NSW Total Allowable Fishing Committee

Report and Determination 2019

SEA URCHIN AND TURBAN SHELL RESTRICTED FISHERY:

Red Sea Urchin

28 November 2018

EXECUTIVE SUMMARY

Preamble

The NSW Total Allowable Fishing Committee (the Committee, formerly the Total Allowable Catch Setting and Review Committee) has responsibility under the NSW Fisheries Act (1994, No. 38) to determine the Total Allowable Commercial Catch (TACC) of red urchin (*Heliocidaris tuberculata*) by NSW commercial fishers holding endorsements for the Sea Urchin and Turban Shell (SUTS) Restricted Fishery. This determination is for the period 1 January to 31 December 2019. The determination is based on a information available about the red urchin stocks, reports from fishery managers, comment from fishers, and input at a public forum in Sydney on October 11th 2018.

The red urchin fishery is part of the SUTS multi-species fishery that is managed by a combination of input controls (endorsements to take all species) and individual quotas for red urchin. A TACC and individual transferable quotas (ITQs) are applied only to red urchin. There have been 37 SUTS endorsement holders since 2002. Each endorsement has received a red urchin quota allocation of 1622 kg, being an equal share of the overall 60 t TACC. The TACC has not changed since 2002. The red urchin ITQ is not divisible nor separable from the SUTS endorsement but can be leased annually.

Determination

The Committee is faced with setting TACCs that are economically fair whilst also limiting harvests to biologically acceptable levels. Current management arrangements for the SUTS fishery in general, and the red urchin harvest in particular, mean these two criteria lead to misaligned conclusions.

The biologically preferred TACC under current management arrangements is significantly less than the 60 t that was set in 2001. The allocation of the TACC evenly among SUTS licence holders and limited opportunity for quota transfer, however, means that a reduced TACC will constrain disproportionately the most active fishers, with little opportunity to acquire additional quota, and have no impact on those that do not take red urchin but will continue to hold (unused) quota. The association of biologically-based Regional Catch Limits with a notioinal TACC, however, allows regulation of total harvest of red urchins whilst balancing economic fairness. This should be seen as an interim arrangement whilst management instruments are resolved that allow internal economic adjustment by the fishery to changing TACC settings.

The Committee accordingly has determined that the notional Total Allowable Commercial Catch of red urchin by NSW commercial fishers during the 2019 fishing period should not exceed 60 tonnes (t) but that the sum of Regional Catch Limits (RCLs) should not exceed 30 t, with catches from Regions 1–5 capped at 4, 13, 6.6, 6.4, and 0 t respectively. The notional TACC will preserve economically viable access to the fishery by those business dependent on harvesting red urchin whilst the RCLs will ensure the landed catch will not exceed that considered biologically prudent given available information. Both the TACC and the RCLs are above most annual total catches reported since 2002 implying little prospect of immediate constraint on fishing activities similar to recent history. The determination is set on advice that unreported commercial catches, catches by aboriginal fishers, and recreational catches likely are less than 5 t.

Recommendations

The Committee provides the following recommendations to the Department of Primary Industries (the Department) and the SUTS fishery industry (Industry) towards improving performance of the fishery.

Recommendation 1: The Department effect robust and definite controls of the Regional Catch Limits for red urchin set as part of this Determination (Table 6.1).

Recommendation 2: The Department and Industry implement a transparent quota trading mechanism to facilitate efficient lease of quota within fishing periods.

Recommendation 3: The Department and Industry resolve a strategy for transferring red urchin quota independently of SUTS endorsements to allow optimisation of the red urchin fishery under proper operation of Individual Transferable Quotas (ITQs) within the TACC and RCLs.

Recommendation 4: A Legal Minimum size Limit (LML) for harvest of red urchin be set at 115 mm test diameter.

Recommendation 5: The Department and Industry complete rigorous targeted surveys of red urchins in areas historically closed and open to fishing to estimate current population densities of harvested and protected populations in each Region.

Recommendation 6: The Department and industry develop a harvest strategy for the red urchin fishery with specific biological and economic objectives linked to target reference points and an associated code of conduct to guide Industry best practice in the red urchin fishery.

Stock Status

There is little recent information from which to infer the current state of the red urchin stock. The commercial catch rate is not expected to be a reliable index of stock abundance because red urchin usually is taken during dives that are primarily focused on other species and relatively few dive events specifically target red urchin. This is confirmed by the lack of coherent signals in the commercial catch rate data even for the areas that consistently have provided the bulk of catches through pulses of large catch. The persistent closure to urchin harvest of about 1/3 of the NSW coast, however, will have protected mature, largely unfished, populations of red urchins in each Region and those protected populations likely provide robust sources of replenishment of depleted populations in fished areas. This conclusion relies on the biological research suggesting that larval dispersal is widespread and that there is very limited movement of post-settlement urchins.

Previous research demonstrated that severe depletion of stocks could occur quickly (months) under heavy fishing. There is no information, however, about the rates at which depleted populations rebuild. Anecdotal evidence from divers indicates that population densities in fished areas remain perhaps at 50–25% of those in closed areas, suggesting that even the low level of red urchin harvest since 2002 has kept local populations at levels well below unfished stocks.

It is reasonable to infer that about 2/3 of the red urchin stock has been outside closed areas. That would mean about 627–797 of the 940–1,195 t of total biomass estimated early in 2001 was available to the fishery, assuming that the stock at that time had not yet been materially depleted. The 60 t TACC, if taken, therefore would represent a harvest fraction of about 5–604% of the total stock and 7.5–9.6% of the fishery-available stock. Average catches during 2002–17 (9.5 t pa) would be approximately 1.2–1.5% of unfished biomass in open areas, with the 2016–17 harvest fraction about 2.3–2.9%. These harvest fractions are considered moderate (5–9.6%) to low (1.2–2.9%) for urchins.

The above information implies that a TACC of around 15–40 t is appropriate biologically for the currently accessible stock. Reducing the existing TACC of 60 t to values of this order accounts for the suggested reductions in stocks through persistent low-level harvest over the last 16 years and the reduced area accessible to the fishery through what effectively are indefinitely closed areas. An appropriate and properly managed rotational harvesting strategy would increase the sustainable harvest but would need to be implemented carefully with robust, evidence-based criteria for opening and closing areas to yield sustainably increased harvest.

Economic Considerations

Few fishers are SUTS-only fishers, with most SUTS endorsement holders also holding quota for the abalone fishery. Activity in the SUTS fishery by many of the latter is incidental to taking abalone. Less than one third of endorsed fishers have harvested red urchin since 2002, meaning there is substantial latent capacity in the red urchin fishery.

Unit prices for red urchin are high compared to prices for other SUTS species but the relative abundance of the species is low, access to the stock is especially weather dependent, and many fishers focus more on the more accessible and abundant purple urchin. Harvest of red urchin mostly is seasonal, with most harvest in winter when purple urchin generally have poor quality roe.

There are few economic data for the SUTS fishery or the red urchin harvest but available estimates indicate that red urchin sales comprise approximately 20% of the Gross Value of Production (GVP) from the SUTS fishery. Relationships between price and catch of red urchin suggest that catch responds to, rather than drives, market price, which seems largely determined by external factors.

A fundamental requirement for an effective ITQ system is divisibility and a well-functioning quota market. Neither exist in the red urchin fishery, impeding severely optimisation of the fishery and realisation of the TACC or RCLs. Changes in the red urchin TACC without these conditions will impede fleet rationalisation and autonomous fishery adjustment. This will mean that economic

impacts of TACC adjustment will fall disproportionately on the small sub-set of businesses for which harvesting red urchin is an important source of income, with little or no efficiency gain to the fishery.

The Committee recommends that Industry and the Department resolve a strategy for permanent quota transfer independently of SUTS endorsements and implement an effective quota trading facility.

Management Considerations

There is no management plan or formal objectives for the SUTS fishery or red urchin harvest to guide decision-making. The TAC Committee in making its decision in 2001 (for 2002) reported that managers then articulated the following fishery objectives:

- To develop the fishery in a controlled manner
- To prevent localised over-fishing; and
- To develop an understanding of the resource.

The red urchin TACC is divided equally between all licence holders in the SUTS Fishery and the resulting individual quotas are allocated at the beginning of each fishing period (currently January 1–December 31 each year). There are 37 fishing businesses with SUTS endorsements, with 26 of those businesses reporting SUTS catch in 2017 but only 12 landing any red urchin.

Quotas are not unitised and are not transferable separately from the SUTS licence. This dependency represents a material constraint on the consolidation of red urchin quota since endorsement holders taking other SUTS species are unlikely to transfer the entire endorsement to transfer red urchin quota.

A number of spatial fishing closures apply to the fishery including marine parks, aquatic reserves, and Intertidal Protected Areas (IPA). The commercial fishery is divided into Regions, Zones and Sub-zones and many sub-zones have been closed to urchin fishing since about 1994.

The Committee in 2001 allocated the TACC to the five fishery Regions in proportion to the estimated biomass at the time: Region 1 – 8 t, Region 2 – 28 t, Region 3 – 13 t, Region 4 – 11 t, Region 5 – nil. Catch is reported for the fives zones but has never reached zonal catch limits or the TACC.

The Committee also recommended that a system of rotational spatial closures of heavily fished sub-zones be set within each Region to protect the stock from over-harvest. Three closures were implemented in 2002 and opened about 2007 but no other rotational closures have been applied.

Compliance rates in the SUTS fishery have varied widely over 23–100% since 2010. No compliance data specific to red urchins are available but Compliance Officers advised that red urchin fishing does not represent a material compliance risk.

The commercial red urchin fishery is currently under-developed. It is limited by a number of factors:

- Red urchins generally occur in shallow waters of <6m depth and are difficult to harvest;
- Management arrangements are inflexible and inhibit adjustment within the fishery; and
- There is no easily accessible market or mechanism for trading quota, meaning a lack of incentive to invest in market development.

Red urchin is a major source of income for relatively few fishers. Some have expressed a desire to develop the fishery in the future but frustration at the difficulty in acquiring additional quota either through endorsement purchase or quota lease. It is desirable that quota rights to the fishery consolidate to a much smaller number of licence holders who regularly target red urchin, either as a primary or important ancillary catch. Such optimisation is impeded severely by existing management arrangements that obstruct trading of red urchin quota independently of SUTS endorsements.

The Committee recommends that management arrangements for the fishery be reviewed. Consideration should be given to making red urchin quota transferable separately from the SUTS licence to which is is attached to enable rationalisation of the red urchin catch to a smaller number of entitlement holders. The review also should consider how best to regulate the catch across the five regions and the systematic, planned implementation of rotational closures as a key management tool that could be used to optimise outputs from the fishery, as recommended in 2001.

Conclusion

A low TACC under the current restricted fishery management regime would precipitate significant reduction in quota allocations per endorsement holder. There currently is no transparent or efficient quota trading scheme by which active fishers could redress such a cut so it is likely TACC reductions will affect active red urchin fishers disproportionately and arguably inequitably.

A strategy that balances the need to regulate harvest of the fishable stock prudently whilst protecting against inequitable economic effects is to:

1. Retain the current notional TACC (60 t) to secure reasonable ITQ allocations to active red urchin fishers; and
2. Set Regional Catch Limits to biologically appropriate levels (30 t in total, below) to ensure total harvest is within likely appropriate biological limits, given available information.

These two determinations should be seen as required and inseparable for the 2019 fishing period.

Regional Catch Limits for red urchin during the 2019 fishing year.

Region	2019 Regional Catch Limits (t)
1	4.0
2	13.0
3	6.6
4	6.4
5	0
Total	**30**

The Committee recognises that the above Determination has the sum of Regional Catch Limits being less than the TACC. That unusual strategy has been set to balance economic fairness and biological sustainability criteria for the fishery in the short term given the unusual, and constraining, management arrangements in place. This should be seen as in interim strategy whilst management of the fishery is amended to enable efficient internal adjustment of quota holdings through efficient quota trading such that the fishery is enabled to adjust efficiently to future TACCs that set biologically sustainable harvests.

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1. INTRODUCTION

The Total Allowable Catch Setting and Review Committee was established by Division 4 (S26-34) of the *Fisheries Management Act 1994*. It was renamed the Total Allowable Fishing Committee (the Committee) and given broader responsibilities in a 2018 amendment to the Act (Part 2A S40) following structural reform of management arrangements for most NSW commercial fisheries. The committee in 2018 was:

- Dr Bruce Mapstone – Chair;
- Ms Kelly Crosthwaite – fisheries management;
- Dr Sean Pascoe – natural resources economics; and
- Dr Keith Sainsbury – fisheries science

The Committee is required to determine the Total Allowable Commercial Catch (TACC) of red sea urchins (red urchin) for the commercial sector of the Sea Urchin and Turban Shell (SUTS) Restricted Fishery, giving effect to relevant objectives of the *Fisheries Management Act 1994,* and as since amended *(1997, 2004, 2006, 2010, 2015, 2018)*. The Committee is not subject to control or direction from the Minister but in reaching its decision is required to consider:

- All relevant scientific, industry, community, social, and economic factors;
- The need to ensure that the red urchin resources are exploited in a manner that will conserve stocks in the long term;
- The impact of fishing on other species and the environment; and
- The precautionary principle as set out in Section 30(2)(c) of the Act.

The Committee also may be consulted out of session on a range of management issues. This or previous Committees have not been asked to review the TACC for red urchin since 2001, when a TACC of 60 t was set for 2002 and has remained unchanged since. The Committee at that time also set Regional Catch Limits by which the TACC should be realised spatially given regional stock abundances.

The Committee has produced this stand-alone report in support of the TACC determination for 2019. The report also includes recommendations for management of the fishery related to setting TACCs, based on the experience and background of the Committee members and reports received by the Committee. Constructive dialogue between the Committee and the Department and Industry on a range of issues related to the fishery, including recommendations from the Committee, is an important and valuable part of the Committee's deliberations in reaching a TACC determination.

The Committee makes a determination on the TACC and matters it is required to regard that affect directly that TACC. The Committee this year has set a notional TACC for red urchins that is contingent on adoption also of revised Regional Catch Limits in order to balance biological, economic, and fairness considerations within the constraints of current management provisions for the SUTS fishery. These two instruments are intrinsic components of setting an appropriate commercial catch and should not be considered discretionary or separable. The degree to which the Committee's other suggestions or recommendations are accepted is a matter entirely for the Minister and the Department.

The Committee must consider the full extent of red urchin exploitation to meet its statutory obligations. Total removals from the NSW red urchin stock are made up of:

- The quota allocated to commercial fishers or allowed via regional catch limits, whichever is less;
- The total legal catch by recreational and Aboriginal fishers; and
- Catches by commercial, recreational, or Aboriginal fishers not sanctioned by the Regulations controlling the fishery and not recorded in catch statistics (illegal catches).

There currently are no data from which to estimate the legal or illegal components of the non-commercial fishery but both are inferred to be minor (less than 5 t annually) based on historical evidence, compliance information, and judgments from the Department and Industry.

The Act defines, in Section 30(2)(c), how the Committee should apply the precautionary principle:

> *'… if there are threats of serious irreversible damage to fish stocks, lack of scientific certainty should not be used as a reason for postponing measures to prevent that damage.'*

The Committee interprets 'threat' in this context to mean an 'indication of probable harm to come'. The Committee therefore must respond to evidence before it that indicates probable future harm to the fishery or the stocks and not postpone action to prevent that harm occurring even if there is uncertainty surrounding such evidence. Similarly, the Committee should not take pre-emptive decisions on issues such as increasing the TACC when there is insufficient verifiable information on which to base such decisions.

2. PROCEDURES

2.1 Public Consultation by Committee

The Committee, through the Department, called for public submission on the appropriate total allowable commercial catch under the requirements of Section 31 Division 4 of the *Fisheries Management Act* 1994. SUTS fishers, relevant industry and stakeholder bodies, and the community were invited to make submissions on the Total Allowable Commercial Catch of red urchin. The consultative process is set out in Appendix 1. No written non-government submissions were received during this process.

The Committee obtained input from participants in the Total Allowable Fishing Committee Open Forum meeting in Sydney on October 11th 2018 and received written reports from:

- NSW Department Primary Industries (DPI) Fisheries Research; and
- NSW Department Primary Industries Commercial Fisheries Management.

Public verbal submissions and presentations to the Committee were invited during the Open Forum. One written submission from a fisher also was accepted at the public forum. The Committee also was able to call for *in-camera* discussions, where appropriate. In-camera discussions were requested with Departmental officers following the 2018 forum.

2.2 Matters considered

The Committee considered the following matters before reaching its determination:

- The original TACC Determination (2001), fishery objectives referred to therein, and research information available to the Committee at that time;
- The current state of the fishery;
- Advice on the status of management of the fishery provided by the Department;
- Advice on the economic status of the fishery by the Department and Industry representatives;
- Advice on compliance with regulations from the Department and Industry representatives;
- The data and assessment report for red urchin stocks provided by the Department;
- The spatial nature of the fishery; and
- Submissions, commentary, and presentations provided at the Open Forum.

2.3 Format of the Report

This report covers the three key areas affecting management of the fishery and setting the allowable commercial catch:

- Status of the red urchin stocks;
- Economic considerations; and
- Management considerations.

The key considerations for each of these areas are presented in the following sections 3, 4, and 5. The Committee's conclusions in view of these considerations are presented in section 6, together with the details of this year's Determination.

The Committee has made several recommendations with the Determination to clarify the position of the Committee on a number of issues related to the TACC. The primary recommendations are included in the Executive Summary.

The Determination of the Committee is to be published by the Minister. The Minister is required to review the regulations and any other instruments under the Act In the light of the Determination. The Determination is to be implemented in accordance with the Act.

3. STATE OF THE STOCKS

3.1 Introduction

The red urchin fishery is part of the SUTS multi-species fishery managed through a combination of input controls (endorsements to take all species) and individual quotas for red urchin. Three species of sea urchin (purple urchin *Centrostephanus rodgersii*, red urchin *Heliocidaris tuberculata*, green urchin *H. erithrogramma*) and three species of turban shell (Sydney turban shell *Turbo torquatus*, military turban shell *T. Militaris*, green turban shell *T. undulatus*) can be taken under a SUTS endorsement. A TACC and individual quotas are applied only to red urchin. There have been 37 SUTS endorsements since 2002 each receiving a red urchin quota of 1622 kg, being an equal share of the overall 60 t TACC. The TACC has not changed since 2002. The red urchin quota is not separable from the SUTS endorsement.

Worthington and Blount[1] completed surveys of red urchins along the NSW coast in early 2000 from which they estimated the total biomass of red urchins, including in areas closed to the fishery, to be 1,195 t, with 154 t, 517 t, 265 t, 252 t, and 7 t in Regions 1–5 respectively. Standard errors were about 50% of the estimate in most Regions. These surveys coincided with the peak harvests of red urchin of 85.5 t in 2000 (over 90% taken by just 3–8 divers, 59 t from Region 3) and so likely were affected by at least part of that exceptional harvest. That harvest had been preceded by annual harvests or 2–5 t up to 1998 and 15.6 t in 1999 and has been followed by annual harvests of approximately 25 t in 2001 and less than 20 t since.

Worthington and Blount also recorded significant fishing-induced depletion of red urchin populations in sub-zones of Regions 3 and 4 opened to fishing in 1999 and 2000. Average depletions of fished sub-zones were estimated at 45% and 49% in Regions 3 and 4 respectively during less than a year of fishing, with extreme instances of depletion to 12–15% of previous biomass. Some declines in closed areas also occurred that partly were attributed to (illegal) fishing and some sub-zones showed an increase in abundance. Total biomass across all fished and closed areas was estimated to be reduced by 53% and 12% for Regions 3 and 4 respectively. Some of these changes might have been due to factors other than fishing but the data nevertheless indicate that local populations of red urchins are vulnerable to very rapid depletion through fishing and also suggest a material risk of serial depletion. There are no data available about rebuilding of the depleted populations after 2000–01, when fishing pressure diminished drastically.

The 2001 determination of 60 t TACC for 2002 largely was based data from Worthington and Blount and application of a yield equation with instantaneous natural mortality of 0.2 and some analysis of sensitivity to alternative assumptions. The Determination report cited a total biomass of "*... approximately 940 t of red urchin, with 380 t in the areas that are currently open to fishing*", which they considered to be likely to be close to the unfished biomass. Reasons for the discrepancy between the biomass estimates by Worthington & Blount and those cited by the Committee are uncertain but may reflect the Committee combining estimates of biomass from 3 regions based on one method with those from the remaining 2 regions based on a different method. The Determination nevertheless was based on the presumption that "*... the remaining biomass will be open to fishing (not only that in the currently open areas)* ..." because scaling the TACC to just the fishable areas "*... is not yet possible as the Department gave no clear indication of which areas would remain open or which areas would be closed in future ...*". The Committee also recognised that a TACC ideally should be based on the fishery-available rather than total stock.

Regional Catch Limits (caps) also were set from the Determination to distribute the TACC roughly in proportion to the Regional distribution of biomass provided by Worthington and Blount. The Committee recommended some areas remain closed to the fishery to protect a portion of the stock and rotational closures of fished areas to reduce the risk of serial depletion and manage harvest spatially.

3.2 Stock Status and Trends

There is little recent information from which to infer the current state of the red urchin stock. Catch and catch rate data are likely to be poor indicators of stock status because most fishers who land red urchin do so as incidental catch whilst targeting either other SUTS species or, more often, abalone. This expectation is supported by examination of the catch rate for areas that consistently provided catch through the history of the fishery, and that provided the bulk of the catches during one or more of the historical pulses of large catch. There was no coherent pattern in the catch rate from these areas through time despite the changes in population size that would necessarily have resulted from the catches. It is concluded that the total commercial catch rate from the fishery is not a reliable indicator of urchin density or abundance, and that developing a reliable index would require use of data from structured fishing or

[1] D.G. Worthington DG and C Blount, 2003. *Research to develop and manage the sea urchin fisheries of NSW and eastern Victoria*. FRDC Project No. 1999/128. NSW Fisheries Final Report Series No. 56. ISSN 1440-3544

from targeted 'red urchin only' dives. There has been no research on the stock since 2002 and there is little published biological research on the species.

The persistent closure to urchin harvest of about 1/3 of the NSW coast will have protected mature, largely unfished, populations of red urchins in each Region. Urchins produce buoyant planktonic larvae that probably disperse over moderate to long distances, meaning it is likely that protected populations provide robust sources of replenishment of depleted populations in fished areas. Research also suggests that the movement of post-settlement red urchins is very limited. The combination of extensive larval exchange with very limited post-settlement movement means that unfished areas can provide very effective protection for the population as a whole but that areas open to fishing are very vulnerable to localised depletion. There are several biological and economic consequences of localised depletion of the fishery-accessible areas, which needs to be avoided, but the overall stock condition is likely to be well protected by the current closed areas.

The work by Worthington and Blount suggest that there likely was material depletion of stocks in Regions 3 and 4 by heavy fishing during 1999–2001 but there is no information about the extent to which affected populations have rebuilt since, notwithstanding continued fishing at relatively low levels. Anecdotal evidence from divers, however, indicates that population densities in fished areas remain considerably below, perhaps at 50–25% of, those in closed areas. Such a pattern would indicate that even the low level of red urchin harvest since 2002 has kept local populations at levels well below unfished stocks.

There is insufficient information available to estimate whether red urchin habitat is distributed roughly uniformly among closed and open areas. It is parsimonious, therefore, to assume that to be the case and infer that the fraction of unfished biomass that was outside closed areas when they were declared was about 2/3. That would mean something less than 627–797 of the 940–1,195 t of total biomass estimated by the TAC Committee or Worthington and Blount respectively early in 2001 was available to the fishery, assuming that the stock at that time had not yet been depleted materially by the intensive fishing of 2000. Those estimates would mean the 60 t TACC, if taken, would represent a harvest fraction of about 5–6.4% of the total (relatively unfished) stock and 7.5–9.6% of the fishery-available stock outside closed areas. The average catches during 2002–17 (9.5 t pa) would be approximately 1.2–1.5% of unfished biomass in open areas under the same assumptions, with the harvest fraction over 2016–17 at 2.3–2.9%. These harvest fractions would be considered moderate (5-9.6%) or low (1.2–2.9%) for an urchin species.

The anecdotal information from industry divers about relative population densities in open and closed areas, however, implies that the catch from these open areas is about, or perhaps somewhat more than, the MSY for fishery-available stock and that the fished populations were being maintained at a relatively low level. A more rigorous measure of the relative density in open or closed areas, perhaps by 'structured fishing' or similar, would provide informative and cost-effective information for managing the fishery, including TACC determination and decisions about rotational closure strategies.

The Committee recommends that the Department and Industry complete a rigorous, properly designed survey of red urchins in areas closed and open to fishing in each Region to estimate current densities of populations subject to fishing and those protected from fishing.

3.3 Biologically Appropriate Allowable Catches

The above alternative approaches to inferring the level of fishing being imposed on the stock (i.e., pro-rate the original biomass estimate to infer that accessible to fishing or, alternatively, infer that current catches result in 50-75% depletion in open areas) suggest a TACC of around 15–40 t is appropriate for the currently accessible stock. Applying the regional distribution of biomass reported by Worthington and Blount (Table 3.1) with TACCs of 15, 30, or 40 t gives Regional Catch Limits in Table 3.1. The regional allocation of the 2002 TACC (also given in Table 3.1) differed very slightly from the biomass distribution reported by Worthington and Blount for unknown reasons. We have applied the Worthington and Blount proportions here but accepted the 2001 Committee's proposition that no catch should be taken from Region 5 given the very low biomass there.

Reducing the existing TACC of 60 t to values of the order given in Table 3.1 is due to accounting for the suggested reductions in stocks through persistent low-level harvest over the last 16 years and for the reduced area accessible to the fishery through what effectively are indefinitely closed areas rather than a system of rotational harvesting closures envisaged by the Committee in 2001. The catch giving 50-75% depletion in open compared to closed areas broadly supports the original basis (MSY) for TACC determination. There is some component of this reduction due to introduction of MPAs and other non-fishery closures since 2001, which is a permanent reduction in the area accessible to the fishery.

Table 3.1. Regional distribution of biomass (Worthington and Blount) and Regional Catch Limits (RCLs) associated with the 2001 TACC (Top), RCLs consistent with the original biomass distribution under alternative prospective TACC settings (Middle), and minimum, maximum, and average annual catches reported from each of the Regions during 2002–17 (Bottom).

Worthington & Blount	**Regional Biomass Estimates (t, proportion)**				
	Region 1	**Region 2**	**Region 3**	**Region 4**	**Region 5**
Biomass (SE) t	154 (118)	517 (174)	265 (153)	252 (119)	7 (5)
P^n of Total	0.129	0.433	0.221	0.211	0.006
2002-18 TACC	**Regional Catch Limits (t, proportion)**				
	Region 1	**Region 2**	**Region 3**	**Region 4**	**Region 5**
TACC = 60 t	8.0	28.0	13.0	11.0	0
P^n of TACC	0.133	0.467	0.217	0.183	0
Prospective TACCs and RCLs (t)					
15	2.0	6.5	3.3	3.2	0
30	4.0	13.0	6.6	6.4	0
40	5.2	17.4	8.9	8.5	0
Reported Catches 2002–17 (t)					
Minimum	0.4	1.1	0.0	0.4	0.00
Maximum	6.0	10.6	4.7	6.7	0.15
Mean	1.9	4.1	1.4	2.1	0.01

A properly managed rotational harvesting strategy would increase the sustainable harvest available to the fishery by allowing more of the resource to be harvested over time. Such a strategy would hinge on establishing robust, evidence-based criteria for opening and closing areas to yield sustainably increased harvest. Such a scheme needs to maintain good stock abundance on average across the rotation zones and rotational harvesting should not be attempted without proper development of such criteria and appropriate catch and stock monitoring. Widespread use rotational harvesting in the absence rigorous design and monitoring could erode quickly the protection offered by the current indefinite area closures.

3.4 Management Implications

It is desirable to have a TACC aligned with what is biologically sustainable from the fishery accessible red urchin resource. That outcome, however, will mean considerably lower TACCs (15–40 t) than that in place for 16 years (60 t). A low TACC under current management, with red urchin remaining part of the multi-species SUTS fishery, would flow into low allocations for each endorsement holder. TACCs of 40 t or 15 t would deliver individual quota allocations to each fishing business of 1.08 t or 0.41 t respectively. Both are material reductions from the current ITQ of 1.622 t. There currently is no transparent or efficient quota trading scheme, so it is unlikely that trading could be effective for active operators to obtain quota from the majority of SUTS businesses that don't harvest red urchin. These conditions mean TACC reductions likely will affect active red urchin fishers disproportionately and arguably inequitably.

The above issues, and those elaborated in the following sections, indicate that there needs to be significant management changes to enable a TACC and ITQ system to operate effectively, equitably, and efficiently in the red urchin fishery.

3.5 Conclusions

There is a reasonable basis for inferring that the current TACC with the current Regional Catch Limits are sustainable for red urchin at the whole-of-population level because of the large proportion of the stock expected to be in areas closed to fishing. The current TACC and the RCLs, however, are much greater than what will be biologically sustainable if they are realised from just the areas open to fishing. A key risk of these settings is that there is no obstacle to excessive, potentially serial, depletion in the open areas if the market or other factors provoke endorsed businesses to seriously attempt to take the current TACC. Such a situation is unlikely to threaten the presence of red urchins in NSW because of the populations protected in closed areas but certainly would render continued fishing unviable and unsustainable, with serious economic and social consequences for fishers.

There is longer-term scope to increase red urchin harvest sustainably from that strictly appropriate for the fishable stock if a reliable system of rotational harvesting could be introduced. That will not happen quickly, however, and should not be done precipitously. Implementation failure in such a scheme would pose biological risks that could unfold very quickly and affect the entire NSW stock.

4. ECONOMIC CONSIDERATIONS

4.1 Introduction

The SUTS fishery is managed through a combination of input controls for all species and individual quotas for red urchin (only). Thirty seven SUTS endorsement holders each have received a red urchin quota allocation of 1622 kg (equal share of 60 t TACC) each year since 2002. The quota is not separable from the SUTS licence, so transfer of quota requires purchase of the full fishery entitlement. Temporary quota transfer (via leasing) is permitted and is divisible (i.e., part of the full ITQ can bee leased).

Catches in the SUTS fishery are dominated by purple urchin (*Centrostephanus rodgersii*), which are managed through limited entry only. Most of the fishing activity for purple urchin takes place during warmer months, with red urchin targeted mainly in cooler months. Fishers advise that purple urchins are of lower value ($/kg) than red urchins, although the higher abundance and broader distribution over greater depths make it more attractive to target and market. Red urchins occur mainly in very shallow near-shore waters, making fishing more difficult and weather-dependent. Many SUTS endorsement holders also operate in the abalone fishery and harvest red urchin opportunistically if abalone are scarce in some dives.

The low quantities of red urchin landed makes processing for export unviable, despite a strong international market for urchin roe and the fishery having export trade approval. The Japanese market is considered very competitive and also has good quality local product available, making prices in Japan generally not worth the processing and transportation costs from Australia. The fishery therefore almost exclusively supplies domestic markets either through direct sales to restaurants or sales through the Sydney Fish Market (SFM). The quantities sold through each outlet are not available.

4.2 Volume and Value of Production

The value of the SUTS fishery overall is uncertain as prices and landings data of other species was not provided. The most recent data from ABARES[2] suggests that the SUTS fishery may have had a Gross Value of Production (GVP) of $608,000 in 2015–16 (indexed to 2017–18 dollars), but that value includes beachworms. The value of red urchins was estimated to have been $128,200 in 2017 (based on SFM prices), and $113,910 up to September 2018. These figures suggest that red urchin catch contributes around 20% of the total value of the SUTS fishery.

Catch of red urchin has fluctuated over 5–19 t since the 60 t TACC was introduced in 2002 (Figure A4.1). Real prices on the SFM over the same period (in 2018 dollars) has tended to increase. Information provided by industry suggest that the SFM prices may underestimate sale value, with several fishers claiming that they currently are receiving more than $10/kg, some up to $14/kg.

Figure 4.1. Changes in catch and real prices for red urchin 2002–2018.

The relationship between quantity supplied and price in in Figure 4.1 suggests that catch responds to price rather than price responding to catch. This is consistent in areas where the price is driven by other factors, such as availability of competing products and exogenous shifts in demand (such as introduction of a new processor and growing restaurant demand). A simple econometric estimate of this relationship

[2] ABARES, 2017. Australian fisheries and aquaculture statistics 2016. Australian Bureau of Agricultural and Resource Economics and Sciences, Canberra.

of the form $\Delta \ln Q = \beta_o + \beta_1 \Delta \ln P + \varepsilon$ allows an estimate of the short term supply response to price changes (Table 4.1). Only data from 2006 were used, as the temporary spike in price in 2004 and 2005 was unexplained. The short term supply elasticity was estimated to be almost 2 (Table 4.1), which suggests a 1% change in price would result in a 2% change in landings, consistent with what might be expected in an opportunistic fishery with substantial excess capacity.

Table 4.1. Short term supply elasticity in the red urchin fishery (2006-2018)

	Coefficients	*Std Error*	*t Statistic*	*P-value*
Intercept	-0.047	0.137	-0.343	0.739
Change in price	1.984	0.855	2.321	0.043
F	5.385			0.043
Adj R Square	0.285			

4.3 Fishing Activity

Activity in the fishery (number of endorsements landing red urchin) has varied since quotas were introduce in 2002 (Table 4.2), again consistent with an opportunistic fishery. Both the number of operators and their fishing effort have increased since 2015, however, consistent with a supply response to the price increases noted above.

Table 4.2. Fishing activity for red urchin 2002 to 2018

Year	Catch (t)	Effort (hrs)	Catch rate (kg/hr)	No. of businesses	% endorsements	Hours per endorsement
2002	11.7	293	40.0	6	15%	48.8
2003	10.8	437	24.7	9	23%	48.6
2004	5.4	210	25.8	11	28%	19.1
2005	5.9	221	26.6	14	36%	15.8
2006	5.3	143	37.0	9	23%	15.9
2007	17.5	199	87.7	8	21%	24.9
2008	12.9	187	69.3	8	21%	23.4
2009	8.5	217	39.0	12	31%	18.1
2010	5.9	153	38.7	9	23%	17.0
2011	6.6	142	46.2	9	23%	15.8
2012	6.7	143	47.0	8	21%	17.9
2013	5.5	168	33.1	9	23%	18.7
2014	4.7	134	35.3	8	21%	16.8
2015	7.5	199	37.9	9	23%	22.1
2016	18.1	573	31.6	11	28%	52.1
2017	19	756	25.1	16	41%	47.3
2018[a]	14.8	513	28.8	12	31%	42.8

[a.] to the end of August 2018

Catch rates peaked in 2007 and generally have declined since then. The large increase in catch rate in 2007 was not accompanied by an increase in fishing effort, suggesting it is price rather than catch rate that drives effort in the fishery. Catch rates have declined by an average of 1.7% a year since 2009.

4.4 Economic Performance Indicators

There are no independent economic performance indicators for the fishery. Quota leasing has ranged from 1.6 t to 8.2 t over the period 2009–2018, although the lease price is unavailable. Permanent transfers are not possible except through transfer of the full endorsement. The average value of a transferred endorsement was $12,500 in 2017, although this reflects the value of the full SUTS endorsement, not just the red urchin component.

4.5 Management Cost Recovery and Community Contribution

Cost recovery charges relate to the full endorsement, not just the red urchin component. An amount of $1169 per participant in the SUTS Fishery has been levied for the 2018–19 financial year, the maximum permissible under the current regulations. There is no community contribution from the fishery.

4.6 Economic Targets and Performance Indicators for the Fishery

There are no specified economic targets or performance indicators for the fishery. The initial TACC was set on the basis of the estimated maximum sustainable yield.

4.7 Conclusion

The red urchin fishery is a subset of the larger SUTS fishery. Red urchin harvest, as a result, largely depends on activities in the broader fishery for most endorsement holders. The fishery seems to be highly responsive to price, with catch increasing as price increases. Price, in turn, seems largely driven by external factors.

The quota fishery has not been able to adjust as well as it might due to the lack of divisibility and transfer of the red urchin quota independently of the SUTS endorsements. Fishers who are not interested in catching red urchin are not able to transfer just that component of the endorsement to other fishers who may be better placed to take the quota. This inability to separate red urchin quota from the general SUTS endorsement has constrained the ability for fishers wishing to increase their catch of red urchin quota to obtain sufficient quota. The few fishers who depend materially on red urchin need to purchase an entire endorsement to increase their harvest potential permanently, effectively buying out an entire fisher even though only part of the endorsement is needed. Leasing red urchin quota each fishing period is an option but this does not allow full adjustment in the fishery and is difficult because there is no public market mechanism by which to access unused quota. The SUTS fishery is a restricted fishery and so has no share register and privacy provisions restrict access to information about who holds endorsements, so limiting access to quota that potentially might be available for lease.

This quota market inflexibility potentially has severe economic consequences for the current sub-set of fishers who are engaged in harvesting red urchin. A red urchin TACC reduction would apply to all endorsement owners equally but have very different consequences for those who harvest red urchin and those who don't. There will be little or no effect of a changed TACC on the majority of SUTS endorsement holders who do not fish red urchin. A reduced TACC, however, will reduce, potentially substantially, the access of active red urchin fishers to the resource, even thought the TACC might not be landed by the fishery. Those fishers would need to either buy-out other fishers' SUTS endorsements in full or discover and lease unused quota for each fishing period to maintain their current income, even within a reduced TACC. Leasing quota will be difficult in the current absence of a transparent trading mechanism and having to purchase SUTS endorsements will incur a financial burden disproportionate to the value of red urchin quota for no efficiency gain in the fishery.

A fundamental requirement for an effective ITQ system is divisibility and a well-functioning quota trading market. The absence of these characteristics for the red urchin harvest means that reductions in the TACC for prudent management of the red urchin stock will result in substantial difficulties for fleet rationalisation and autonomous adjustment in the fishery.

The Committee recommends that Industry and the Department resolve a strategy to allow permanent quota transfer other than through purchase of an entire endorsement and implement a transparent and effective quota trading facility.

5. MANAGEMENT CONSIDERATIONS

5.1 Current Management Arrangements

Commercial Fishing

The commercial harvest of red sea urchins is managed as part of the Sea Urchin and Turban Shell Restricted Fishery (the SUTS Fishery) in NSW. The SUTS Fishery is a declared restricted fishery under Division 1 of Part 9 of the Fisheries Management (General) Regulation 2010 and pursuant to section 111 of the Fisheries Management Act 1994. The SUTS fishery is managed by a combination of input and output controls.

Access to the SUTS Fishery is limited to fishing business owners that are eligible for an endorsement authorising the take of three species of sea urchin (purple urchin *Centrostephanus rodgersii*, red urchin *Heliocidaris tuberculata*, green *urchin H. erithrogramma*) and three species of turban shell (Sydney turban shell (*Turbo torquatus*, military turban shell *T. Militaris*, and green turban shell *T. undulatus*). Urchins are harvested commercially by fishers using underwater breathing apparatus or freediving using a hook.

Only one person is eligible for an endorsement in respect of each fishing business but each business owner can nominate another licensed commercial fisher to operate the endorsement in a single fishing period. There currently are 37 fishing businesses with endorsements to operate in the SUTS Fishery, with 26 of those fishing businesses reporting catch in 2017 and 12 reporting landings of red urchin.

An annual Total Allowable Commercial Catch (TACC) is applied only to the harvest of the red urchin. The TACC for red urchins is determined by the Total Allowable Fishing Committee (the Committee), formerly the Total Allowable Catch Setting and Review Committee. The Committee last reviewed the TACC in 2001 and set a TACC for 2002 of 60 tonnes (t) which has not changed since.

The TACC is divided equally between all licence holders in the SUTS Fishery and the resulting individual quotas are allocated at the beginning of each fishing period (currently January 1–December 31 each year). The current TACC of 60t equates to 1622 kgs per licence. These quotas are not unitised, however, and are not transferable separately from the SUTS licence on which they are an endorsement. This dependency represents a material constraint on the trading of quota for red urchin when an endorsement holder fishes for other SUTS species and does not want to transfer the entire endorsement, even though they might not be harvesting red urchin.

Fifteen SUTS fishery spatial closures applied in 1994 remain closed and additional exclusions for marine parks (MPAs, 5), Aquatic Reserves (ARs, 12), and Intertidal Protected Areas (IPAs, 9) have been effected since. The Regional Catch Limit of zero for Region 5 set in the 2002 (below) also still applies and encompasses some of the 1994 closures. These closures collectively exclude SUTS harvesting from approximately 1/3 of the NSW coast and probably about a similar amount of red urchin habitat.

Recreational

Recreational fishers are subject to a bag limit of 10 sea urchins (all species combined), and bag and size limits exist for all species of molluscs (including turban shell), with a limit of 20 of any species or combination of species. Recreational harvest of sea urchins is not known but is estimated at less than 5 t.

Aboriginal

Aboriginal fishers are subject to the same limitations as recreational fishers when taking red urchins. There are no additional possession limits for red urchins under the NSW Aboriginal Cultural Fishing Interim Access Policy. There have not been any cultural fishing permits sought to take red urchins.

5.2 Decision-making Framework

There is no management plan for the fishery that guides decision-making. There also is no resource allocation mechanism or policy that applies.

5.3 History of the Fishery's Management

The commercial fishery is divided into 5 Regions and numerous Zones and Sub-zones within Regions. The Committee in making its determination in 2001 (for 2002) reported that while no formal management plan was in place for the fishery, the objectives that fishery managers articulated for the fishery were:

- To develop the fishery in a controlled manner
- To prevent localised over-fishing; and
- To develop an understanding of the resource.

That Committee set an annual TACC of 60t allocated to the five fishery Regions in proportion to their estimated biomass: Region 1 – 8 t, Region 2 – 28 t, Region 3 – 13 t, Region 4 – 11 t, Region 5 – zero.

The Committee also recommended that the existing spatial closures in each Zone set in 1994 be retained to protect a portion of the stock, prevent localised overfishing, and facilitate understanding of population dynamics, and that other, heavily fished areas be accessed and closed alternately on a rotational basis.

Four previously closed sub-zones in Regions 3 and 4 were opened to fishing in 1999–2000 and three heavily-fished sub-zones were closed to fishing in 2002 and reopened to fishing in 2007, consistent with the 2001 Committee recommendation, but no other rotations have been applied. The original 1994 closures, and subsequently declared MPAs, IPAs, and ARs have remained in place, excluding fishing from approximately 1/3 of potential SUTS fishing ground.

Catch is reported for the five SUTS Regions but no Regional Catch Limits for red urchins have been reached since 2002 and, accordingly, no enforcement of them has been required. Red urchin catches overall since 2002 have been only 7.8–31.7% of the TACC[3].

The catch of red urchins peaked at a catch of 85.5t in 2001, immediately prior to the 2002 TACC, when some processors and a small number of fishers made a dedicated effort to establish an export market for red urchin roe. Those ventures failed, however, and catches since generally have been extremely low — limited by the lack of a market, the difficulty of physically harvesting red urchins (which are most abundant in very shallow water), and inflexible management arrangements that have limited quota trading.

5.4 Compliance

Compliance data are available only since 2010 and only for the SUTS fishery as a whole. Compliance rates were reported to be 100%, 67%, 45%, 83% and 63% in 2010–15 respectively[4] and 33.3%, 23%, and 40.5% in 2015–17[3]. The Fisheries Compliance Unit have provided advice that red urchins do not represent a compliance risk, however, and that most offences are minor even for the whole SUTS fishery.

5.5 Fees

The fees that can be levied for licence holders in a restricted fishery are capped under the regulations. Each licence holder therefore has been levied the maximum amount possible, $1169, for 2018–19.

5.6 Recommendations for Review of Management Arrangements

The commercial red urchin fishery is currently under-developed. It is limited by a number of factors:

- Red urchins generally occur in shallow waters of <6m depth and therefore are difficult to harvest;
- Management arrangements are inflexible and inhibit adjustment within the fishery; and
- There is no easily accessible market or mechanism for trading quota, meaning a lack of incentive to invest in market development.

There is a small number of fishers that target the species on a part-time basis and a few for whom the fishery is a major source of income. Some of these fishers have been involved in the fishery long term and have been a part of earlier attempts to develop the fishery. Some have expressed a desire to develop the fishery in the future but also express frustration at the difficulty in acquiring additional quota either through endorsement purchase or lease. The TAC Committee in 2001 noted that the SUTS fishery is a niche fishery that was likely only ever to provide sufficient catch and income to support a small number of dedicated fishers. It is desirable that the quota rights to the fishery consolidate to a much smaller number of licence holders who regularly target red urchin, either as a primary or important ancillary catch.

The Committee recommends that the management arrangements for the fishery be reviewed. Consideration should be given to making red urchin quota transferable separately to the SUTS licence to which is is attached to enable rationalisation of the red urchin catch to a smaller number of entitlement holders. The review also should ensure effective monitoring and regulation of Regional Catch Limits and development of a systematic, planned rotational closure strategy as a key management tools to optimise outputs from the fishery, as recommended in 2001.

Review of the management regime for red urchin also should include setting a Legal Minimum size Limit (LML) to prevent the harvest of immature individuals. The primary product from urchin fisheries is the

[3] McKinnon. F. 2018. Management Report – NSW Red Urchin Fishery Report to the TAC Committee for the 2019 Fishing Period

[4] NSW Pepartment of Primary Industries. *2015. Assessment of the NSW Sea Urchin and Turban Shell Fishery - Prepared for the Department of the Environment for the purpose of assessment under Part 13 and 13(A) of the Environment Protection and Biodiversity Conservation Act 1999*

mature roe, meaning that harvest of immature urchins is a pointless waste of resource potential. Biological information from which to establish a science-based LML was not available to the Committee but industry representatives stated that red urchins were mature at approximately 110–115 mm test diameter. The Committee therefore recommends setting an initial LML for red urchin of 115 mm test diameter. Research should be commissioned to verify whether this is a limit appropriate to protecting individuals until they have had at least some opportunity to reproduce before entering the fishery.

5.7 Total Allowable Commercial Catch

The limitations of the current management arrangements for the SUTS fishery in general and the red urchin harvest in particular mean the Committee is faced with the difficult task of setting a TACC and associated provisions that both protect the red urchin stock from over-exploitation and also ensure procedural and economic fairness for fishers within the currently constrained management arrangements.

The stock status section of this report sets out the biological reasons that the TACC ideally would be set in the range 15–40 t, which would equate to harvest levels biologically appropriate to the part of the fishery that is open to fishing.

That preferred TACC is significantly less than the 60 t that was set in 2001, and has remained in place for the last 16 years. The original TACC was set on the expectation that most of the stock would be available to the fishery over time under rotational area closures. Such rotation has never been implemented, however, despite extensive SUTS fishery closures being declared since 1994. The preferred TACC now would be set on the expectation that those areas currently closed to the fishery will remain so at least in the short term and given limited evidence of the status of the red urchin populations in those areas open to fishing. There seems little reason for concern with the biological status of the entire stock at current catch levels given that approximately 1/3 of the stock is expected to be within closed areas and totally protected from fishing, potentially indefinitely.

The current requirement that a TACC for red urchin is allocated evenly among licence holders and the limited opportunity to transfer quota, however, means that reducing the TACC would see reduction in each and every licence holder's allocation from the current 1.622 t to as low as 0.41 t. Existing conditions mean that such a cut would constrain disproportionately the most active fishers, who will have little opportunity to acquire additional quota to meet their current catches, even though the current total catch is less than 20 t. This is unfair as it would reduce materially the catches of active fishers and have no impact on those that do not take red urchin but would continue to hold quota and might not wish to transfer their SUTS endorsement. Restricting those active fishers who are most likely to develop the fishery would be perverse and would create further disincentive to invest.

The Committee therefore will set this Determination with two dependent and necessary components. The first will be to maintain the TACC at 60t to secure the fair allocation of ITQs to active fishers under the current 'flat' allocation system. The second component will require Regional Catch Limits (RCLs) that total 30 t and reflect the prudent total catch that should be harvested safely from each Region, and collectively over all the fishery-available stock, based on the limited data available. These two components ideally would be equal overall but in this Determination will differ because the biologically prudent setting, through RCLs, is less than the TACC required to allow fair access to the fishery in the absence of an effective quota trading system. The total harvest from the red urchin stock should be enforced to remain below the less of these two settings (30 t).

The Committee understands that there has been no enforcement of existing RCLs but emphasises that procedures should be implemented immediately to realise the intent of this determination whilst management arrangements for the fishery are being revised to make more effective the operation of a TACC and ITQ system for red urchin fishing.

6. CONCLUSION

6.1 Summary

There is very limited information from which to infer the status of the red urchin stock in NSW. Annual total catches since the current TACC of 60 t was set in 2002 have been less than 20 t, and mostly less than 10 t. Catch rates have varied considerably without conspicuous relationship with catch but are likely to be uninformative about stock status because of the multi-species nature of the fishery and the fact most SUTS endorsement holders are primarily abalone fishers and take red urchin as incidental catch.

Protection from fishing of approximately 1/3 of red urchin habitat likely means that the overall stock is robust to current harvest rates (about 9.5 t pa) and potentially to the unrealised current TACC (60 t). That TACC is not biologically appropriate for ensuring sustainable harvest of red urchins in the areas available to the fishery, however, notwithstanding the preservation of significant populations beyond the reach of the fishery. A biologically more appropriate TACC under current conditions would be in the range 15–40 t. Setting such a TACC alone, however, would have inequitable consequences for SUTS endorsement holders given existing management provisions that inhibit access to adjustment mechanisms for those fishers who depend on income from red urchin harvest.

There is some longer-term scope to increase the biologically sustainably harvest from that strictly appropriate for the currently fishable stock if a reliable system of rotational harvesting could be introduced. That will not happen quickly, however, and should not be done precipitously. Implementation failure in such a scheme would pose biological risks that could unfold very quickly and affect the entire NSW stock.

The harvest of red urchin as the only species with a TACC within the multi-species Sea Urchin and Turban Shell (SUTS) restricted fishery presents therefore several challenges for setting a TACC under current management arrangements. Three key properties of existing management severely constrain the operation of TACC-ITQ instruments for red urchin:

1. The uniform distribution of a TACC among SUTS endorsement holders;
2. Binding of the resultant ITQs to the multi-species SUTS endorsement with consequential prevention of medium–long term rationalisation of red urchin quota without corresponding consolidation of SUTS endorsements, at inflated cost to red urchin fishers; and
3. The absence of any transparent endorsement or trading mechanism, analogous to the share registers present in share managed fisheries.

These conditions precipitate an inherent tension between setting a TACC based primarily on stock status and productivity and economic inequities that flow from changes in TACC because of the obstacles to market optimisation of ITQs. A TACC-ITQ system will operate optimally and equitably only if quota can be traded efficiently both within fishing periods (via lease) and in the long term through transfer of quota ownership. The absence of these features means that changes in TACC will impact disproportionately fishers depending on red urchin catch but not affect at all those who do not harvest red urchin but nevertheless will retain quota.

6.2 Total Allowable Commercial Catch for 2019

A compromise strategy is needed to balance the need to regulate harvest of the fishable stock prudently whilst protecting against inequitable economic effects of a sharply reduced TACC. The Committee therefore has decided to set this Determination with two essential and dependent components:

1. Retain a notional TACC of 60 t in the interests or securing fair and reasonable ITQ allocations to those who depend on red urchin harvest; and
2. Set Regional Catch Limits (RCLs, Table 6.1) that total 30 t and provide reasonable biological protection to the stock if they were realised.

Harvesting of red urchin should cease in any single Region when the relevant Regional Catch Limit is reached and the fishery should close for the fishing period if the overall sum of RCLs reaches 30 t, notwithstanding the 60 t notional TACC.

This two-fold Determination will mean that the sum of RCLs (30 t) will be less than the notional TACC. The mismatch between the TACC for ITQ allocation purposes and the harvest limits imposed by RCLs should be seen as an interim measure whilst management arrangements for the red urchin fishery are amended to enable efficient internal adjustment of quota holdings through a transparent leasing and permanent quota trading system. Satisfactory implementation of such changes will allow the alignment of

TACC and RCLs with the knowledge that fishers will be able to realise their economic aspirations as expected in a properly functioning TACC-ITQ system.

The stipulated Regional Catch Limits (Table 6.1) are a sensible balance of the range of options (15–40 t) that might be biologically appropriate to harvest of the fishery-available stock, given uncertainties in the available data, and also do not constrain harvests below what has been taken since 2002.

6.3 The Determination

The Total Allowable Fishing Committee, pursuant to Division 4 of Part 2 of the Fisheries Management Act 1994, determines that the commercial catch of red urchins in the NSW SUTS Restricted Fishery should be controlled by two essential and dependent instruments:

1. A notional Total Allowable Commercial Catch of red urchin during the period 1 January 2019 to 31 December 2019 of **60 tonnes;** and
2. Regional Catch Limits per Table 6.1 that collectively total, and should not exceed, **30 tonnes.**

These two instruments of this determination should be seen as required and inseparable for the 2019 fishing period.

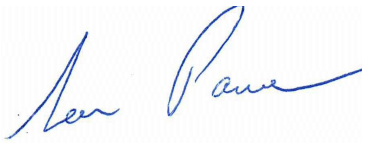
The Committee expects that the Department, in consultation with industry, to manage the fishery to achieve the recommended spatial distribution of catch in support of the above Determinations.

Table 6.1: Regional Catch Limits for red urchin during the 2019 fishing year.

Region	2019 Regional Catch Limits (t)
1	4.0
2	13.0
3	6.6
4	6.4
5	0
Total	**30**

Bruce Mapstone, Chair

Kelly Crosthwaite, Fisheries Management



Sean Pascoe, Natural Resource Economist

Keith Sainsbury, Fisheries Scientist

APPENDIX 1. DETAILS OF PUBLIC CONSULTATION

Public consultation steps taken by the Committee, with support from the Department, are summarised in the table below. These steps effected the consultation requirements stipulated, *inter alia*, in the *Fisheries Management Act 1994, Part 2a, Division 2, S40.*

Date	Fisheries Management Act Reference	Consultation Stages
04.09.2018	Section 40F(1)	Committee called for public submissions on the appropriate level of the annual TACC for red urchins for 2019 fishing period.
04.09.2018	Section 284 (1b)	Individual calls for submissions sent to particular interest groups who the Committee considered might wish to provide collective submissions either due to their direct involvement in the Sea Urchin and Turban Shell (SUTS) Restricted Fishery or their interest in related issues. These groups included: ■ NSW SUTS Fishery Nominated Divers; ■ NSW Recreational Fishing Advisory Committee; ■ NSW Aboriginal Fishing Advisory Committee; ■ Professional Fishermen's Association.
12.09.2018	Section 284 (1b)	Advertisement calling for public submissions placed in the Sydney Morning Herald and the Daily Telegraph.
02.10.2018	Section 284 (1b)	Public consultation closing date, after at least 30 days.
28.09.2018	Section 40F (1)	The Committee received the following collated submissions: ■ NSW DPI – Commercial Fisheries Management Report; ■ NSW DPI Red Urchin Assessment Report; No submissions were received from either NSW SUTS fishery endorsement holders, or other stakeholders by the due date but a written submission was accepted by the Committee at the Public Fourm.
11.10.2018	Section 40F (2)	The Committee considered submissions and heard formal presentations and opinions at the Total Allowable Fishing Committee Open Forum meeting in Sydney on 11 October 2018. The following made presentations or provided information to the Committee: ■ Mr Nicholas Giles (Management) ■ Ms Fiona McKinnon, NSW DPI Management Report ■ Dr. Rowan Chick, NSW DPI stock status report; The following also attended the public forum: ■ Mr Mick Arentz ■ Mr Timothy Blunden ■ Mr Stephen Bunney; ■ Mr Greg Finn; ■ Mr Ryan Morris; ■ Mr Gunther Pfrengle ■ Mr Greg Ryzy ■ Mr Craig Sheppard ■ Mr John Smythe

APPENDIX 2. SUMMARY OF SUBMISSIONS

One submission was received from a SUTS fishery endorsement holder at the Public Forum on October 11 and accepted by the Committee as a late submission. The submission was considered confidential and identification of the author has been withheld from the Report and Determination.

Submission from	Summary
SUTS endorsement holder	Suggested TACC of perhaps 20-25 tonne. TACC to be held by DPI or Industry (mechanism to be determined) as a 'pool' to be accessed by entitlement holders in 500 kg batches up to 2000kg - 2500kg individual limit. Fishing activities to be governed by an industry "Code of conduct" containing the following conditions. 1. All urchins in one box per outing to be counted and measured and recorded with box weight and logged using App to provide average weight. 2. Observe minimum 120 mm Minimum Size Limit. Randomly audit catches & revoke access to quota pool for that quota season for any fisher found failing to adhere to the Code of Conduct. The audit could be carried out by SFM staff, who currently QA Mud crabs. 3. Quota allocation available from June 1 to Nov 30 only to capitalise on optimum harvest period and provide substitute urchin to domestic market opposite peak purple urchin supply period of December–June. 4. Maintain current Area catch caps, or reduce caps if required. In summary, the active fishers gain access, rather than adding a value to non-active endorsements. Having a seasonal closure provides a level of resource protection accompanied by a code of conduct to reduce the numbers of urchins being taken to make up weights of bins. Domestic market doesn't suffer. The allocation in "batches" allows for a level of resource conduct, bearing in mind many port-specific fishers will only acquire what they can sustainably harvest. Cost recovery in a data poor fishery with minimal management and compliance can be achieved using the Industry Code of Conduct.