL FISH CONDITION

Images were assessed for VFC using the following indicators fins, skin, eyes, parasites and deformities. VFC was assessed using both machine learning algorithms and human assessors. Microsoft Azure was used again this year to undertake the machine assessment. There was close to 100% agreement between the human and machine assessment of each indicator.

The VFC of 6 key species Yellowfin Bream, Pikey Bream, Barred Javelin, Dusky Flathead, Mangrove Jack and Barramundi was obtained using 879 images mostly captured by the TMF app. The numbers of images for the key species are shown in the accompanying summary table.

For the key species, the observed prevalence of fin damage was moderate to high ranging from 32% for Barred Javelin to 70% for Yellowfin Bream however the severity of the damage was low and assessed as light active erosion. Skin damage was low with just 1 detection for Yellowfin Bream. The observed issues for eyes, parasites and deformities were either non-existent or very low (less than 1%). The resulting VFC scores are shown in the accompanying summary table.

### FISH BODY CONDITION

FBC was calculated using Relative Condition Factor (RCF) as used in previous years. FBC was obtained for a total of 525 fish for 5 of the target species. Barramundi were not included as no fish weights were obtained. The resulting FBC scores are shown in the accompanying summary table.

## FISH CONDITION SCORES AND GRADES

The VFC and FBC scores were then averaged to provide a species FC score and an all of harbour score that were converted to GHHP grades from A to E. The following table provides a summary of the scores and grades with the sample size in brackets. There was no VFC for Barramundi due to insufficient images. The fish condition grade for all species and across all of harbour was B.

Species	Visual Fish Condition (VFC)	Fish Body Condition (FBC)	Fish Condition (FC)	GHHP Species Grade
Yellowfin Bream	0.97 (452)	0.48 (242)	0.73	B
Pikey Bream	0.97 (240)	0.51 (131)	0.74	B
Barred Javelin	0.97 (102)	0.54 (57)	0.72	B
Dusky Flathead	0.97 (30)	0.42 (54)	0.70	B
Mangrove Jack	0.96 (55)	0.46 (41)	0.72	B
Barramundi (VFC only)	NA (14)	NA (0)	NA	NA
<b>All of harbour</b>	<b>0.97</b>	<b>0.48</b>	<b>0.72</b>	<b>B</b>
Barramundi (Awoonga)	0.91 (287)	NA	0.91 (VFC only)	A

## COMPARISON WITH OTHER SITES

This year the only site comparison made was for Barramundi in Lake Awoonga using 286 images recorded using the TMF app for the ABT fishing competition held in Lake Awoonga. Barramundi from the lake can impact fish health when the dam spills and fish enter the downstream waterways, so it was considered relevant to include them in the assessment as a comparison.

However there has been no spilling of Awoonga since 2017. An assessment was made for VFC only as no weights were able to be obtained. This resulted in a FC score of 0.91 (VFC only) which converts to a GHHP grade of A.

# 1. INTRODUCTION

The Gladstone Healthy Harbour Partnership (GHHP) was established in 2013 to assess the health of Gladstone Harbour. The GHHP produces an annual report on the health of the harbour that includes Environmental, Social, Cultural and Economic indicators. Fish recruitment and fish health were identified as important Environmental indicators for the report card by the Gladstone community.

In 2018, GHHP and the Fisheries Research and Development Corporation (FRDC) commissioned Infofish Australia to undertake a trial of new tools to assess visual fish health using photographs and artificial intelligence algorithms to recognise fish parts such as fins, tail, gills, eyes and mouth and fish health issues such as fin and tail damage, wounds and “redness” (e.g. lesions, scale damage).

Following the successful completion of that project GHHP has undertaken fish condition health assessments in 2018-19, 2019-20, 2020-21 and 2021-22, and included a fish condition health indicator score in its 2019-2022 report cards using 5 key species.

The results are contained in the reports:

- Visual fish health indicators for the Gladstone Harbour Report Card 2019 (Sawynok et al. 2019),
- Visual fish health indicators for the Gladstone Harbour Report Card 2020 (Sawynok et al. 2020),
- Fish condition health indicators for the Gladstone Harbour Report Card 2021 (Sawynok et al. 2021) and
- Fish condition health indicators for the Gladstone Harbour Report Card 2022 (Sawynok et al. 2022).

## 2. OBJECTIVES

The objectives of the project were:

1. Visual Fish Condition (VFC) and Fish Body Condition (FBC) scores and grades for the 2023 Gladstone Harbour Report Card. The required scores and grades are presented as shown in Table 1 and the conversion scale for the A to E grades is presented as shown in Figure 1. The scores and grades to be calculated using the statistical methods developed in the 2019 visual fish condition project (Sawynok S et al 2019).
2. An updated fish condition project report.

**Table 1:** Required fish health outputs for the 2023 Gladstone Harbour Report Card.

Species	Visual Fish Condition (VFC)	Fish Body Condition (FBC)	Fish Condition (FC)	GHHP Grades
Yellowfin Bream	score	score	score	grade
Pikey Bream	score	score	score	grade
Barred Javelin	score	score	score	grade
Dusky Flathead	score	score	score	grade
Mangrove jack	Score	Score	Score	grade
Barramundi VFC only	score	NA	NA	grade VFC only
All of harbour	score	score	score	grade



**Figure 1:** Grading scale for the 2023 Gladstone Harbour Report Card.



### 3. GLADSTONE HARBOUR MONITORING ZONES

Gladstone Harbour has been divided into 13 environmental monitoring zones for the GHHP Report Card as shown in Figure 2. However, owing to the potential for fish movement, fish health is scored at the harbour level. The single harbour score is justifiable as fish are mobile and the health of the key species cannot necessarily be attributed to individual monitoring zones.



**Figure 2:** Gladstone monitoring zones for the GHHP Report Card (from 2020 Gladstone Harbour Technical Report).

## 4. METHODS

### 4.1 COLLECTING FISH SAMPLES

Data were collected from 1 July 2022 to 30 June 2023. The target was a minimum of 25 photographic samples of 6 species throughout the study area. There were 4 methods for collecting the fish samples using the Infofish Trackmyfish (TMF) phone apps.

1. Images from the Australian Bass Tournament (ABT) Bream tournament in the Gladstone area using the TMF app (September 2022).
2. Images and length-weights from the live weigh-in section of the Boyne Tannum HookUp (BTHU) fishing competition using TMF (April 2023).
3. Images from Suntag taggers including Gladstone Sportfishing Club members using TMF during normal fishing trips (July 2022-June 2023).
4. Images from the ABT Barramundi tournament in Lake Awoonga using the TMF app (September 2022).

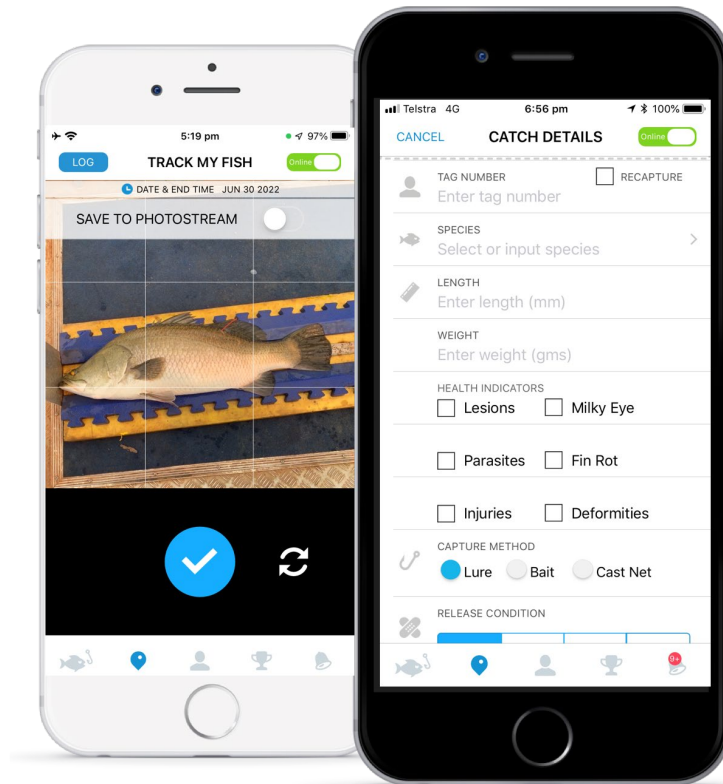
The data collected through the TMF apps were:

- Photos of one side of the fish, preferably on a measuring ruler.
- Tag number for fish that were tagged.
- Total length of the fish to nearest half centimetre.
- Weight of the fish in grams.
- Date and GPS location of where the fish were caught.

At the BTHU there were 2 stations where fish were presented for measuring, weighing and photographing. These were at the main station at Bray Park near the mouth of the Boyne River where Infofish staff collected data and at the Gladstone Marina where Gladstone Sportfishing Club volunteers collected data. This year an approximate location (e.g. Boyne River, Gladstone Harbour etc.) where the fish were captured was recorded to determine the geographic distribution of samples. As well as data collected through TMF, length-weights were also recorded manually as a backup. Figure 4 shows a Mangrove Jack presented at the BTHU live weigh-in being measured before being tagged and weighed.

The following were the target species however images were collected from all species recorded.

- Yellowfin Bream (*Acanthopagrus australis*)
- Pikey Bream (*Acanthopagrus berda*)
- Barred Javelin (*Pomadasys kaakan*)
- Dusky Flathead (*Platycephalus fuscus*)
- Barramundi (*Lates calcarifer*)
- Mangrove Jack (*Lutjanus argentimaculatus*)



**Figure 3:** TMF screen to capture fish images and collect details of the fish.



**Figure 4:** Mangrove Jack caught during the BTHU being measured before being tagged and weighed.

Length-weight data used to assess FBC were collected at:

- BTHU (28-30/4/2023) in conjunction with the live weigh-in conducted by the Gladstone Sportfishing Club.

Pikey Bream was reinstated at the live weigh-in allowing sufficient samples of this species to be collected. Images and lengths for Yellowfin and Pikey Bream were collected at the ABT Bream competition however weights were not obtained as that was not required as part of the competition.

Figure 5 shows a Barred Javelin being weighed after being tagged and measured at the BTHU.

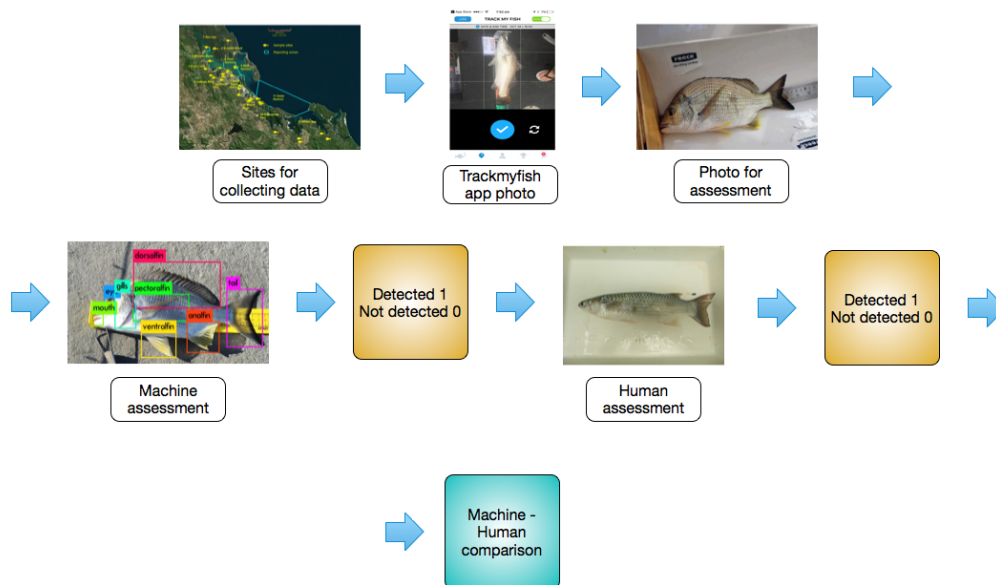


**Figure 5:** Weighing Barred Javelin at the BTHU fishing competition.



## 4.2 VISUAL FISH CONDITION (VFC)

A simplified flow chart for Visual Fish Condition (VFC) is presented in Figure 6 (Sawynok et al 2018a).



**Figure 6:** Simplified flow chart of the process from field collection of data to the comparison of the machine and human assessment for VFC.

VFC was assessed for all samples obtained from the study area as well as samples obtained from Lake Awoonga. For all images the assessment was carried out using the same methods outlined in Sawynok et al. 2020. Both human and machine assessment continue to be used. Microsoft Azure was again used as the machine learning tool as this has been adopted by a number of fisheries agencies including Fisheries Queensland.

The 5 visual condition factors assessed were:

- Fins
- Skin
- Eyes
- Parasites
- Deformities

Table 2 and an overall score was generated for each individual fish with low score reflecting healthier fish. The overall score was then converted to a 0-1 score using the following formula with high VFC scores reflecting healthier fish.

$$VFC = \frac{\text{maximum score} - \text{fish score}}{\text{maximum score}}$$



**Table 2:** Designation and score for the VFC assessed.

Fins		
Variable Condition	Designation	Score
No Active Erosion	0	0
Light Active Erosion	1	10
Moderate Active Erosion with some haemorrhage	2	20
Severe Active Erosion with some haemorrhage	3	30

Skin		
Variable Condition	Designation	Score
Normal no aberrations	0	0
Mild skin aberrations	1	10
Moderate skin aberrations	2	20
Severe skin aberrations	3	30

Eyes		
Variable Condition	Designation	Score
No aberrations	0	0
Opaque/Milky Eye	1	10
Swollen Eye	2	20
Haemorrhaging or bleeding Eye	3	30
Missing Eye	3	30

Parasites		
Variable Condition	Designation	Score
No parasites	0	0
Observed parasites	1	10

Deformities		
Variable Condition	Designation	Score
No deformity	0	0
Observed Deformity	3	30

### 4.3 FISH BODY CONDITION (FBC)

FBC was calculated using Relative Condition Factor (RCF) using the same methods as in previous years (Sawynok S et al. 2020).

Values calculated for the FBC are presented as shown in Table 3. Historic length-weight data collected at the BTHU from 2003-2022 was also used to provide a baseline for FBC.

**Table 3:** Determining RCF scores for Fish Body Condition.

Species	number	Relative Condition Factor score				
		Mean	Median	Min	Max	Std dev
Species 1	value	value	value	value	value	value
Species 2	value	value	value	value	value	value

#### 4.4 INFLUENCE OF RIVER FLOW

To provide some context to the assessment of FC there was a need to examine some environmental conditions. Fish health can be influenced by river flow and rainfall. Skin aberrations are often associated with freshwater flows. While there can be considerable variation in flows and rainfall throughout the study area the following were used as measures of relevant environmental conditions.

Monthly flows recorded at the Castlehope recording station 132001A on the Calliope River were considered indicative of flows in the rivers and creeks in the study area.

The exception is the Boyne River where flows are related to water releases and spilling of Awoonga dam. Spilling has been associated with fish health issues since 2011, particularly in Barramundi in the Boyne River, however there was no spilling during the study period. Data on the dam level were obtained from the GAWB.

#### 4.5 GENERATING SPECIES SCORES AND GRADES

A species FC score was generated for each key species by averaging VFC and FBC as shown in Table 4 and these were averaged to provide a single harbour wide score for fish condition health. Only those species with a VFC and FBC were included in the overall report card score. Cut-off bands and grades are shown in Figure 7.

$$FC = \frac{VFC + FBC}{2}$$

Key species for which there were sufficient data:

- Yellowfin Bream
- Dusky Flathead
- Pikey Bream
- Mangrove Jack
- Barred Javelin
- Barramundi (VFC only)

**Table 4:** Generating scores (average of VFC and FBC) and grades for key species.

Species	Visual Fish Condition (VFC)	Fish Body Condition (FBC)	Fish Condition (FC)	Species Grade
Yellowfin Bream	0 – 1	0 – 1	Score (0 – 1)	Grade (A – E)
Pikey Bream	0 – 1	0 – 1	Score (0 – 1)	Grade (A – E)
Barred Javelin	0 – 1	0 – 1	Score (0 – 1)	Grade (A – E)
Dusky Flathead	0 – 1	0 – 1	Score (0 – 1)	Grade (A – E)
Mangrove Jack	0 – 1	0 – 1	Score (0 – 1)	Grade (A – E)
Barramundi	0 – 1		Score (0 – 1)	Grade (A – E)
All of harbour	0 – 1	0 – 1	Score (0 – 1)	Grade (A – E)

**A** Very good (0.85 – 1.00)

**B** Good (0.65 – 0.84)

**C** Satisfactory (0.50 – 0.64)

**D** Poor (0.25 – 0.49)

**E** Very poor (0.00 – 0.24)

**Figure 7:** The grading scale and the scores used in the GHHP 2023 report card.

#### 4.6 GENERATING HARBOUR SCORES AND GRADES

A harbour-wide FC score was generated by averaging the individual species FC scores for Yellowfin Bream (YB), Pikey Bream (PB), Barred Javelin (BJ), Dusky Flathead (DF) and Mangrove Jack (MJ).

$$\begin{aligned} \text{All of harbour score} \\ = \frac{\text{YB score} + \text{PB score} + \text{BJ score} + \text{DF score} + \text{MJ score}}{5} \end{aligned}$$

#### 4.7 COMPARISON WITH OTHER LOCATIONS

Barramundi stocked in Lake Awoonga are relevant to fish health issues in Gladstone Harbour and are likely to contribute to fish health issues in the future. Fish leave Lake Awoonga when it spills but it has not spilled since 2017. Images were only assessed for VFC as no weights were able to be obtained for Barramundi, hence FBC was unable to be calculated.

Images were obtained from the following:

1. ABT Barramundi Australian Open – September 2022
2. Fishing in Lake Awoonga – July 2022-May 2023

## 5. RESULTS

### 5.1 VISUAL FISH CONDITION (VFC)

VFC was assessed for 929 images collected in the study area with 879 images for the key species and 286 images in Lake Awoonga from July 2022-June 2023. Figure 8 shows the sources of the images while Figure 9 shows the timeframe in which the images were collected.

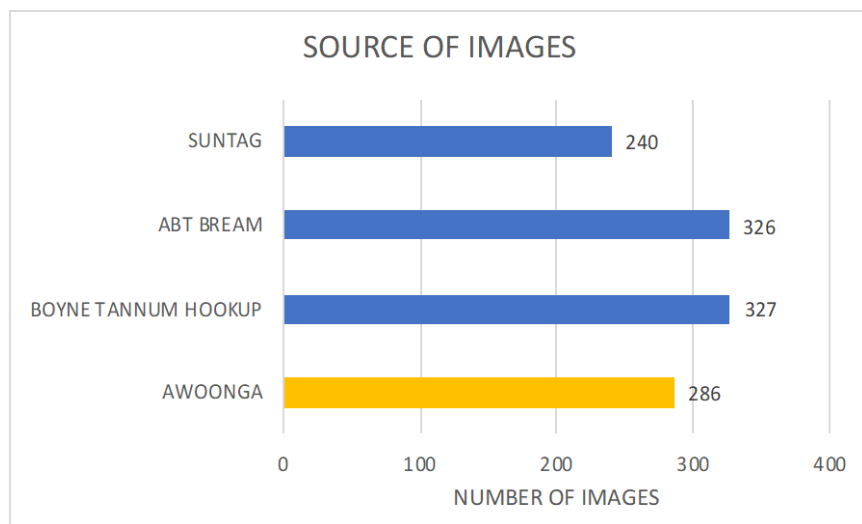


Figure 8: Sources of images for assessing Visual Fish Condition (VFC).

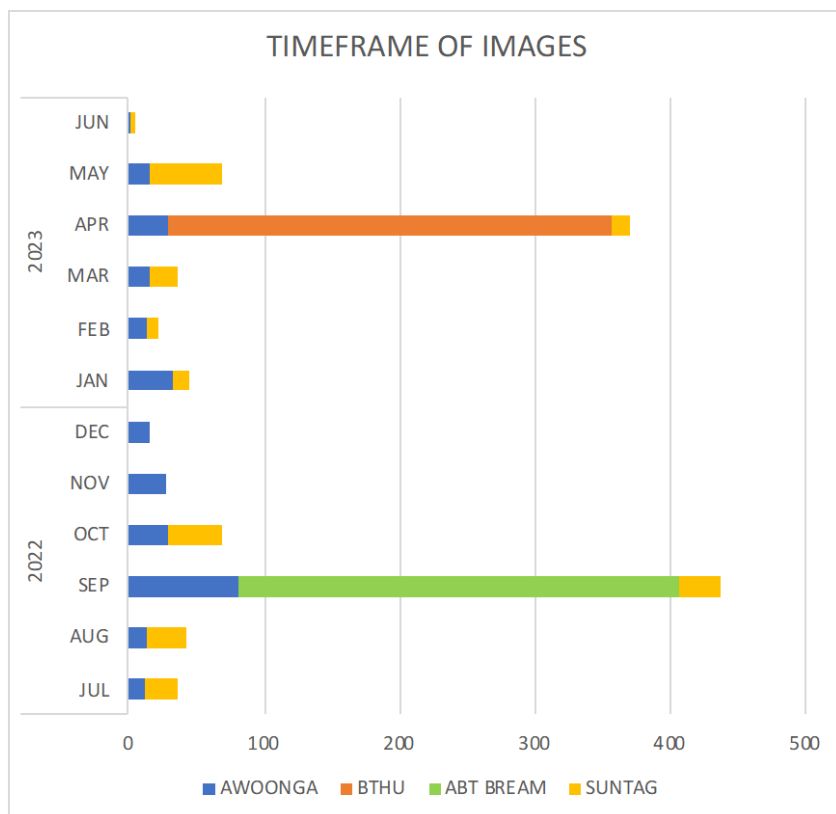
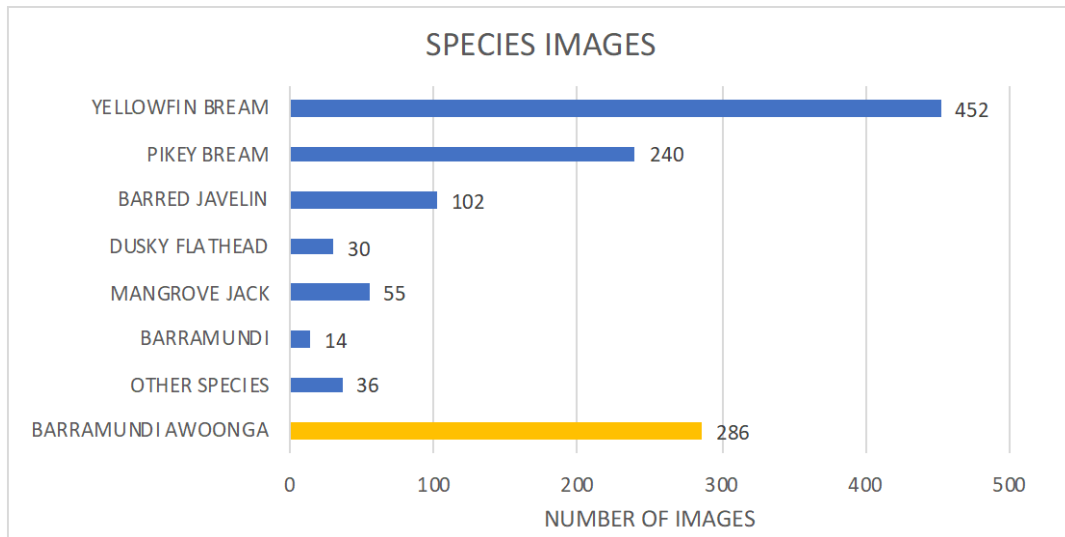
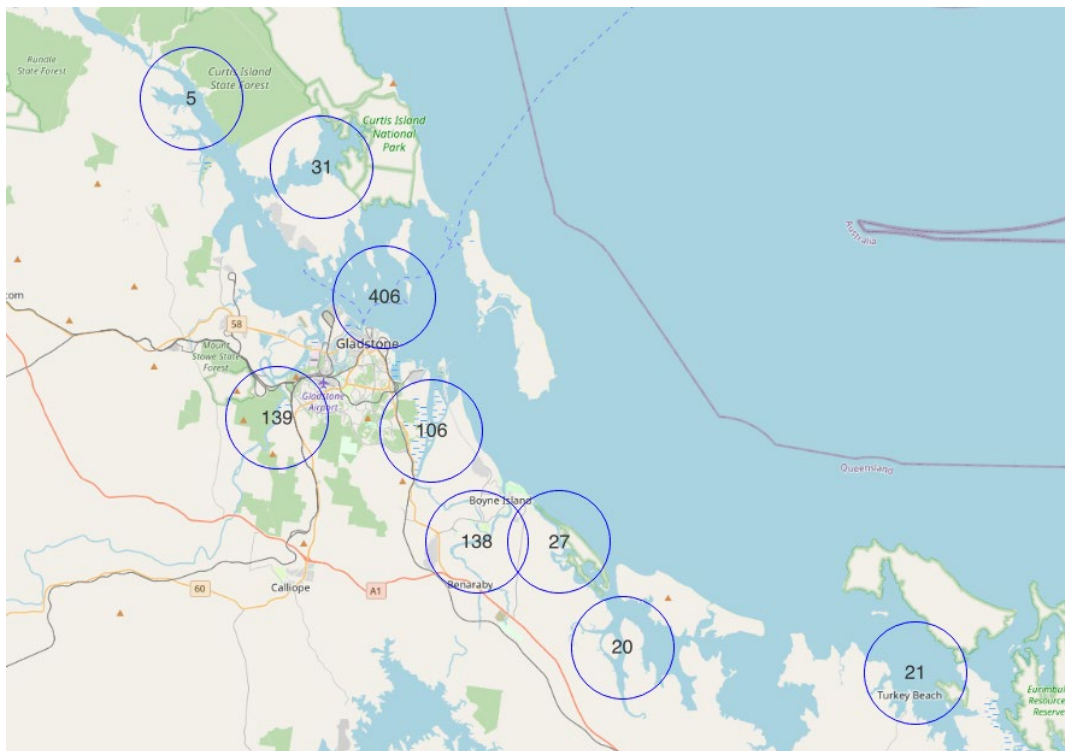


Figure 9: Timeframe for when images were obtained in 2022-2023.



**Figure 10:** Number of images for each of the key species.



**Figure 11:** Number of images of key species obtained at locations.

Figure 10 shows the number of images collected for each species and Figure 11 shows the general area from where the images were obtained for the key species. There was a total of 879 images for the key species in the study area. VFC condition was not assessed for Barramundi as there were insufficient images (14) obtained in the study area. However, there were 286 Barramundi images obtained from Lake Awoonga that were used for comparison.



VFC was assessed based on images of the key species using human and machine assessments for each condition and the overall result was close to 100% agreement between the 2 methods.

Table 5 and Table 6 provide the severity of detection for fins and skin damage for the key species. The level of severity was mostly light active erosion for fins and mild skin aberrations for skin. There were low detections for eyes (less than 1%), and none for parasites or deformities.

**Table 5:** Severity score of variable fins condition for key species (eg YB = Yellowfin Bream) and the number of observations.

Fins	Score	YB	PB	BJ	DF	MJ	B
No Active Erosion	0	135	77	69	19	28	11
Light Active Erosion	10	297	158	32	10	27	3
Moderate Active Erosion with some haemorrhage	20	20	4	1	1	0	0
Severe Active Erosion with some haemorrhage	30	0	1	0	0	0	0

**Table 6:** Severity score of variable skin conditions for key species (eg YB = Yellowfin Bream) and the number of observations.

Skin	Score	YB	PB	BJ	DF	MJ	B
Normal no aberrations	0	451	240	102	30	55	14
Mild skin aberrations	10	1	0	0	0	0	0
Moderate skin aberrations	20	0	0	0	0	0	0
Severe skin aberrations	30	0	0	0	0	0	0

Table 7 shows the number of observations of VFC issues in images of the key species. Fin damage was the most detected issue across for all species at 62% however was highest in Yellowfin Bream (70%), Pikey Bream (68%) and Barramundi (62%). It was lowest for Barred Javelin (32%).

Apart from fin damage all other conditions were observed at a low level (less than 1%) across all species. Skin damage was only observed in 1 Yellowfin Bream image. There was 1 instance of an eye issue in a Yellowfin Bream. There were no detections recorded for parasites or deformities.

**Table 7:** Observation of VFC issues in key species in 2022-23.

Species	Images	Fins	Skin	Eyes	Parasites	Deformities	GHHP score
Yellowfin Bream	452	317 (70%)	1 (0.2%)	1 (0.2%)	0	0	0.97
Pikey Bream	240	163 (68%)	0	0	0	0	0.97
Barred Javelin	102	33 (32%)	0	0	0	0	0.96
Dusky Flathead	30	11 (37%)	0	0	0	0	0.94
Mangrove Jack	55	27 (49%)	0	0	0	0	0.95
Barramundi	14	3 (21%)	0	0	0	0	NA
All species	929	556 (60%)	1 (0.1%)	1 (0.1%)	0	0	

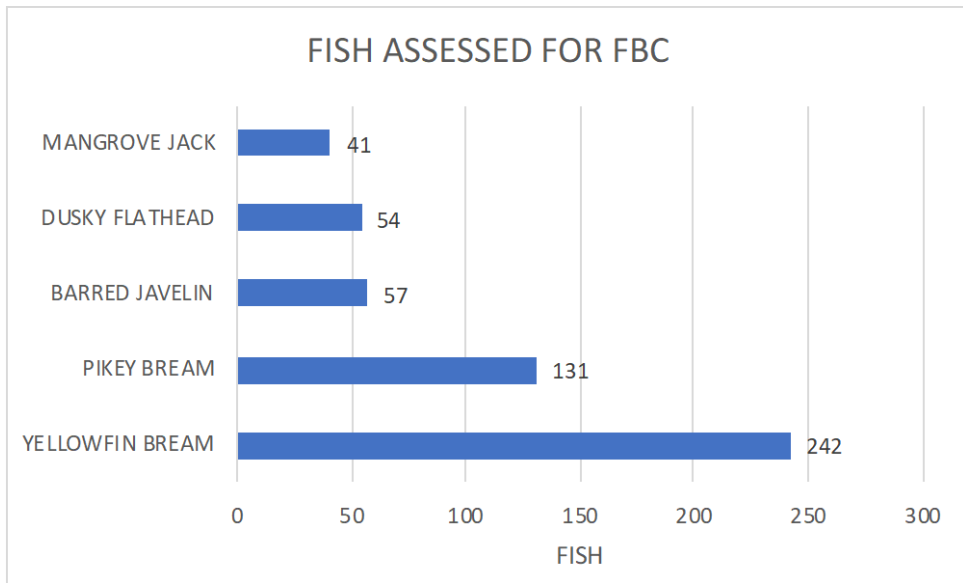
## 5.2 FISH BODY CONDITION (FBC)

FBC was assessed using Relative Condition Factor (RCF) as used in previous years (Sawynok S et al 2020). There was a total of 525 fish of 5 of the target species where length and weight were recorded at the BTHU. Table 8 and Figure 12 show the numbers of fish caught during the BTHU competition where length and weight were recorded at the live weigh-in. Figure 13 shows how many samples were obtained from each location.

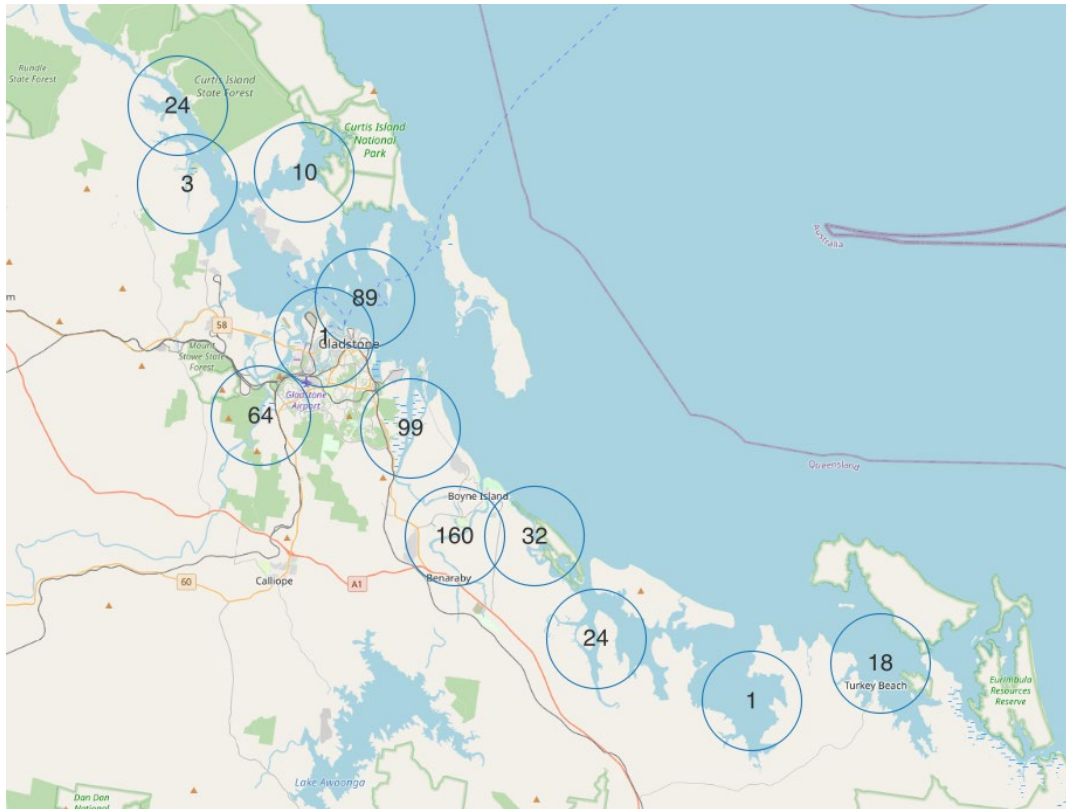
For each of the key species, historic data recorded during the BTHU competition from 2003-2023 were used to generate the length-weight curve of best fit and subsequently to generate the parameters for each of the key species. Figure 14 shows the length-weight scatterplot for each of the key species showing the difference in length-weight.

**Table 8:** Numbers of fish where length-weight were recorded at the BTHU competition.

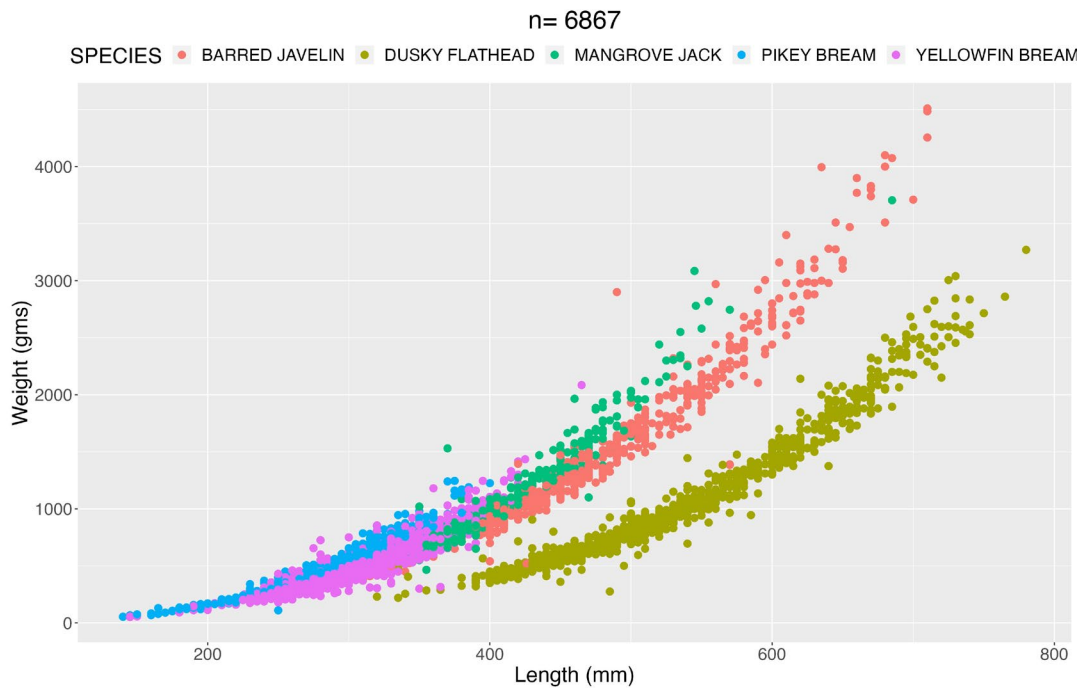
SPECIES	BTHU
Yellowfin Bream	242
Pikey Bream	131
Barred Javelin	57
Dusky Flathead	54
Mangrove Jack	41
Total	525



**Figure 12:** Numbers of fish where length-weight was recorded at the BTHU competition.



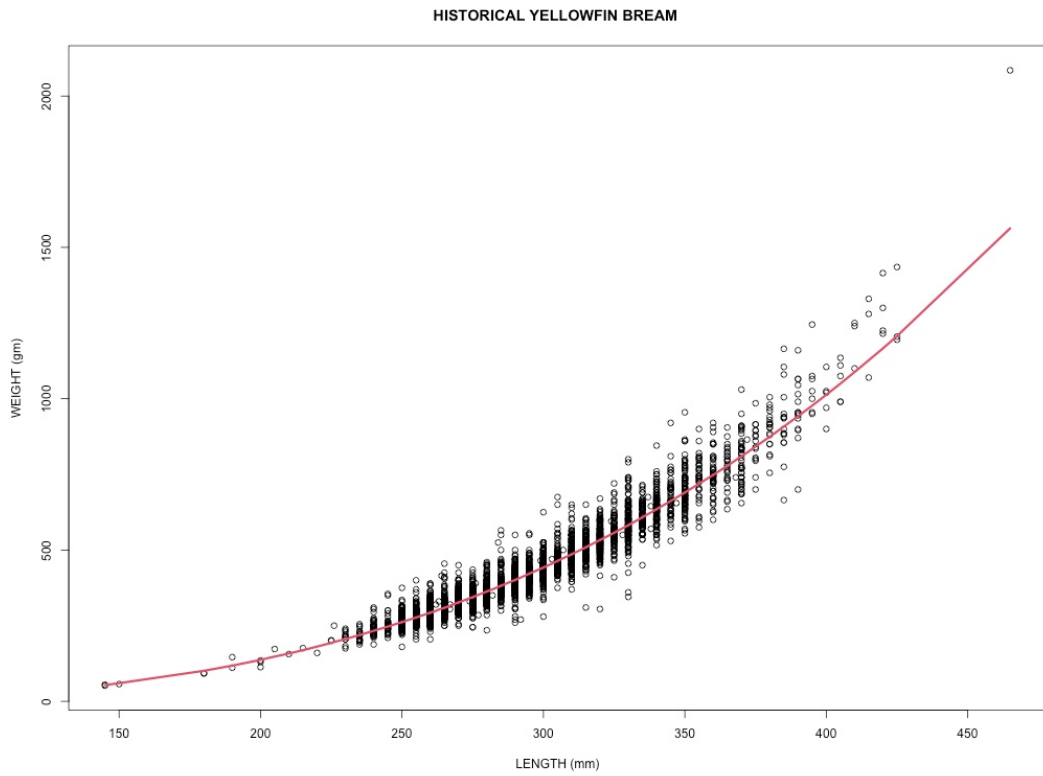
**Figure 13:** Number of samples at locations where length-weight was obtained at the BTHU competition.



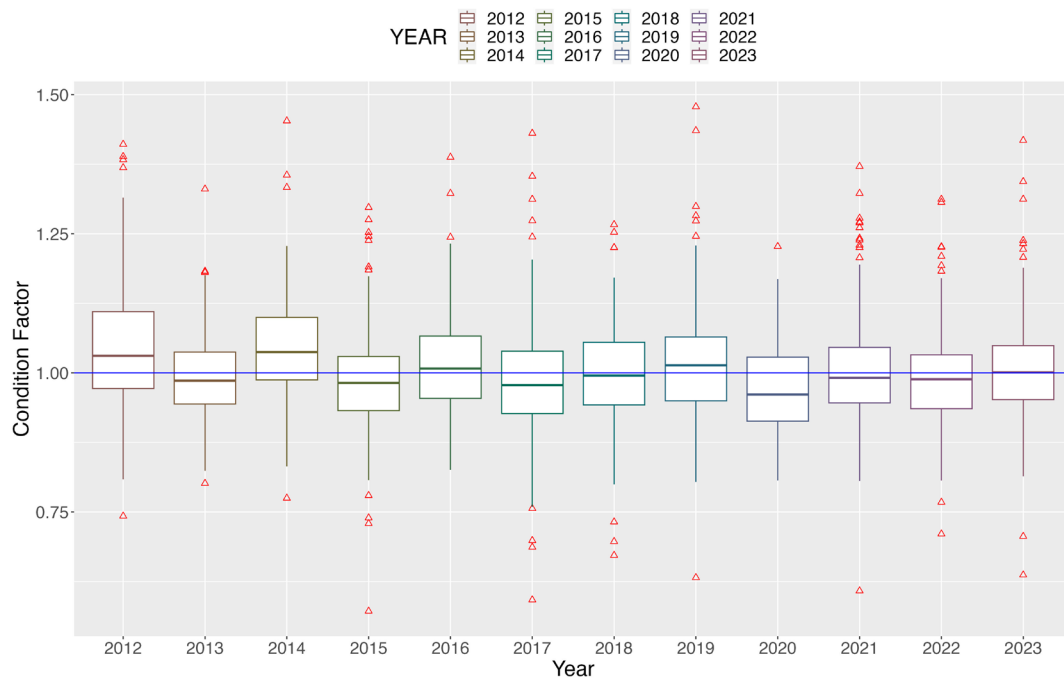
**Figure 14:** Length-weight data for the key species using the historic data from the BTHU from 2003-2023.

The historic length-weight data were plotted separately for each species and FBC was recalculated using RCF for all years. For each year, box plots show the distribution of FBC including the median, RCF, 25<sup>th</sup> and 75<sup>th</sup> percentiles, range and outliers. Note that  $FBC=RCF=1$  means average condition and is indicated in each plot.

Figures 15, 17, 19, 21 and 23 show the length-weight plots for the 5 key species using historic data from the BTHU from 2003-2023 while Figures 16, 18, 20, 22 and 24 show the plots of FBC for each year from 2012-2023.

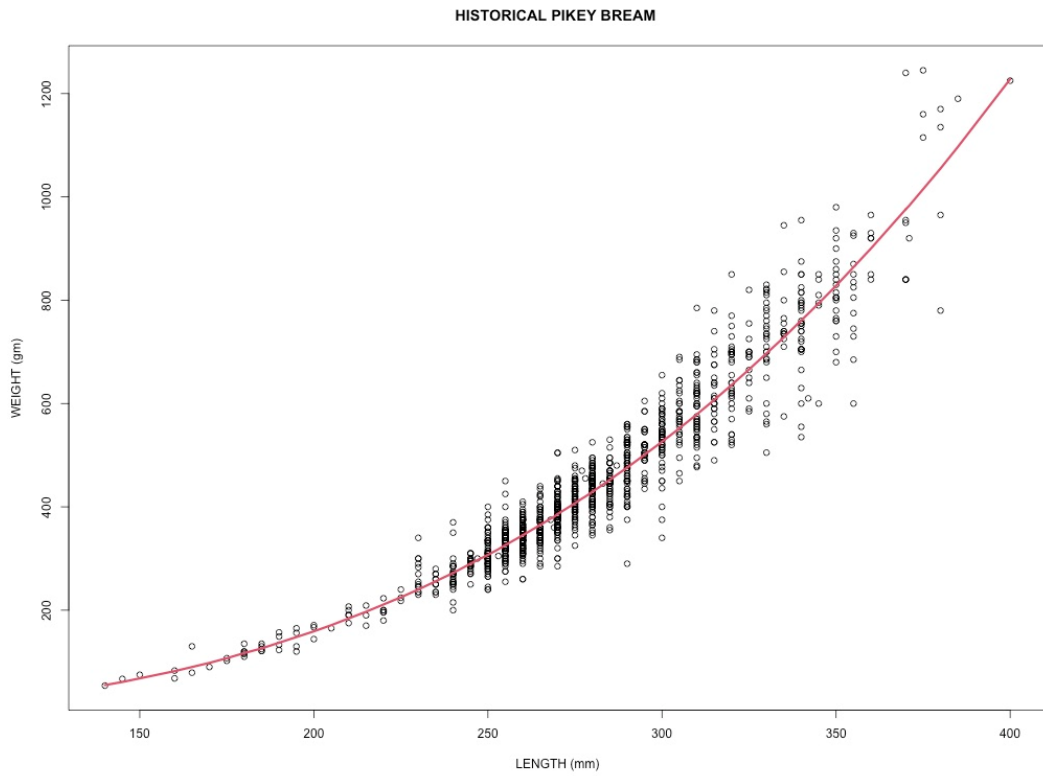


**Figure 15:** Length-weight plot for Yellowfin Bream using data from the BTHU from 2003-2023.

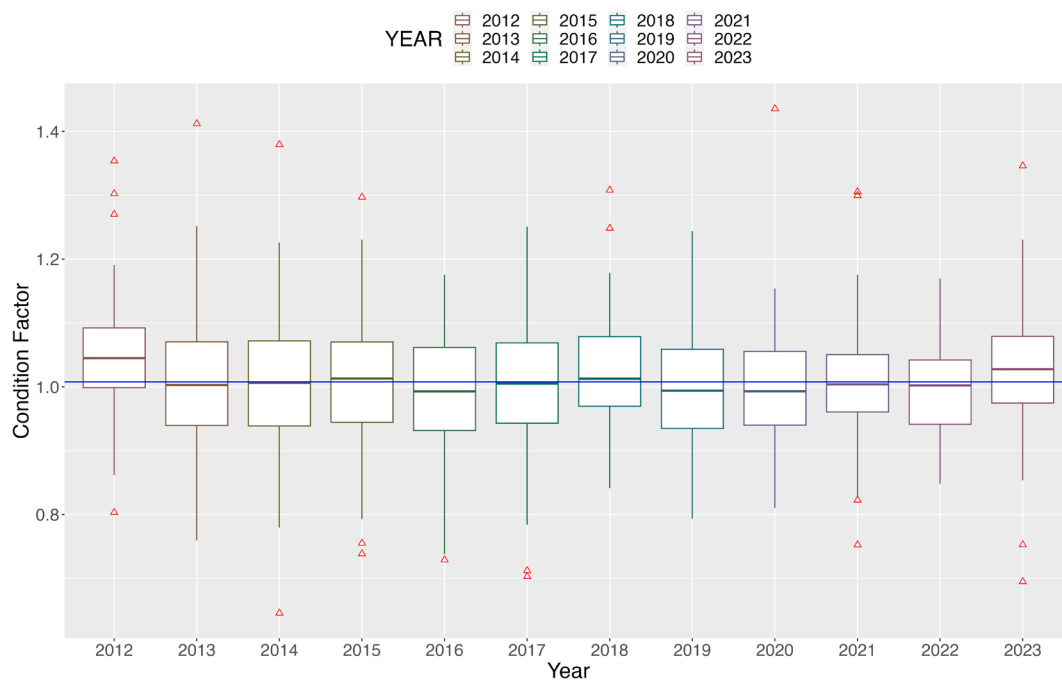


**Figure 16:** Plot of FBC for Yellowfin Bream from 2012-2023.

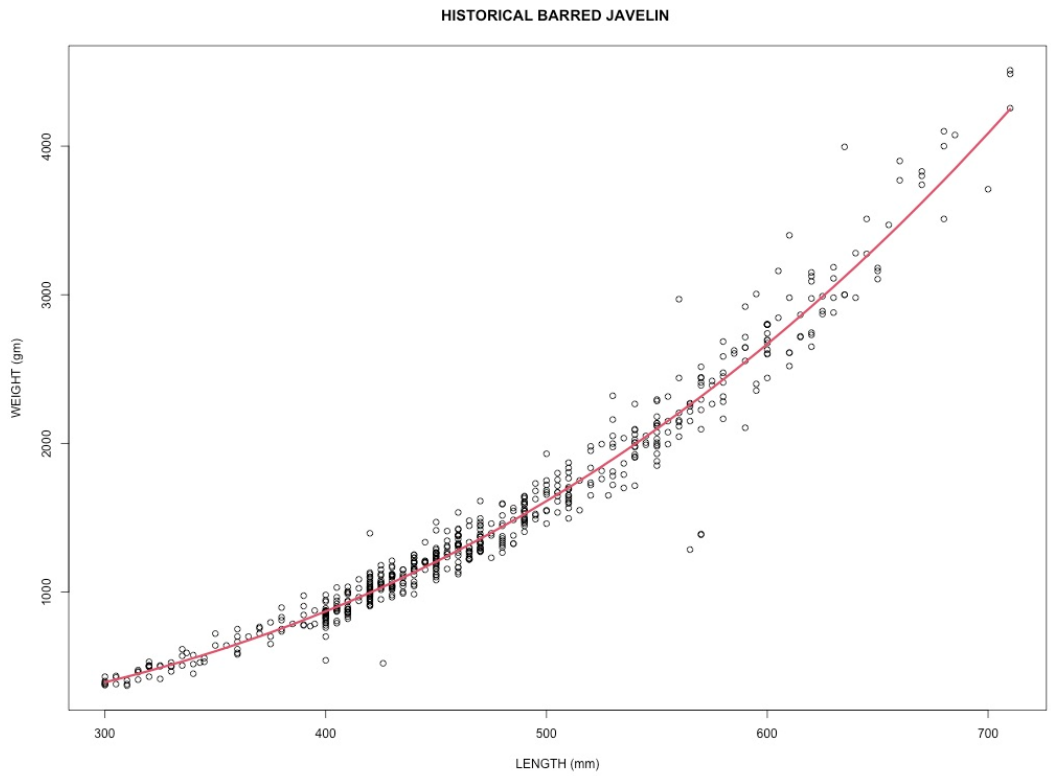




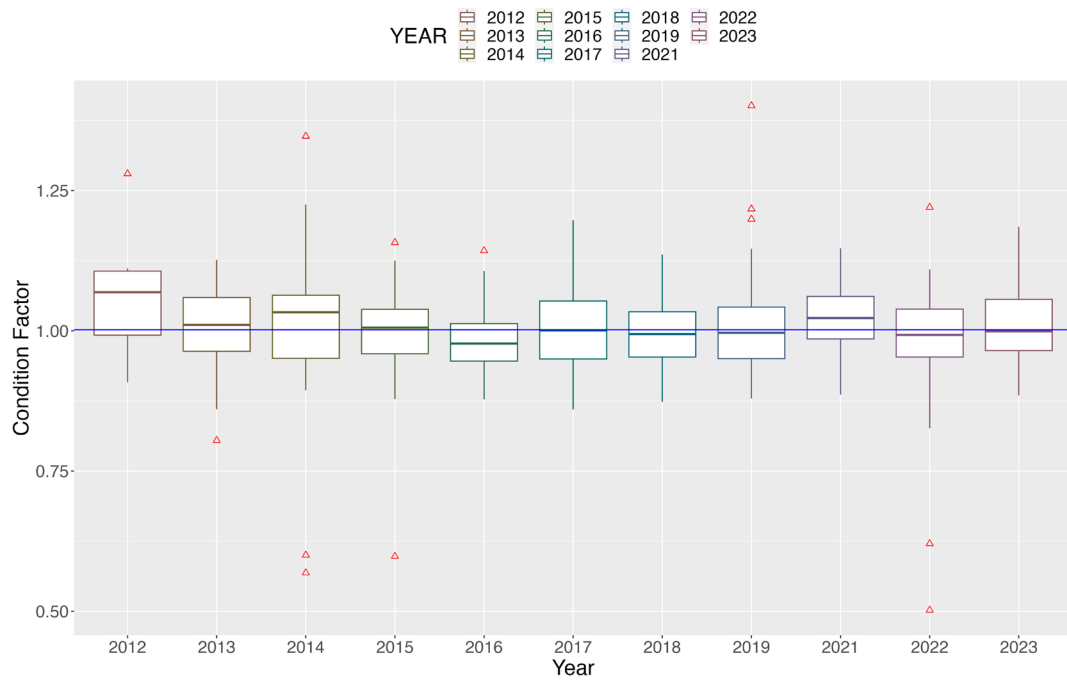
**Figure 17:** Length-weight plot for Pikey Bream using data from the BTHU from 2003-2023.



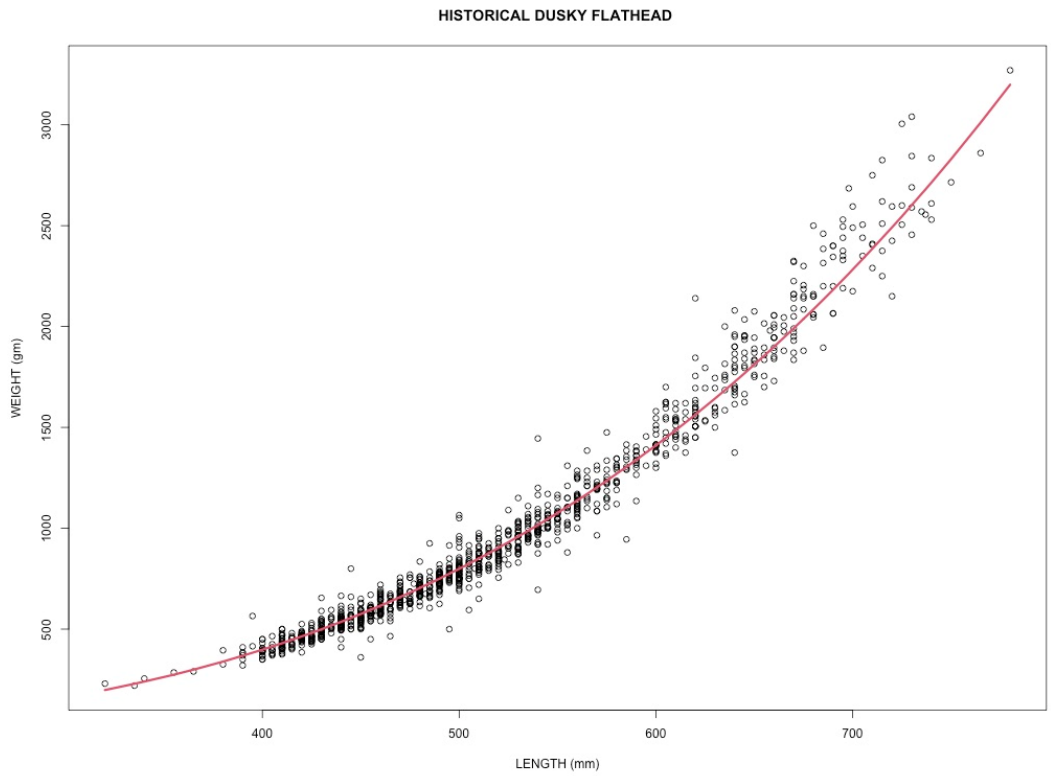
**Figure 18:** Plot of FBC for Pikey Bream from 2012-2023.



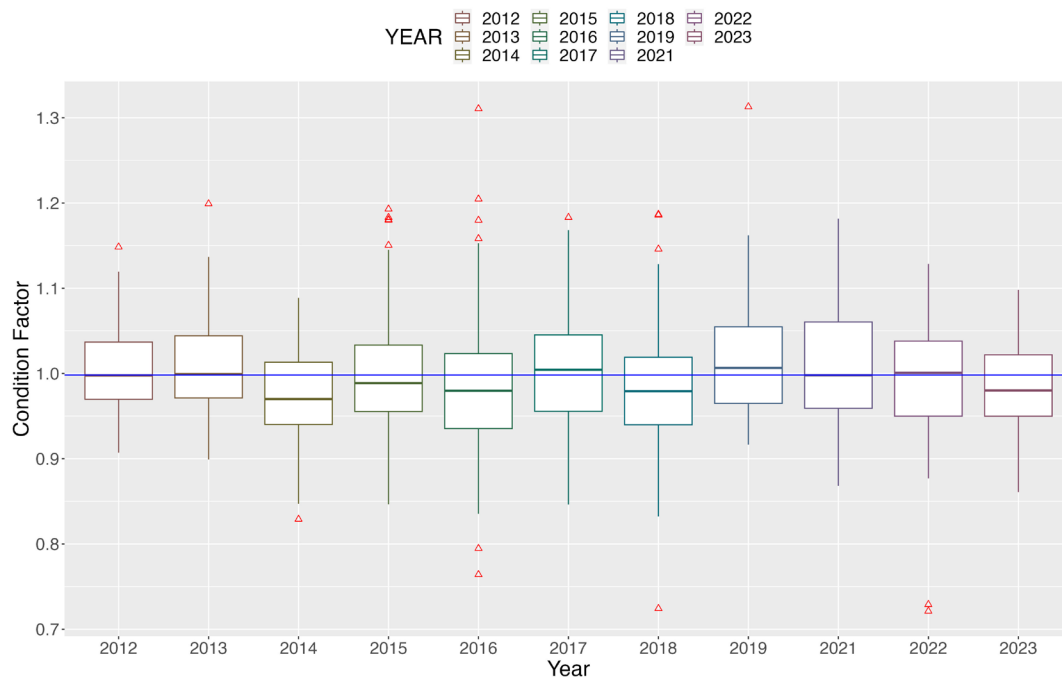
**Figure 19:** Length-weight plot for Barred Javelin using data from the BTHU from 2003-2023.



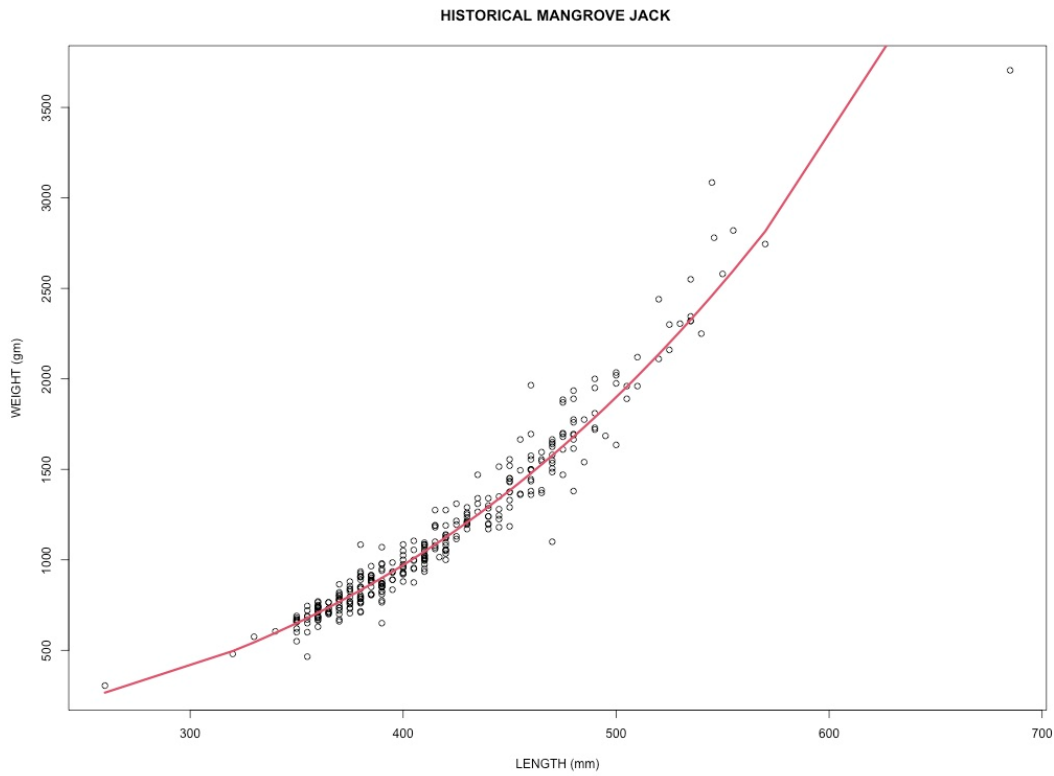
**Figure 20:** Plot of FBC for Barred Javelin from 2012-2023.



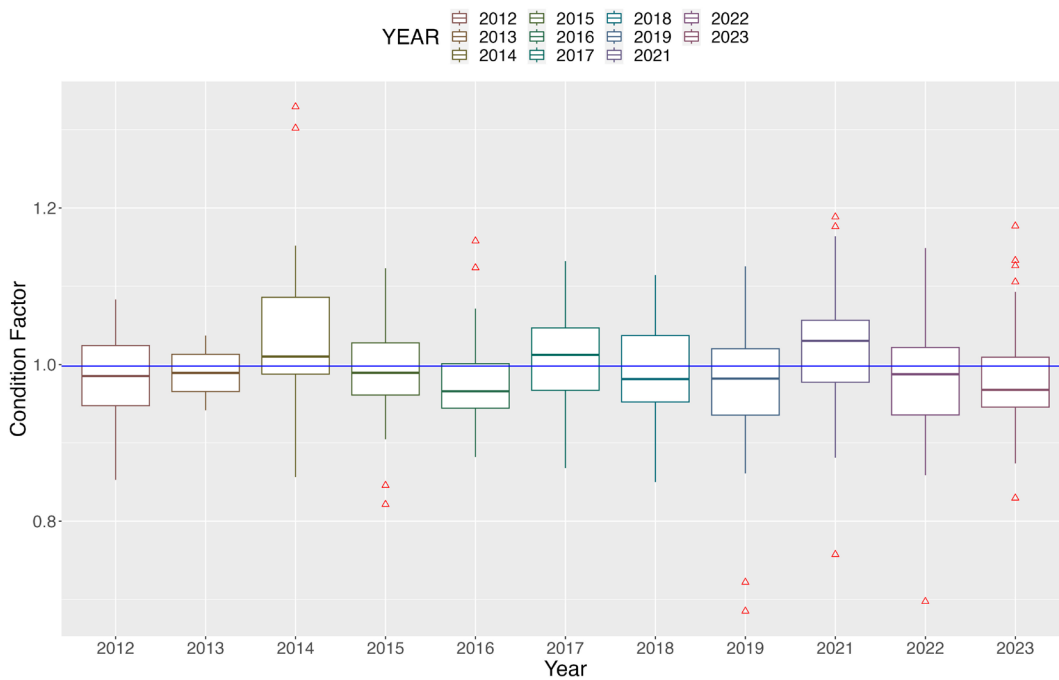
**Figure 21:** Length-weight plot for Dusky Flathead using data from the BTHU from 2003-2023.



**Figure 22:** Plot of FBC for Dusky Flathead from 2012-2023.



**Figure 23:** Length-weight plot for Mangrove Jack using data from the BTHU from 2003-2023.



**Figure 24:** Plot of FBC for Mangrove Jack from 2012-2023.

Table 9 shows the FBC values calculated for the key species using the historic data from the BTHU from 2003-2023 where a and b are parameters in the model, while  $R^2$  is a measure (between 0 and 100%) of how well the model fits the data. Table 10 show the mean, median, minimum and maximum FBC from the historic data

from 2003-2023. Table 11 shows the values calculated for 2023 and Table 12 shows the values converted to FBC scores for 2023.

**Table 9:** FBC values for the key species using the historic data from the BTHU from 2003-2023.

SPECIES	Number Samples	a	b	R <sup>2</sup>
Yellowfin Bream	3736	3.28E-05	2.878	0.921
Pikey Bream	1157	2.68E-05	2.944	0.934
Barred Javelin	568	5.59E-05	2.764	0.967
Dusky Flathead	1084	3.08E-06	3.117	0.961
Mangrove Jack	322	1.48E-05	3.005	0.939

**Table 10:** Mean, median, minimum and maximum condition factors for the key species from the historic data from the BTHU for 2003-2023.

SPECIES	Mean Condition	Median Condition	Minimum Condition	Maximum Condition
Yellowfin Bream	1.004	0.996	0.571	1.478
Pikey Bream	1.006	1.005	0.608	1.436
Barred Javelin	1.003	1.003	0.568	1.398
Dusky Flathead	1.000	0.993	0.625	1.471
Mangrove Jack	1.002	0.999	0.686	1.326

**Table 11:** Mean, median, minimum and maximum condition factors and standard deviation for the key species in 2023.

Species	Sample size	Mean Condition	Median Condition	Minimum Condition	Maximum Condition	Standard deviation condition
Yellowfin Bream	242	1.005	1.000	0.636	1.417	0.091
Pikey Bream	131	1.028	1.027	0.695	1.346	0.086
Barred Javelin	57	1.013	0.999	0.883	1.183	0.067
Dusky Flathead	54	0.984	0.980	0.860	1.097	0.059
Mangrove Jack	41	0.981	0.967	0.828	1.175	0.071

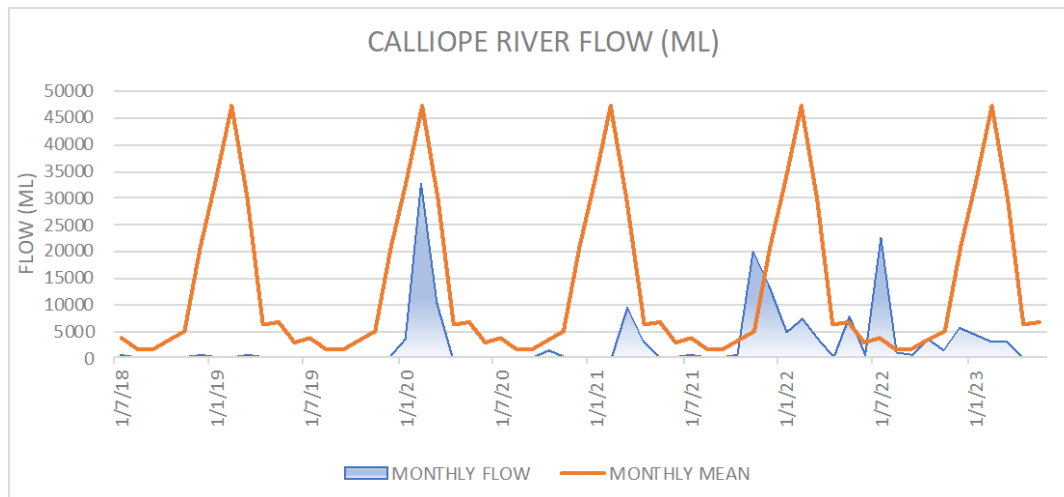
**Table 12:** Mean, median FBC scores and standard deviation for the key species in 2023.

Species	Mean Score	Median Score	Standard Deviation Score
Yellowfin Bream	0.48	0.47	0.10
Pikey Bream	0.51	0.51	0.10
Barred Javelin	0.54	0.52	0.08
Dusky Flathead	0.42	0.42	0.07
Mangrove Jack	0.46	0.44	0.11

### 5.3 CALLIOPE RIVER FLOWS AND LAKE AWOONGA LEVELS

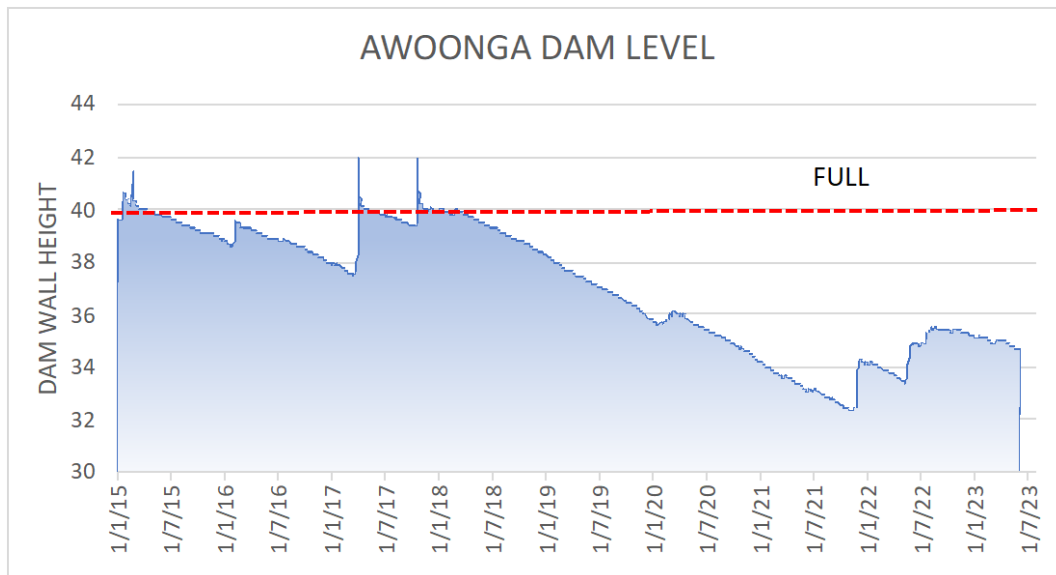
Figure 25 shows the monthly flow and the mean monthly flow in the Calliope River at Castlehope from 1 July 2018 – 31 May 2023. There was very little flow in the river in 2019, with below average flows during the 2020 wet season and moderate flows in February and March. There was no flow in either January or February 2021 and a low flow in March. The highest flow in 2021 was 20,154ML in November prior to the wet season. There were flows from December 2021 to March 2023 however there were low flows during the 2023 wet season. Since 2019 monthly wet season flows have mostly been well below mean monthly flows with only 2020 having a reasonable wet season flow.

Figure 26 shows the Awoonga lake level at the dam wall. There has not been any spilling of the dam since November 2017. There was an increase in the lake level in 2022 and 2023 however it is still below full level.



**Figure 25:** Calliope River flows and mean monthly flows (ML) July 2018 – May 2023.





**Figure 26:** Awoonga lake levels and dam wall height (40m).

## 5.4 SPECIES SCORES AND GHHP GRADES

Table 13 shows the VFC and FBC scores and the averaged FC scores for the 6 key species, the species score on a 0-1 scale and the corresponding GHHP grade. There was no VFC score for Barramundi as there were insufficient images. The GHHP grade for all key species and all of harbour was B.

**Table 13:** GHHP scores and grades for the 6 key species (figures in brackets are sample size) for the 2023 report card.

Species	Visual Fish Condition (VFC)	Fish Body Condition (FBC)	Fish Condition (FC)	GHHP Species Grade
Yellowfin Bream	0.97 (452)	0.48 (242)	0.73	B
Pikey Bream	0.97 (240)	0.51 (131)	0.74	B
Barred Javelin	0.97 (102)	0.54 (57)	0.72	B
Dusky Flathead	0.97 (30)	0.42 (54)	0.70	B
Mangrove Jack	0.96 (55)	0.46 (41)	0.72	B
Barramundi (VFC only)	NA (14)	NA (0)	NA	NA
All of harbour	0.97	0.48	0.72	B

## 5.5 VFC COMPARISON BY LOCATION

While there were low numbers of Barramundi images recorded in the study area there were good numbers recorded in Lake Awoonga. These provide an assessment of VFC that is relevant as when the dams spill the fish enter the study area.

There were 286 images of Barramundi that were assessed for VFC for fish caught in Lake Awoonga. Table 14 shows the number of severity scores for fins while there were no detections made in relation to skin, eyes, parasites or deformities.

Table 15 shows the mean, median, minimum and maximum values for VFC for fish in both impoundments while Table 16 shows the GHHP grade.

**Table 14:** Severity score of variable fins condition for Barramundi in Lake Awoonga with the number of detections.

Fins	Score	B
No Active Erosion	0	134
Light Active Erosion	10	151
Moderate Active Erosion with some haemorrhage	20	0
Severe Active Erosion with some haemorrhage	30	1

**Table 15:** VFC results for Barramundi in Lake Awoonga

Species	Sample size	Mean Condition	Median Condition	Minimum Condition	Maximum Condition	Standard deviation condition
Barramundi	286	0.91	0.83	0.5	1.000	0.087

**Table 16:** GHHP scores and grades for Barramundi in Lake Awoonga (figure in brackets is sample size).

Species	Visual Fish Condition (VFC)	Fish Body Condition (FBC)	Fish Condition (FC)	GHHP Species Grade
Barramundi	0.91 (286)	NA	0.91 (VFC only)	<b>A</b>

## 6. DISCUSSION

This year the number of images for the key species exceeded the targets except for Barramundi. With poor recruitment in the last few years and no addition to stocks from fish spilling from Lake Awoonga there has been a decline in the Barramundi population in Gladstone Harbour, and it was expected that reaching the target number of images would be difficult.

Lake Awoonga is regularly stocked with Barramundi and fish enter the study area when it spills. Lake Awoonga has not spilled since November 2017 so has not “topped up” stocks in the Boyne River and Gladstone Harbour. Lake Callemondah is also regularly stocked with Barramundi. Barramundi are regularly tagged in Lake Callemondah however none have been recorded as being recaptured below the dam for a number of years (Suntag 2023 unpublished) suggesting a low level of fish leaving the lake.

Length-weight data were able to be obtained for the key species at the BTHU except for Barramundi. Fortunately, the BTHU committee decided to reinstate Pikey Bream in the live weigh-in categories which increased the data available for that species.

The overall grade for Gladstone Harbour was B (0.72) with all species receiving a B grade. VFC scores were high ranging from 0.96-0.97 for the key species and an All of Harbour score of 0.97. The only VFC issue was in relation to fins. Fish handling and the use of inappropriate landing nets and containers for transporting the fish to the live weigh-ins are likely to have contributed to the moderate to high level of fin issues although most issues were classified as light.

As in the last few years for VFC the incidence of issues with eyes, parasites and deformities has been very low and likely to be within the expected range for a normal population.

From November 2022 to February 2023 there were moderate flows in the Calliope River although flows from December-March in each year were well below the long-term mean. These conditions were likely to have improved food supply as indicated by the second highest numbers of prawns recorded during recruitment surveys in the last 8 years (Sawynok B and Sawynok S 2023). There were no flows in the Boyne River as there was insufficient rainfall for Lake Awoonga to spill and it hasn't spilled since 2017.

FBC was equal to or better than the benchmark for Yellowfin Bream, Pikey Bream and Barred Javelin while it was less than the benchmark for Dusky Flathead and Mangrove Jack.

## 7. REFERENCES

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8. Sawynok B and Sawynok S, Infofish Australia Pty Ltd (2023), Fish recruitment indicators for the Gladstone Harbour Report Card using data derived from castnet sampling 2023, Gladstone Healthy Harbour Partnership, Gladstone, Queensland

## APPENDIX 1: VISUAL FISH CONDITION OBSERVATIONS AT GLADSTONE

**Table 17:** VFC detections for all species at Gladstone 2022-23.

Species	Fins	Skin	Eyes	Parasites	Deformities	Images
Barcheek Coral Trout	0	0	0	0	0	1
<b>Barramundi</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>14</b>
<b>Barred Javelin</b>	<b>33</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>83</b>
Blackspotted Rockcod	0	0	0	0	0	10
Blue Threadfin	0	0	0	0	0	1
<b>Dusky Flathead</b>	<b>11</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>30</b>
Golden Snapper	0	0	0	0	0	6
Goldspotted Rockcod	1	0	0	0	0	13
<b>Mangrove Jack</b>	<b>27</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>55</b>
<b>Pikey Bream</b>	<b>163</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>240</b>
Speckled Javelin	0	0	0	0	0	1
<b>Yellowfin Bream</b>	<b>317</b>	<b>1</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>452</b>
All species	556	1	1	0	1	929
Percentage	60%	0.1%	0.1%	0	0.1%	
Species	Fins	Skin	Eyes	Parasites	Deformities	Images
<b>Barramundi (Awoonga)</b>	<b>152</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>286</b>
Percentage	53%	0	0	0	0	