# Summary of Deliberations by a Task Group on West Coast Rock Lobster Recreational Telephone Survey Catch Estimates, and Implications of those Results

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On 22 June 2009 a Task Group (D. Butterworth, J. Glazer, K. Hutchings, F. Keulder, S. Johnston, D van Zyl) met to discuss the West Coast Rock Lobster telephone survey results for 2008/09 as well as for preceding years.

The service providers and the methods used to estimate catches from these surveys have changed over time. Appendix 1 summarises the methods. In simple terms, up to and including 2001/02 the method was based on estimating catch in each two week period from telephone survey results obtained immediately thereafter for that period, and then adding for all periods over the season. Subsequently, though surveys were conducted throughout the season, the estimate of total catch was based only on a question asked in the final survey on the number of lobster caught over the whole season. Total recreational catch estimates reported from these surveys are listed in Table 1.

Anchor (the current service provider responsible for the telephone survey) reported that there was an error in the method used for drawing the random numbers to be used to select permit holders to call for the telephone surveys which are conducted every two weeks (see MCM/2009/JUL/SWG/WCRL/13 for details). The correct method would be to draw the random numbers from **all** currently registered permit holders, i.e. those that had bought permits from the start of the season to the then current date. What had occurred (incorrectly) however, was that random telephone numbers were being drawn only from permit holders who had bought permits in the previous two weeks.

The Task Group confirmed that this error had occurred since 2003/04. Note that the service provider Enviro was responsible for surveys for the period 2003/04-2007/08. The 2003/04-2007/08 total catch estimates (see Table 1) have thus been produced using these "error" lists, instead of a correct fully "random" list. The error results in an appreciable negative bias in the estimates of total recreational catch for the season, as typically persons who purchased permits only towards the end of the season caught fewer lobster during the season as a whole than those who purchased their permits earlier.

The Task Group identified two possible methods to be used for correcting for this error.

**Method 1**
The error was detected shortly before Anchor completed the 2008/09 set of telephone interviews, so they fortunately had the opportunity to calculate the total catch estimate for 2008/09 using both the "error" list and the "random" list for their final survey, thus providing a scaling factor between catch estimates produced from the two methods. The rationale for this method is then to use this scale factor between the "error" method and the "random" method from 2008/09 to scale the Enviro estimates for the 2003/04-2007/08 period to adjust for the bias introduced by the error. The scale factor is $= \dfrac{243775}{121413} = 2.01$. Table 2 reports the 2003/04-2007/08 catch estimates when scaled upwards by this multiplicative amount.

**Method 2**
The Task Group also identified a further method that could be used to scale the incorrect 2003/03-2007/08 catch estimates. This method uses the Anchor 2001/02 and the Anchor 2008/09 catch estimates which were both estimated using the correct "random" list. The 2001/02 and 2008/09 catch estimates are however not completely comparable, as they are calculated slightly differently with the former being based on summation of the set of two-week period catch estimates, and the later based on permit holders from the last two-week period who estimate their total catch for the full season (see Appendix 1 for full details). Each method provides an estimate of the average number of rock lobster caught by a permit holder for the season (6.274 for 2001/02 and 6.093 for 2008/09), with the average over the two seasons being 6.184. The assumption made for Method 2 is that this average applies also to the intermediate seasons, for which an estimate of the total recreational catch is then obtained by multiplying this average (6.184) by the number of permits issued for the season concerned. The results are shown in Table 2.

**Relationship between total number of fishing days (season length) and total number of permits sold**
Figure 1 shows the relationship between the total number of permits sold and the total number of fishing days (season length) for the 2003/04-2008/09 period. There is no obvious correlation.

**Relationship between total catch estimate and total number of permits sold**
Figure 2 shows the relationship between the number of permits sold and the total catch estimates using either Method 1 or Method 2 for the 2003/04 -2008/09 period.

## IMPLICATIONS

[Note: These are the views of the authors of this document, and do not necessarily reflect the views of all members of the Task Group.]

Figure 3 plots the time series of recreational catch estimates since the 1991/92 season. For the period from 2003/04 onwards, the "incorrect" results are shown together with the estimates provided by the two correction methods.

Even were the methods used to adjust the 2003/04+ estimates exact, the results are not exactly comparable methodologically to those for the earlier period. Nevertheless similarity of the overall number of lobsters caught per permit holder for the 2001/02 and 2008/09 seasons suggests that the effect of this lack of exact comparability is small.

The broad impression from Figure 3 is that rather than an appreciable reduction in annual recreational catch since the turn of the century as the "incorrect" survey results from the Enviro analyses had seemed to suggest, this catch has remained about the same (Method 1) or dropped only slightly (Method 2). This has important management implications (see Appendix 2). Note also the arguments in that Appendix regarding the possibility of bias in these estimates and their implications for TAC advice: an unchanging bias over time is of little or no consequence, particularly if the magnitude of the catch has remained roughly constant. What is important however, is if the catch shows a trend over time, especially recently.

Figure 4 plots the ratio of total catch per permit holder over time. This is important because the main management measure used with the intent of reducing or increasing recreational catch is season length. Table 3 shows TACs set using the OMP over recent years, with its intended breakdown to offshore commercial, nearshore commercial and recreational users. For the 2007/08 season, the intended recreational allocation was reduced by 19.8% (from 320 MT) in terms of the OMP rules, given the deteriorating status of the resource. To effect this, the length of the season was reduced by about 20% (see Table 1). Figure 4 broadly suggests that this restriction has had an effect along the lines desired.

Table 1: Summary of recreational catch estimates as contained in telephone survey reports. Values in square parentheses show the 95% CI where available; the associated CV is given in round parentheses.

| Season | Analyst | Total Catch estimate (kgs) | Total Catch estimate (#s) | Mean *cpue* (lobsters/fisher/day) | $E_{total}$ (fisher days) | Total number of fishing days | Total number of permits sold |
|---|---|---|---|---|---|---|---|
| 1991/92 | DSI | **159 229/205 931** | 419 286/541 923 | | | 5 months (150 days) | 44 469 |
| 1992/93 | DSI | **469 257 (0.098) [379 550; 558 964]** | 1360 166 (0.098) 1100 146; 1620 186] | | | 8 months (240 days) | 59 202 |
| 1993/94 | DSI | **391 137 (0.058) [346 436; 435 839]** | 1133 731 (0.058_ [1004 161; 1263 301] | | | 6.5 months (195 days) | 57 590 |
| 1994/95 | DSI | **336 017 (0.070) [289 719; 382 316]** | 973 963 (0.070) [839 764; 1018 163] | | | 6.5 months (195 days) | 54 160 |
| 1996/97 | DSI | **495 617 (0.091) [407 434; 583 800]** | 1436 571 (0.091) [1180 968; 1692 173] | | | 5.5 months (165 days) | 65 617 |
| 1997/98 | DSI | **339 560 (0.066) [295 552; 383 568]** | 984 233 (0.066) [856 673; 1111 792] | | | 5.5 months (165 days) | 44 383 |
| 1998/99 | DSI | **258 264 (0.071) [222 543; 293 983]** | 748 591 (0.071) [645 054; 852 127] | | | 5.5 months (165 days) | 39 982 |
| 2000/01 | DSI | **314 169 (0.071) [270 679; 357 660]** | 910 636 (0.071) [784 577; 1036 695] | | | 146 | 47 063 |
| 2001/02 | Anchor | **336 964 (0.115) [261 088; 412 841]** | 976 708 (0.115) [756 776; 1196 640] | | | 91 | 53 704 |
| 2003/04 | Enviro | **135 053** | 391 459 | 3.03 | 129 409 | 78 | 55 077* |
| 2004/05 | Enviro | **156 408** | 453 358 | 3.17 | 143 015 | 107 | 28 902 |
| 2005/06 | Enviro | **275 063** | 797 285 | 3.07 | 259 702 | 99 | 47 325 |
| 2006/07 | Enviro | **162 092** | 469 833 | 3.38 | 139 004 | 108 | 34 245 |

| 2007/08 | Enviro | **170 676** | 494 713 | 3.17 | 156 061 | 80 | 42 177 |
|---|---|---|---|---|---|---|---|
| 2008/09 | Anchor (error list) # | **121 413 (0.15)** **[85 835; 150 436]** | 351 922 (0.15) [248 798; 436 047] | 2.17 (SE=0.13) | 111 217 (0.12) [83 235; 130 269] | 79 | 40 011 |
| 2008/09 | Anchor (random list) & | **243 775 (0.11)** **[197 001; 300 465]** | 706 594 (0.11) [571 017; 870 913] | 3.0 (SE=0.11) | 226 729 (0.091) [188 852; 270 208] | 79 | 40 011 |

*:Estimate is said to be based on previous three years – this value seems unlikely however, as it is bigger than all three previous seasons total number of permits sold???

#: 137 calls made at season end from ongoing fortnight "error list" provided by MCM that were selected only from permits sold during the preceding two weeks, as in the case of the 2003/04 to 2007/08 surveys.

&: 150 calls made after season end from a random selection of 1000 telephone numbers from all permit holders who took out a permit at some stage during the season

Table 2: Incorrect and alternative corrected total catch estimates (kgs) for the 2003/04-2008/09 period.

| Season | "incorrect" total catch estimate (MT) | Method 1 corrected values | Method 2 corrected values |
|--------|------------------------|--------------------------|--------------------------|
| 2003/04 | 135 053 | 271 456 | 340 596 |
| 2004/05 | 156 408 | 314 380 | 178 730 |
| 2005/06 | 275 063 | 552 877 | 292 657 |
| 2006/07 | 162 092 | 325 805 | 211 771 |
| 2007/08 | 170 676 | 343 059 | 260 823 |
| 2008/09 | 243 775 (correct) 121 413 (incorrect) | 243 775 | 243 775 |

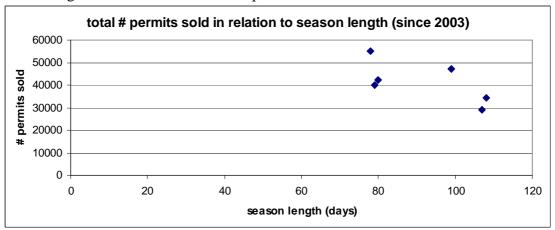Table 3: TACs calculated by OMPs for the commercial offshore, the commercial inshore and the recreational fishery since 2003.

| Season | Global TAC (commercial + recreational) | Offshore | Inshore | Recreational |
|--------|------------------|----------|---------|--------------|
| 2003/04 | 3238 | 2918 | - | 320 |
| 2004/05 | 3525 | 3205 | - | 320 |
| 2005/06 | 3195 | 2312 | 560 | 320 |
| 2006/07 | 2857 | 1997 | 560 | 300* |
| 2007/08 | 2571 | 1754 | 560 | 257 |
| 2008/09 | 2340 | 1632 | 451 | 257 |

* Not from OMP output (as distinct from global TAC); rather *ad hoc* assumption by Management

Figure 1: The total number of recreational permits sold each season in relation to the season length for the 2003/04-2008/09 period.
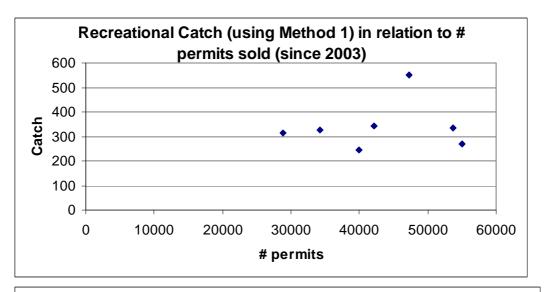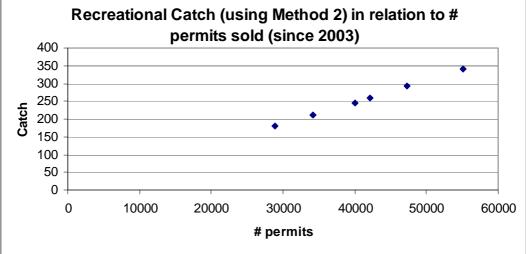
Figure 2: The total recreational catch estimate (MT) using either Method 1 or
Method 2 in relation to the number of permits sold for the 2003/04-2008-09 period.
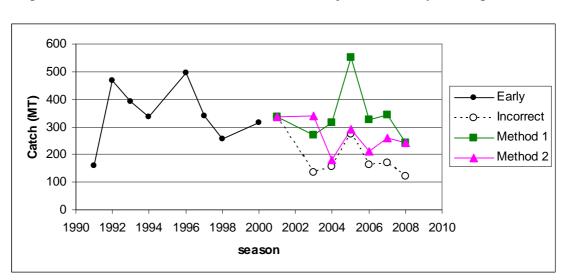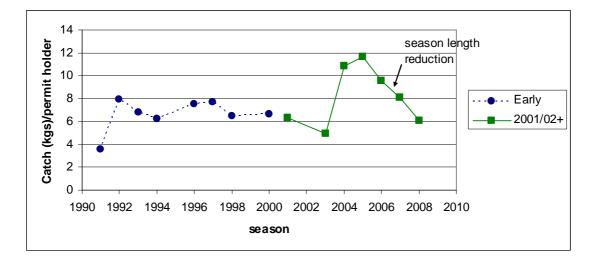
Figure 3: Time series of estimates of total recreational catch in MT from surveys over the period 1991/92 to 2008/09. Points are shown adjacent to first year of split season.



Figure 4: Catch (kg) per permit holder (Method 1 correction used for 2003/04 to 2007/08). Points are shown adjacent to first year of split season.

## Appendix 1: Summary of different methods used to calculate total recreational catch from the recreational telephone surveys.

### Period 1991/92 – 2000/2001

The telephone surveys during this period were conducted by Decision Surveys International. Note no surveys were conducted in the 1995/96 and 1999/2000 seasons. Each season was broken into two-week survey stages. The number of stages, number of interviews per stage, and total number of interviews is as follows:

|  | Number of stages | Number of interviews per stage | Total number of interviews |
|---|---|---|---|
| 1991/92 | 7 | 100 | 700 |
| 1992/93 | 17 | 70 | 1190 |
| 1993/94 | 14 | 70 | 980 |
| 1994/95 | 10 | 70 | 700 |
| 1996/97 | 12 | 70 | 840 |
| 1997/98 | 12 | 90 | 1080 |
| 1998/99 | 11 | 100 | 1100 |
| 2000/01 | 10 | 100 | 1000 |

Calculation of total recreational catch

| | |
|---|---|
| Total volume per stage | = number of permits sold x ave # lobster removed per person per fortnight |

Thus,

| | |
|---|---|
| Total volume per stage | = (# permits x total # lobsters removed by interviewees for that stage)/# of interviewees in the sample for that stage |

The total catch is then simple the addition of the catches over all the stages.

Estimate of variance associated with the total recreational catch estimate
The total recreational catch estimate is provided with the 95% confidence level (see Table 1). The method used to provide this CI is not specified in the reports.

### Period 2001/02

This telephone survey as conducted by Lara Atkinson of Anchor Environmental Consultants CC, Department of Zoology, UCT.

The season was broken down into six interview stages. A total of 1500 interviews were conducted. Stages 2-6 had 184 interviews conducted, and 580 interviews were conducted for stage 1.

<u>Calculation of total recreational catch</u>

Total volume per stage = (Adjusted number of permits sold x Total # of rock lobster removed for that stage)/# of interviewees sampled for that stage

where adjusted number of permits sold takes into the account that some for the fact that some permit holders may have purchased their permit at the start of the stage and had more time available to fish. The method employed was as follows:

Stage 1:
Dates for interviews 31 Jan-10 Feb; interview relating to period 22 Nov-31 Jan

$\qquad$ # Permit sales for Oct (280) + Nov (20 829 ) $\qquad$ = 21109

$+\dfrac{3}{4}$ #permits sales for Dec (24 941) $\qquad$ = 18705.75

$+\dfrac{1}{4}$ # permits sales for Jan (5190) $\qquad$ = <u>1297.5</u>

Stage 1 adjusted permits soled $\qquad$ = <u>41112.25</u>

Stage 2:
Dates for interviews 11 Feb-13 Feb; interview relating to period 2-3 Feb and 9-10 Feb

$\qquad$ Total permits sold during Stage 1 $\qquad$ = 50283

$+\dfrac{1}{2}$ difference of permits sold between Stage 2 and Stage 1 (50960-50283)/2

$\qquad$ = <u>338.5</u>

$\qquad$ Stage two adjusted permits sold $\qquad$ =<u>50621.5</u>

Figures for the other stages were adjusted in a similar manner.

<u>Estimate of variance associated with the total recreational catch estimate</u>
The total recreational catch estimate is provided with the 95% confidence level (see Table 1). The method used to provide this CI is not specified in the report.

## Period 2003/04 – 2007/08

For the period covering the 2003/04 – 2007/08 seasons, a telephonic survey was carried out by Enviro-Fish Africa (Pty) Ltd. The method used to estimate the recreational catch for each season is as follows.

The recreational catch season was broken up into two-week periods (there would thus be between 7-11 survey periods each season, depending on the season length). About 150 phone interviews were conducted for each sample period. [Note: It has subsequently been determined that these numbers were not selected at random from all permit holders at that time, as was the intention, but instead only from those acquiring permits since the time of the previous survey period.] The total number of interviews each season is:

$\qquad$ 2003/04 = 1502
$\qquad$ 2004/05 = 1054

2005/06 = 1644
2006/07 = 1498
2007/08 = 1336

During an interview, the person was asked about their lobster fishing in the previous two-week period. The person was asked how many days they fished, and the total number of lobsters caught during this period. Other questions were also asked e.g. from what area did most lobsters come from.

Calculation of total recreational catch

$$C_{total} = cpue \ x \ E_{total} \qquad (1)$$

where

$C_{total}$     is the total recreational catch in numbers

$cpue$     is mean CPUE (lobsters/fisher-day) over all four areal zones

$E_{total}$     is the total effort (fisher-days)

$C_{total}$ in numbers is converted to $C_{total}$ in kgs by multiplying numbers by 0.345kg.

Estimation of CPUE

Each person was asked how many lobsters they caught in the season ($C$) and how many fisher-days they used ($E$). A *cpue* for each person was then calculated as follows:

$$cpue = \frac{C}{E} \qquad (2)$$

These cpue values were averaged for each of four Zones (Zones A, B, C and D). A mean value across all four zones was then used in equation (1).

Estimation of fishing effort $E_{total}$

The estimation of fishing effort takes into account the increase in effort that occurs throughout the season – as recreational licences are sold throughout the fishing season, the number of fishers entering the fishery will increase as the season progresses. As such, the fishing effort is calculated individually for each sample period using the following equation:

$$E_i = \left(\frac{e}{fs}\right)P \qquad (3)$$

where

$E_i$     is the effort (in days) during survey period *i*,

*e*     is the effort recorded by the interviewees during the sample period (in days),

*fs*     is the number of fishers interviewed during the survey period, and

*P*     is the number of permits that have been issued at that point in the season.

$P$ is calculated as:

$$P = p_i + \left(\frac{i}{d_m} \ x \ d_s\right) \qquad (4)$$

where

$p_i$  is the number of permits that have previously been issued during the season,

$i$  is the number of permits issued in the month,

$d_m$  is the days in the month, and

$d_s$  is the number of days that are within the survey period.

Total fishing effort is then calculated as:

$$E_{total} = \sum_{i=1}^{n=10} E_i \qquad\qquad (5)$$

where

$E_{total}$  is the total seasonal fishing effort, and

$E_i$  is the fishing effort during the two weekly sampling periods.

Estimate of variance associated with the total recreational catch estimate

For each season, the analysts provide the mean for all respondents from the final sample period of how many lobsters they had caught over the whole season. The SD of this figure is provided for the last two seasons only, where for both seasons the number of interviews in the last stage was 149.

> 2003/04 = 11.54
> 2004/05 = 12.04
> 2005/06 = 9.8
> 2006/07 = 28 $\pm$ 23.8
> 2007/08 = 20.1 $\pm$ 15.5

Obtaining a standard error of the mean based on the number of interviews for the last two seasons suggests CVs for the total takes per respondent and hence the estimate of total recreational catch to be:

2006/07 = 0.104
2007/08 = 0.094.

**Appendix 2: MCM/2008/JUL/SWG-WCRL/08**

# IMPLICATIONS OF A NEW SURVEY ESTIMATE OF THE SIZE OF THE WEST COAST ROCK LOBSTER RECREATIONAL CATCH

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Apparently arguments have been advanced that the difference between the present recreational allowance from the TAC for west coast rock lobster and an estimate of the recreational take from, say, a recent telephone survey constitutes a "saving" that can be allocated to others without compromising the long-term sustainable use of the resource that is intended by the implementation of overall annual TACs output by the OMP adopted for the fishery.

Though attractively simple, this argument is in fact **NOT** correct, and it is important that the reasons why this is so are understood.

The quantities for past recreational catches that are used in calculations of the quantity of rock lobster that can be taken sustainably are of a different nature to the data used for the commercial catches. Whereas the latter are measured directly, recreational catch levels can only be inferred under certain assumptions, and are much less accurately known. When the OMP indicates a change, say a reduction, is needed, in terms of the existing agreed rules, to the allocation from the overall TAC to recreational fishers, this is not achieved by direct catch limitations on these fishers (which would be impractical to enforce). Rather it is effected by changing the duration of the season to an extent estimated to achieve the proportional change in their catch that is sought.

Consider a hypothetical example: say the past annual recreational catch had been taken to be 300 tons every year, and the overall TAC calculated under this assumption is 3000 tons, of which 2700 tons is allocated to commercial users. Then let us assume that a detailed survey of recreational fishers is carried out, and reveals that their catch has in fact been 150 tons every year, not the 300 tons assumed – i.e. a "saving" of 150 tons. Does this mean that the 150 tons "saved" can be added to the commercial fishers allocation without compromising long-term sustainable use of the resource? The answer is: **NO**. The reason is that if the calculations of the overall sustainable catch level were carried out with the corrected values of past recreational catch (down by 150 tons each year), the resultant TAC would no longer be 3000 tons, but very close to 2850 tons. This is because if past catches were lower than previously thought, it means that the resource is less productive than previous calculations indicated. The true "saving" achieved for re-allocation to the commercial fishers would in fact be virtually zero.

Table 1 details the time series of past recreational catches that are used at present when calculating levels of long-term sustainable yield for the west coast rock lobster resource. Note that for many of the years concerned, the value shown is purely an assumption without even an associated survey that year. Though the situation is not as simple as in the example given above, in broad terms the implications are the same. Say a telephone survey was to indicate that the 2007 recreational catch was 157 tons instead of the 257 tons indicated in the Table. This does **NOT** mean that there is therefore 100 tons of TAC "saving" available for re-allocation. The actual "saving" is not necessarily exactly zero – careful further analysis would then be needed to calculate this – but it is likely to be appreciably less than to the "apparent saving" of 100 tons.

A key reason that inferences about a "saving" are not straightforward in this situation is that such a reduction in the estimate of recreational catch for 2007 would necessarily mean that the crude estimates for preceding years from 2001 (at least) would have to be revised downward as well (unless there was independent evidence of a marked decrease in recreational effort over this period). This in turn would lead to a lower estimate of recent resource productivity and hence lower overall TACs. Furthermore, although a current telephone survey would give an absolute estimate of catch, in the same way as the surveys a decade back in time, for many reasons such a new survey would not be exactly comparable to previous exercises, so that appropriate adjustments for differences would need to be developed.

The bottom line is that should a direct estimate of the recent level of recreational take become available, and this is found to be less than the portion of the TAC allocated to recreationals, that would **NOT** mean that the difference between these two numbers can be automatically allocated to others without compromising sustainability. If such action is to be considered, the matter needs to be referred back to the SWG to undertake an analysis to determine the size of such an amount (which will likely be appreciably less than the difference between the past assumed and newly estimated level of recreational catch).

Table 1: Estimates of annual recreational catch used in assessment of sustainable level of catch from the west coast rock lobster resource. Note that 1992 refers to the 1992/3 season. It is assumed that the recreational catch increased linearly from zero in 1959 to the level shown for 1992,

| Season | Recreational Catch (MT) | Source |
|--------|-------------------------|--------|
| 1992 | 469 | Telephone survey |
| 1993 | 391 | Telephone survey |
| 1994 | 336 | Telephone survey |
| 1995 | 379 | Telephone survey |
| 1996 | 496 | Telephone survey |
| 1997 | 340 | Telephone survey |
| 1998 | 249 | Telephone survey |
| 1999 | 360 | Average 1994-1998 values |
| 2000 | 404 | Telephone survey |
| 2001 | 468 | Assumed 20% of OMP TAC calc$^n$ |
| 2002 | 583 | Assumed 20% of OMP TAC calc$^n$ |
| 2003 | 320 | Assumed* |
| 2004 | 320 | Assumed |
| 2005 | 320 | Assumed |
| 2006 | 300 | *Ad hoc* assumption by management |
| 2007 | 257 | Decr to 10% of TAC per OMP rule |

*  This seems linked to the comment in the 2004 TAC recommendation document that: "Despite the fact that recreational fishing days were reduced by 43% in 2000/2001, the recreational sector is consistently landing around 320 tons per season."