Marine Science 2019 v1.3

IA3 high-level annotated sample response

October 2022

Research investigation (20%)

This sample has been compiled by the QCAA to assist and support teachers to match evidence in student responses to the characteristics described in the instrument-specific marking guide (ISMG).

The following sample is an unedited authentic student response produced with permission. Any identifying features have been redacted from the response. It may contain errors and/or omissions that do not affect its overall match to the characteristics indicated.

Assessment objectives

This assessment instrument is used to determine student achievement in the following objectives:

2. apply understanding of oceans of the future or managing fisheries to develop research questions
3. analyse research evidence about oceans of the future or managing fisheries
4. interpret research evidence about oceans of the future or managing fisheries
5. investigate phenomena associated with oceans of the future or managing fisheries through research
6. evaluate research processes, claims and conclusions about oceans of the future or managing fisheries
7. communicate understandings and research findings, arguments and conclusions about oceans of the future or managing fisheries.

Note: Objective 1 is not assessed in this instrument.

Queensland Government
Queensland Curriculum & Assessment Authority
221328

Instrument-specific marking guide (ISMG)

Criterion: Research and planning

Assessment objectives

2. apply understanding of oceans of the future or managing fisheries to develop research questions
5. investigate phenomena associated with oceans of the future or managing fisheries through research

The student work has the following characteristics:	Marks
• informed application of understanding of oceans of the future or managing fisheries demonstrated by a considered rationale identifying clear development of the research question from the claim • effective and efficient investigation of phenomena associated with oceans of the future or managing fisheries demonstrated by – a specific and relevant research question – selection of sufficient and relevant sources.	5–6
• adequate application of understanding of oceans of the future or managing fisheries demonstrated by a reasonable rationale that links the research question and the claim • effective investigation of phenomena associated with oceans of the future or managing fisheries demonstrated by – a relevant research question – selection of relevant sources.	3–4
• rudimentary application of understanding of oceans of the future or managing fisheries demonstrated by a vague or irrelevant rationale for the investigation • ineffective investigation of phenomena associated with oceans of the future or managing fisheries demonstrated by – an inappropriate research question – selection of insufficient and irrelevant sources.	1–2
• does not satisfy any of the descriptors above.	0

Criterion: Analysis and interpretation

Assessment objectives

3. analyse research evidence about oceans of the future or managing fisheries
4. interpret research evidence about oceans of the future or managing fisheries

The student work has the following characteristics:	Marks
• systematic and effective analysis of qualitative data and/or quantitative data within the sources about oceans of the future or managing fisheries demonstrated by – the identification of sufficient and relevant evidence – thorough identification of relevant trends, patterns or relationships – thorough and appropriate identification of limitations of evidence • insightful interpretation of research evidence about oceans of the future or managing fisheries demonstrated by justified scientific argument/s.	5–6
• effective analysis of qualitative data and/or quantitative data within the sources about oceans of the future or managing fisheries demonstrated by – the identification of relevant evidence – identification of obvious trends, patterns or relationships – basic identification of limitations of evidence • adequate interpretation of research evidence about oceans of the future or managing fisheries demonstrated by reasonable scientific argument/s.	3–4
• rudimentary analysis of qualitative data and/or quantitative data within the sources about oceans of the future or managing fisheries demonstrated by – the identification of insufficient and irrelevant evidence – identification of incorrect or irrelevant trends, patterns or relationships – incorrect or insufficient identification of limitations of evidence • invalid interpretation of research evidence oceans of the future or managing fisheries demonstrated by inappropriate or irrelevant argument/s.	1–2
• does not satisfy any of the descriptors above.	0

Criterion: Conclusion and evaluation

Assessment objectives

4. interpret research evidence about oceans of the future or managing fisheries
6. evaluate research processes, claims and conclusions about oceans of the future or managing fisheries

The student work has the following characteristics:	Marks
• insightful interpretation of research evidence about oceans of the future or managing fisheries demonstrated by justified conclusion/s linked to the research question • critical evaluation of the research processes, claims and conclusions about oceans of the future or managing fisheries demonstrated by – insightful discussion of the quality of evidence – extrapolation of credible findings of the research to the claim – suggested improvements and extensions to the investigation that are considered and relevant to the claim.	5–6
• adequate interpretation of research evidence oceans of the future or managing fisheries demonstrated by reasonable conclusion/s relevant to the research question • basic evaluation of the research processes, claims and conclusions about oceans of the future or managing fisheries demonstrated by – reasonable description of the quality of evidence – application of relevant findings of the research to the claim – suggested improvements and extensions to the investigation that are relevant to the claim.	3–4
• invalid interpretation of research evidence oceans of the future or managing fisheries demonstrated by inappropriate or irrelevant conclusion/s • superficial evaluation of the research processes, claims and conclusions about oceans of the future or managing fisheries demonstrated by – cursory or simplistic statements about the quality of evidence – -application of insufficient or inappropriate findings of the research to the claim – -ineffective or irrelevant suggestions	1–2
• does not satisfy any of the descriptors above.	0

Criterion: Communication

Assessment objectives

7. communicate understandings and research findings, arguments and conclusions about oceans of the future or managing fisheries.

The student work has the following characteristics:	Marks
• effective communication of understandings and research findings, arguments and conclusions about oceans of the future or managing fisheries demonstrated by – fluent and concise use of scientific language and representations – appropriate use of genre conventions – acknowledgement of sources of information through appropriate use of referencing conventions	2
• adequate communication of understandings and research findings, arguments and conclusions about oceans of the future or managing fisheries demonstrated by – competent use of scientific language and representations – use of basic genre conventions – use of basic referencing conventions	1
• does not satisfy any of the descriptors above.	0

Task

See IA3 sample assessment instrument: Research investigation (20%) (available on the QCAA Portal).

Note: Students, in consultation with their teacher, may identify an alternative claim to investigate other than those listed in the assessment. This claim must be related to Unit 4 subject matter.

This student response investigates the alternative claim: Zoning plans are integral to fishery management.

Sample response

Criterion	Marks allocated	Provisional marks
Research and planning Assessment objectives 2, 5	6	6
Analysis and interpretation Assessment objectives 3, 4	6	6
Conclusion and evaluation Assessment objectives 4, 6	6	6
Communication Assessment objective 7	2	2
Total	**20**	**20**

The annotations show the match to the instrument-specific marking guide (ISMG) performance-level descriptors.

.	# The effects of NTMR on *Plectropomus leopardus* biomass ## Claim Zoning plans are integral to fishery management ## Rationale To maintain a healthy coral reef ecosystem, a high abundance and diversity of predatory fish species are required to stabilise the food chain (Studies, 2015). However overexploitation from both commercial and recreational fishing have led to a loss of diversity.
Research and planning [5–6] **A considered rationale for the experiment** The rationale shows evidence of careful, deliberate thought. The sequence of ideas involved in the development of the research question from the claim is easily seen.	In 2003, action was taken to “better protect the range of biodiversity in the Great Barrier Reef”, the GBRMPA introduced the ‘Great Barrier Reef Marine Park Zoning Plan’, which implemented specific zones across the reef such as ‘No Take Marine Reserves’ (NTMR) (GBRMPA, 2003). These NTMR completely restrict fishing as no species at all is permitted to be taken from said area, protecting all of the species in the zone. NTMR are designed to replenish fish populations within overexploited areas (Marshall, et al., 2019).
Communication [2] **Appropriate use of genre conventions** The use of headings and paragraphs fits the purpose of a scientific essay.	The Great Barrier Reef accommodates over 1500 species of fish (GBRMPA, 2021), many of which are targeted by commercial fisheries. Operating predominantly in the Great Barrier Reef Marine Park (GBRMP), the ‘Reef line fishery’ is Australia’s major commercial fishing industry as many coral reef species such as coral trout and red throat emperor are harvested and exported, providing a significant income for the economy. One of the major species impacted from the overexploitation is one of Australia’s prize fish species; the coral trout. Coral trout, or *Plectropomus leopardus* was one of the main targeted species that NTMR were introduced to replenish. Prior to zoning in 2003, coral trout biomass declined from approximately 5 kg/1000 m^2 in the 1980s to 1 – 2 kg/1000 m^2 in 1996 (Emslie, 2021). Fish biomass the estimated weight of biological material (Queensland Governent, 2017). Multiple reports since the introduction of NTMR have investigated how effective they have been in replenishing *Plectropomus* biomass as they provide the species with the protection needed to grow and reproduce. Specifically, the hypothesis of being able to replenish coral trout populations back up to their prior values of around 4-5 kg/1000 m^2. Therefore, the following research question was developed;
Research and planning [5–6] **A specific and relevant research question** The research question has been developed from the claim and is connected to the topics covered in the unit.	Do NTMR increase the biomass of *Plectropomus leopardus* by 2kg/1000m^2 in comparison to fished sites within the Great Barrier Reef Marine Park? ## Background *Plectropomus leopardus* contribute heavily to the reef line fisheries’ stocks. From a report published in 2020 for Fisheries Queensland, *P. leopardus* quantities were recorded at 889,297 out of the 1,451,712 total fish caught in the reef line fishery in 2017/18; 61.25% of the total catch (EconSearch, 2020).

Table 1; Quantity, price, GVP and market destination of catch from key species of the Coral Reef Fin Fishery (Reef Line Fishery) in 2017/18 (EconSearch, 2020)

Species[a]	Quantity (kg)	Price ($/kg)	GVP ($m)	Market Destination Queensland (%)	Interstate (%)	International (%)
Coral trout	889,297	29.71	26.4	58%	13%	29%
Emperor - red throat	149,535	12.62	1.9	72%	28%	0%
Snapper - saddletail	98,684	8.84	0.9	100%	0%	0%
Emperor - red	40,896	10.69	0.4	100%	0%	0%
Other	*273,299*	13.99	*3.8*	*82%*	*9%*	*9%*
Fishery total	**1,451,712**	**23.04**	**33.4**	**63%**	**13%**	**24%**

The economic value of the *P. leopardus*, with each kilogram of the species being sold for $29.71, is significantly higher than the remaining reef line fishery species' (Table 1). The profit as well as exporting 29% of the catch internationally arguably displays the coral trout to be not only the most prized fish species in the reef line fishery, but also one of the most important species in the Australian economy.

Analysis and interpretation [5–6]

Justified scientific argument/s

Scientific arguments are evident throughout the response. The background shows development of the argument by explaining the importance of NTMR to fecundity, biomass and value

With the implementation of NTMR, both the reef line fishery performance as well as *Plectropomus* biodiversity can be optimized (Frisch, et al., 2015). NTMR are designed to protect against overfishing of *P. leopardus*, allowing the fish to live longer lifespans and increase in biomass. When it comes to population replenishment, an increase in biomass exponentially increases the fecundity of *Plectropomus,* allowing the female fish to be able to reproduce at a far more efficient rate (Carter, et al., 2009`)

As *P. leopardus* are protogynous hermaphrodites, the overexploitation of the species can also complicate the gender diversity (Ferreira, 1995). This is due to the 'ideal' size caught being targeted by the reef line fishery mainly being male fish. The overexploitation of male *P. leopardus* resultantly decreases the species fecundity due to the lack of male partners required to breed, providing another issue that must therefore be addressed in the no take marine reserves. To determine the extent at which NTMR increase biomass, the following datasets were analysed;

Evidence

Analysis and interpretation [5–6]

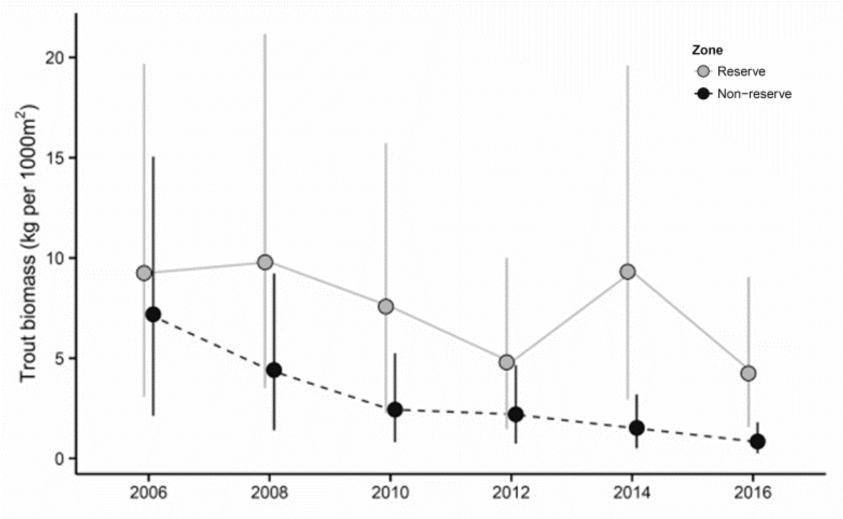
Thorough identification of relevant trends, patterns or relationships

The response identifies trends, patterns or relationships that are not superficial or partial. The trends, patterns, or relationships have direct bearing upon and are applicable to the formation of the scientific argument.

Evidence 1;

In a study produced by Sweatman (2017), the reported biomass of *P. leopardus* were outlined to be greater in the NTMR in comparison to the fished sites of the Capricorn Bunker Region (refer to figure 1). Between 2006-2016, the fish biomass increased by approximately 126 % in the reserve sites compared to the non-reserve sites, with a fluctuation in difference values in each year.

Figure 1; Mean biomass of *Plectropomus spp* in the Capricorn Bunker Region from 2006 – 2016 (Sweatman, et al., 2017)



Analysis and interpretation [5–6]

Thorough identification of relevant trends, patterns or relationships

The response identifies trends, patterns or relationships that are not superficial or partial. The trends, patterns, or relationships have direct bearing upon and are applicable to the formation of the scientific argument.

Thorough and appropriate identification of limitations of evidence

The response identifies limitations of the evidence that are not superficial or partial. The limitations are suitable for determining the reliability of the evidence in responding to the research question.

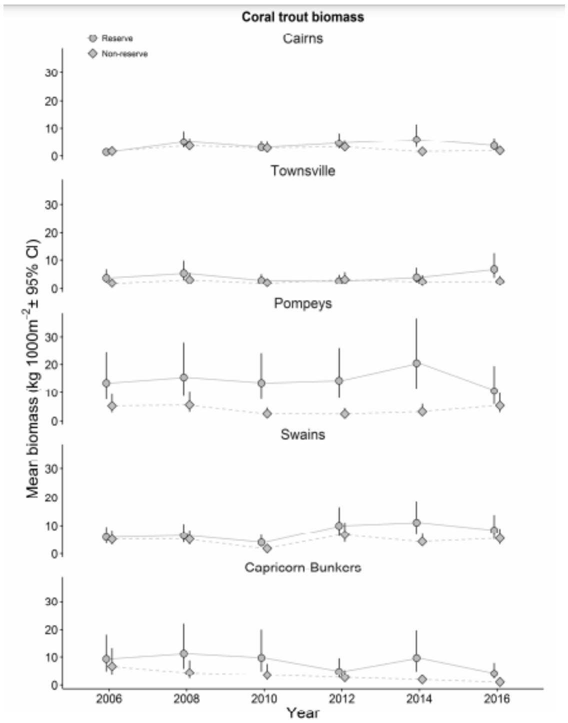
Analysis;

This graph indicates that the NTMR sites recorded a significantly larger biomass, with an average of 4.42 kg/1000m^2 more than the non-reserve value (refer to appendix). With all of the recorded years demonstrating this pattern, 2014 specifically, recorded the largest difference in *Plectropomus* biomass with an 8 kg/1000m^2 increase in the reserve zone.

The figure also suggests a steady decline in overall trout biomass in non-reserve sites with the reserve sites also following the pattern, disregarding the anomaly of 2014.

Evidence 2;

Sweatman further extended on the study from Figure 1, incorporating multiple sites across the GBRMP as well as the Capricorn Bunker Region in a separate investigation. Similar to Figure 1, the same time frame was used and a similar pattern to the previous dataset was observed however minor data value variation was present between each site.

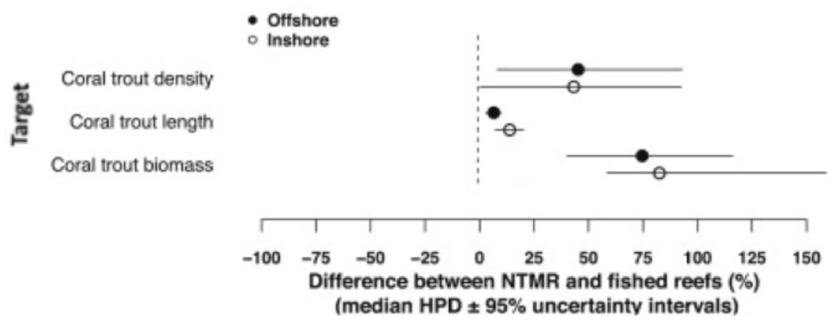
Analysis and interpretation [5–6] **Identification of sufficient and relevant evidence** The evidence is appropriate for the purpose of responding to the research question. It is applicable and directly connected to the formation of the scientific argument. **Communication [2]** **Fluent and concise use of scientific language and representations** Data is clearly represented so that the trends, patterns and relationships can be easily identified. **Analysis and interpretation [5–6]** **Justified scientific argument/s** The scientific argument uses a process of sound reasoning and draws upon valid and reliable evidence.	**Figure 2; Mean biomass of *Plectropomus spp* across varying sites of the GBRMP from 2006 – 2016 (Sweatman, et al., 2016)**  **Analysis;** This data shows that across each investigated site, the NTMR had a positive impact in increasing *P. leopardus* biomass. As the report includes 5 different site locations, the relationship between NTMR and fished sites is shown to differ depending on the location, with this also being clarified as reliable due to the same sample techniques being used across each site. The Pompey region specifically recorded an extremely high figure of 20 kg/1000m^2 in the NTMR in 2014, far outperforming the remainder of the data. This extreme figure resultantly creates question regarding the impact that location in the GBRMP also has on coral trout biomass. **Evidence 3;** Emslie, 2015 continues to support the effectiveness of NTMR as this study produces a figure incorporating the effect sizes of multiple surveys conducted across the GBR. Using the median figure of the data rather than mean, percentage values were created to establish the extent that each variable was increased in NTMR.

Communication [2]

Acknowledgment of sources of information through appropriate use of referencing conventions

The use of in-text referencing fits the purpose of an essay.

Figure 3; Median difference between NTMR and fished reefs from 2004 – 2012 (Emslie, et al., 2015)



Analysis and interpretation [5–6]

Identification of sufficient and relevant evidence

The evidence responds to the research question in terms of biomass across GBRMP and can support a valid conclusion. The evidence is applicable to the formation of the scientific argument.

Analysis;

Figure 3 is indicative of the overall positive performance that NTMR have on *Plectropomus* biomass. With both offshore and inshore NTMR reefs producing a 75 and 80 % greater biomass than fished sites in the same areas. As further verified by the dataset, *P. leopardus* density is also increased by approximately 50 %, however a minimal percentage increase in length is shown. This relationship between data measures demonstrates that whilst the *P. leopardus* remain a similar length, their population numbers as well as overall size, represented in biomass are significantly increased in NTMR.

Analysis and interpretation [5–6]

Justified scientific argument/s

The interpretation of the evidence shows an understanding of the process used to select evidence to construct a scientific argument. The scientific argument communicates sound reasoning and draws upon valid and reliable evidence.

Evaluation

Evaluation of data;

The dataset triangulation shown in this report demonstrates a significant statistical difference. This is represented by *P. leopardus* biomass being increased by 4.42 kg/1000m^2 in NTMR in dataset 1, as well as an increase in biomass across every NTMR recorded in each site represented in dataset 2. Furthermore by the overall percentage increase of *Plectropomus* biomass by 75 and 80 % demonstrated in dataset 3. While large error bars are present in sections of each dataset, the lack of overlap between NTMR and non-reserve sites allow for a confident overall consensus to be made that *Plectropomus* biomass was recorded to be greater in NTMR.

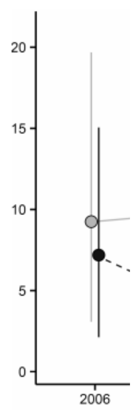
Analysis and interpretation [5–6]

Thorough and appropriate identification of limitations of evidence

The response identifies limitations of evidence that affect how well it can be used to develop a response to the research question.

Limitations affecting data reliability;

Upon analysis of Figure 1 specifically, the error bars are extremely large for multiple values. As shown, in 2006, the error bar covered for approximately 16 – 17 kg/1000m^2 , leaving significant room for error in the data points. The size of the error bars in 2006 were large, with this resulting in an overlap in the data values, further limiting the data. This was the only dataset with this level of uncertainty.



Overall, majority of the error bars of each dataset did not overlap, displaying that there is high confidence that there is a significant difference between fished and NTMR. Furthermore, the pattern emerged that the error bars of the non-reserve sites were larger than the NTMR, as well as the overall size of the error bars decreasing over time. Reasons

Analysis and interpretation [5–6]

Thorough and appropriate identification of limitations of evidence

The response identifies limitations of the evidence that are not superficial or partial. The limitations are suitable for determining the reliability of the evidence in responding to the research question.

Justified scientific argument/s

The interpretation of the evidence shows an understanding of the process used to select evidence to construct a scientific argument. The scientific argument communicates sound reasoning and draws upon valid and reliable evidence.

for these patterns were reasonably assumed to be a result of the data being taken from the same site each time period. With the difference in error bar size between reserve and non-reserve remaining in question, further evaluation of the data was required.

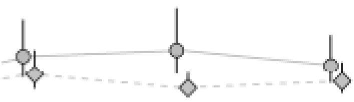
Limitations affecting data validity;

In Figure 2 specifically, the data variation paired with the large error bars present across multiple datasets from different locations of the GBRMP resulted in the possibility of site location being a significant contributor to the NTMR effectiveness. This is primarily a result of the ‘spill over’ effect restricting the NTMR from maximising the *P. leopardus* biomass from said site. The ‘spill over’ effect is essentially linked to the carrying capacity of *P. leopardus* ; the maximum amount of species the site can sustainably habituate. Hypothesising the concept that once a NTMR has reached its carrying capacity, a portion of *P. leopardus* could migrate from the NTMR, possibly travelling to a nearby non-reserve site where data for the experiment is also collected. These specimen from the NTMR can therefore boost the biomass recorded in the non-reserve site despite them not originally being from the area.

Conclusion and evaluation [5–6]
Insightful discussion of the quality of evidence

The discussion shows understanding of the features of the evidence that affect its ability to be used to respond to the research question.

Figure 4: Stabilisation of data in Swains Region (Figure 2)

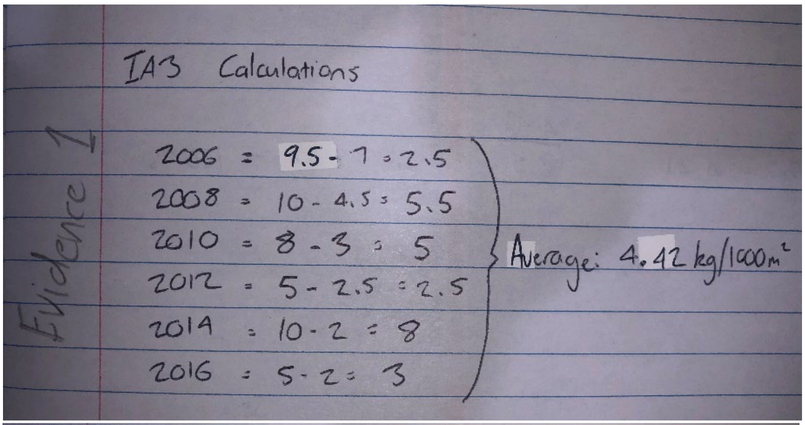


This hypothesis can be supported from the stabilisation of the NTMR data values represented from 2012-2016 in the Swains region. As shown the circle points representing NTMR are shown to reach a ‘peak’ in the centre value (2014), however in 2016, the data stabilises back down to approximately 10 kg/1000m^2 that was previously recorded in 2012.

Figure 4: Map of recorded sites from Figure 2 (Sweatman, et al., 2016)

Conclusion and evaluation [5–6] **Insightful discussion of the quality of evidence** The discussion shows how the limitations identified in the analysis have affected the use of the evidence to evaluate the claim.	Looking at the map of the recorded sites, it was highlighted that the distance between the no take and open reefs differed across each region. Bunt, 2014 states *P. leopardus* are mainly known to be a relatively non-migratory species; moving around 0.6 km^2 from their habitat (Bunt & Kingsford, 2014). Despite this, the actual size of the migrating *Plectropomus* were not included in the report, therefore requiring further research targeting the relationship between biomass and carrying capacity. Nonetheless, this hypothesis of migrating *Plectropomus* can resultantly pose as a factor limiting both Figures 1 and 3 also, however there is also insufficient indication that NTMR and non-reserve sites are close enough for an observable spill over effect.
Conclusion and evaluation [5–6] **Justified conclusion/s linked to the research question** The discussion shows how the limitations identified in the analysis have affected the use of the evidence to evaluate the claim.	Finally, the variation between mean and median data values also limits the data due to the subjectiveness of surrounding values possessed by both units of measurements. This report argues that the median values represented in Figure 3 is a more reliable measure than the mean values of Figures 1 and 2 in terms of validity. The median value is the middle dataset point, evenly accounting for 50% above and below the value. With the median value, outliers from the sample have a minimized impact on the value in comparison to the mean, which can be drastically changed depending on the size of an outlier in the data. In terms of *P. leopardus* biomass, the minimal impact from outliers can account for an evenly distributed age-size variation, providing a more accurate indicator of the entirety of the sample, demonstrating the 50 % of the population records higher than the median and 50 % records under.
Suggested improvements and extensions to the investigation, which are considered and relevant to the claim The response uses the analysis of the investigation's limitations to inform suggested improvements and extensions that are connected to the claim.	**Conclusion** This research set out to answer the proposed research question. Through the analysis and interpretation of datasets 1-3, an increase in *Plectropomus leopardus* biomass of over 2kg/1000m^2 was recorded in NTMR. As shown in the analysis of dataset 1, *Plectropomus* biomass increased by 4.42 kg/1000m^2 in the NTMR. Despite variation in NTMR vs non-reserve difference values, the pattern of an increased biomass in NTMR remained constant throughout datasets 2 and 3 also. The reliability of each analysed dataset is further supported with the lack of error bar overlapping showing an increase in *Plectropomus* biomass regardless. For further studies, it is recommended that the median value is used as a measure of central tendency over the mean as the median accounts for the age-size variation required for alternative measures such as fecundity and resilience rates over time. In terms of fisheries management, the collected data will prove useful as NTMR have been demonstrated to be vital in replenishing over-fished locations.
Communication [2] **Fluent and concise use of scientific language and representations** The response is easily understood, avoids unnecessary repetition and meets the required length.	**Extrapolation of credible findings of the research to the claim** The response identifies believable outcomes of the research and then applies them to the claim. **Word count (excluding refences and tables): 1984**

Appendix

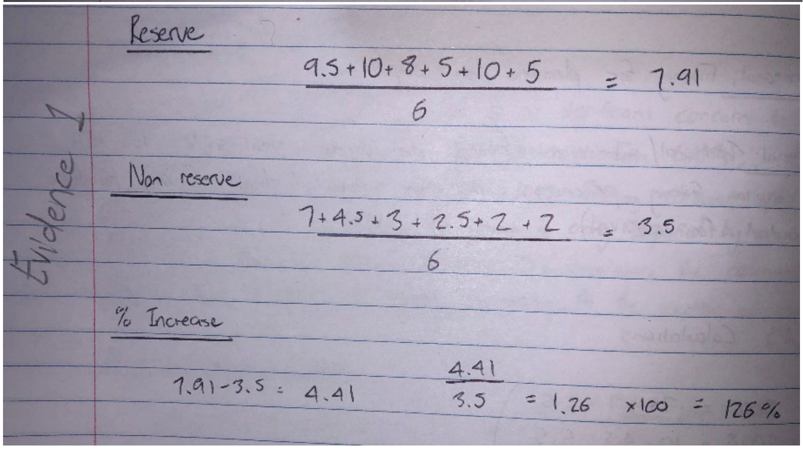


IA3 Calculations

Evidence 1

2006 = 9.5 - 7 = 2.5
2008 = 10 - 4.5 = 5.5
2010 = 8 - 3 = 5
2012 = 5 - 2.5 = 2.5
2014 = 10 - 2 = 8
2016 = 5 - 2 = 3

Average: 4.42 kg/1000m²



Evidence 1

Reserve

$\frac{9.5+10+8+5+10+5}{6} = 7.91$

Non reserve

$\frac{7+4.5+3+2.5+2+2}{6} = 3.5$

% Increase

7.91 - 3.5 = 4.41 $\frac{4.41}{3.5} = 1.26$ ×100 = 126%

References

Bunt, C. M. & Kingsford, M. J., 2014. *Movement, habitat utilization and behaviour of coral trout Plectropomus leopardus during and after the reproductive period on the southern Great Barrier Reef*, s.l.: Marine Ecology Progress Series .

Carter, A., Tobin, A. & Williams, A., 2009`. *The effects of no-taking region and year on reproducive output of the common coral trout, Plectropomus leopardus*, s.l.: James Cook University.

Davies, C. R., 2021. *STOCK STRUCTURE AND REGIONAL VARIATION IN POPULATION DYNAMICS OF THE RED THROAT EMPORER AND OTHER TARGET SPECIES OF THE QUEENSLAND TROPICAL REEF LINE FISHERY*, s.l.: Australian Government.

EconSearch, B., 2020. *Economic and social indicators for the Queensland coral reef fin fishery, 2017/18 and 2018/19*, s.l.: Queensland Government.

Emslie, M., 2021. *Twice the coral trout in Great Barrier Reef protected zones*, s.l.: Australian Institute of Marine Science .

Research and Planning [5–6]

Selection of sufficient and relevant sources

Sources are scientific and provide enough evidence for the development of a scientific argument that responds to the research question.

Communication [2]

Acknowledgment of sources of information through appropriate use of referencing conventions

The use of a referencing system fits the purpose of an essay.

	Emslie, M. et al., 2015. *Expectations and Outcomes of Reserve Network Performance following Re-zoning of the Great Barrier Reef Marine Park*, s.l.: Elsevier Inc. Ferreira, B. P., 1995. *Reproduction of the common coral trout, Plectropomus leopardus from the central and northern Great Barrier Reef, Australia*, s.l.: Bulletin of Marine Science. Fisheries, D. o. A. a., 2020. *Sustainable Fisheries Strategy; Coral Reef Fin Fish Fishery (Line Fishery Reef)*, s.l.: Queensland Government. FRDC, 2017. Coral Trout - *Queensland Coral Reef Fin FIsher*y, s.l.: s.n. Frisch, A. J. et al., 2015. *Key aspects of the biology, fisheries and management of Coral grouper*, s.l.: Springer International. GBRMPA, 2003. *Great Barrier Reef Marine Park Zoning Plan 2003.* [Online] Available at: https://www.gbrmpa.gov.au/__data/assets/pdf_file/0015/3390/GBRMPA-zoning-plan-2003.pdf [Accessed 10 07 2021]. GBRMPA, 2021. *Animals.* [Online] Available at: https://www.gbrmpa.gov.au/the-reef/animals [Accessed 08 07 2021]. Marshall, D. et al., 2019. Underestimating the benefits of marine protected areas for the replenishment of fished populations, s.l.: Ecological Environment of America. Marshall, D. J. et al., 2019. *Underestimating the benefits of marine protected areas for the replenishment of fished populations*, s.l.: The Ecological Society of America. Queensland Government, D. o. A. a. F., 2017. *Managing fisheries for sustainability.* [Online] Available at: https://www.daf.qld.gov.au/business-priorities/fisheries/sustainable/managing-fisheries-for-sustainability [Accessed 10 07 2021]. Studies, A. C. o. E. i. C. R., 2015. *Fishing impacts on the Great Barrier Reef.* [Online] Available at: https://www.sciencedaily.com/releases/2015/04/150421105352.htm [Accessed 08 07 2021]. Sweatman, H. et al., 2017. *Effects of marine park zoning on coral reefs of the Capricorn-Bunker Group,* s.l.: Australian Institute of Marine Science (AIMS). Sweatman, H., Emsile, M. & Logan, M., 2016. *Monitoring the effects of rezoning on the Great Barrier Reef,* s.l.: Australian Institute of Marine Science (AIMS). Williamson, D. H. et al., 2013. Habitat dynamics, marine reserve status, and the decline and recovery of coral reef fish communities, s.l.: *Ecology and Evolution*.

	Zhou, Y., 2021. *Great Barrier Reef.* [Online] Available at: http://greatbarrierreefissues.weebly.com/overfishing1.html [Accessed 08 07 2021].