A summary of the west coast rock lobster fishery

S.J. Johnston and D.S. Butterworth

MARAM
Department of Mathematics and Applied Mathematics
University of Cape Town
Rondebosch, Cape Town

Geographical distribution

West Coast rock lobster *Jasus lalandii* occur inshore (<200m depth) from, just north of Walvis Bay in Namibia ~ 23°S, to East London ~ 28°S (see Figure 1). Commercial exploitation occurs from about 25°S in Namibia to Danger Point (~35°S). However, recreational fishing extends further eastwards to Mossel Bay.

Biology

West Coast rock lobster are slow growing long-lived animals. Juveniles moult several times annually but once sexual maturity is attained moulting becomes an annual event. Female size at maturity varies regionally and ranges from 54 mm carapace length (CL) to 66 mm CL. Male lobsters attain a larger size and grow faster than females, and as a result of the size limit (75 mm CL for commercial fishers) make up 90-99% of the catch.

Trends in abundance

When compared to the assessed biomass of West Coast rock lobster in the early 20th century the resource is evidently heavily depleted, both in terms of the harvestable component of the population (> 75mm CL) and spawning biomass (females > 65mm CL). The recent harvestable biomass is estimated at ~2% of the pre-exploitation level. This decline is largely a result of two effects: large unsustainable catches taken particularly during the middle decades of the 20th century and a substantial reduction in the somatic growth rate which has applied for over the last thirty years. Uncontrolled and increasing poaching has recently become an important factor.

Harvesting

The earliest exploitation of West Coast rock lobster dates back to the early Holocene approximately 10 000 years ago (evidence from Koi San shell middens). The commercial industry expanded rapidly in the early part of the twentieth century, although catch statistics prior to 1940 are sparse, catches appeared to have peaked in the period 1950 – 1965, when between 13 000 and 16 000 metric tons were landed annually.

Prior to 1946, the commercial fishery was unregulated. In that year, a tail-mass production limit was imposed in order to control exports. This formed the basis of the “output-controlled” management philosophy still employed in the administration of this resource today.

From 1946 onwards, annual TACs were set, based primarily on the performance of the fishery in the preceding season. Until the mid-1960's, catches were directly controlled by these limits. In the 1967 season, catch rates began to decline and catch limits could not be filled. Decreases in the TAC (to between 4 000 and 6 000 tons) restored some balance over the period 1970 – 1989. The tail-mass production limit was replaced by a whole lobster (landed mass) limit, and Area/Zone allocations were introduced in the early 1980's (a TAC for each Zone/Area). Other management measures enforced from the early stages of the fishery were size limits, closed season and the prohibition of catches of berried or soft-shelled lobsters. The 1990 season again saw the catch rates drop (a feature linked in part to a drop in the somatic growth rate which led to a reduction in the minimum size from 89 mm to 75 mm carapace length). In the ensuing years, the commercial TAC was gradually reduced, reaching 1 600 tons in the 1995[1] season. Since then, there was first a slow recovery, with the commercial TAC reaching 3 206 tons for the 2003 season, and thereafter a broadly steady downward trend to 1924 tons for the 2016 and 2017 seasons. The TAC for both the 2018 and 2019 seasons was set at 1084 MT.

Prior to the introduction of lobster traps in the 1960's, the commercial fishery depended almost exclusively on hand-hauled hoopnets, which are light and easy to deploy from small boats in shallow waters. Hoopnets are seldom used at depths exceeding 30m. Hoopnet dinghies may either operate independently from the shore (harbour) by means of an outboard motor or rowing or be transported to the fishing grounds by means of a motorized mother vessel (deckboat). Currently the inshore commercial sector may only use hoopnets and may not move between Areas.

Commercial fishing began in the 1880's. Currently there are a number of "sectors" utilising West Coast rock lobster in South Africa:

- Offshore commercial (fish is caught in deeper waters using traps). The quota allocated to this sector for the 2018 season was 564 MT.
- Nearshore commercials (fish is caught in shallower waters using hoopnets). The quota allocated to this sector for the 2018 season was 170 MT.
- Interim Relief/Small scale fishing sector (lobster are caught using hoops from nearshore areas). The quota allocated to this sector for the 2018 season was 170 MT.
- Interim Relief/Small scale fishing sector caught Offshore. The quota allocated to this sector for the 2018 season was 140 MT.
- Recreational sector. Participation in the recreational fishery is by permit only and lobsters may be caught by diving without artificial breathing apparatus or by ringnets from either the shore or vessels This sector is managed by controlling the number of days in the recreational season. The allocation to recreational take for the 2018 season was 39 MT.

[1] The 1995 split season, which commenced in November 1995, is conventionally termed the 1995 season.

Management measures currently being implemented in the fishery

The resource is managed using the following mechanisms:

- Minimum size limit (currently 75mm CL for commercial and 80mm CL for recreational).
- Gear restrictions
- Total Allowable Catch (TAC)
- Closed seasons and restriction on the retention of berried females and soft shelled animals
- Sub-division into management Zones and Marine Protected Areas (MPA's)

Global TACs are split not only between the different sectors, but between five management Zones or Super-areas (A1+2, A3+4, A5+6, A7 and A8+) (see Figure 1), which are combinations of "Areas".

Since the 1997 season, the TAC has been set annually through the application of an Operational Management Procedure (OMP), which provides, as output, recommendations for a global TAC recommendation and a TAC for each Zone. The input data required by the OMP are the TAC from the previous year and the average, over the three most recent seasons, of the three indices of the resource status (somatic growth; commercial *cpue*; and FIMS *cpue* – where FIMS is an annual Fishery Independent Monitoring Survey). The OMP formula is such that if one of the indices increases, it will tend to adjust the TAC to be recommended upward, while a decrease in any index will have the opposite effect. All three of the input data series used in the OMP are standardized using a general linear model (GLM) approach. Since 1997 four OMPs have been developed and tested across a wide range of scenarios to check that they displayed appropriate levels of resilience in achieving management goals (related to a biomass rebuilding target and low inter-annual variability in TACs). Typically, each OMP has been put in place for a period of 3-4 years.

In 1997, the Sea Fisheries Advisory Committee (SFAC) (the management advisory body at that time) adopted a resource management strategy aimed at achieving a 20% increase in resource biomass (>75mm carapace length) from 1996 to 2006. While initial progress towards that goal appeared promising, it was not reached by 2006. Subsequent OMPs were based on similar rebuilding targets, but performance in achieving these was poor – likely the result of a combination of poor recruitment and increasing levels of poaching. The most recent OMP (OMP-2011) had a recovery target of an increase in biomass of 35% from 2006 to 2021. However, an updated assessment in 2016, coupled to a re-evaluation of the magnitude of poaching which indicated a doubling over the three preceding years, saw the resource outside the range of the scenarios for which this OMP had been tested. Consequently, under the "Exceptional Circumstances" provisions of the OMP, TAC recommendations were based instead on "best estimate" projections. Since the 35% recovery target was unachievable, even in the absence of catches, the Scientific Working Group responsible suggested it be replaced by a 7% target, with a consequent TAC reduction of some 60% phased in over two seasons. Final decisions, however, reflected maintaining the 2015 season TAC of 1924 MT for 2016, and recently also for 2017. Figure 5 shows the current model biomass estimates relative to 2006 (B75m/B75m2006) and projections (2019+) assuming a future constant annual legal catch of CC= 640 mt (solid black curve) or zero (dashed black curve). Orange circles indicate previous OMP recovery targets

(rescaled to current estimate of B75m(2006)). The red circle indicates the 2018 recovery target of 1.07; at that time the recovery estimated under zero legal catch was 1.13.

Following legal action by WWF last year, seeking that TACs be sustainable, the TAC for the 2018 season was reduced to 1084 MT. The TAC remains unchanged at 1084 MT for the 2019 season.

Data

The following data are available as inputs into the west coast rock lobster area-disaggregated assessments. Assessments are conducted at a super-area level, i.e. five different assessments are conducted. Methods and assumptions used to split these data for use in the area-disaggregated assessments had to be developed. (Note that the resource is actually treated as five independent stocks for assessment and management purposes, based both on evidence of relative low movement of lobsters, and following recommendations from a previous (2010) International Panel to this effect in the light of indications of different trends and hence dynamics amongst the different Zones.)

1. Commercial Catch Data

There are commercial catch input data from 1870+. As the assessment models are run from 1910 only, the 1870-1909 catches are added to the 1910-1920 period equally. The Roy Melville-Smith catch record is used for the pre-1968 period. These data are for the resource as a whole and the method used to split these catches is described in ASWS/JUL07/WCRL/ASS/1. Area-disaggregated catches are available from the DAFF database for the 1968+ period.

2. Recreational catch data

Area-aggregated data are available for 1992 onwards. The 1992-2000 values were estimated from telephone surveys (note though that the 1999 value is the average of the 1994-1998 values). The 2001 and 2002 estimates rested on the assumption that the recreational catch was 20% of the TAC calculated from the OMP for that season. For 2003-2005 it was assumed that the recreational take would be 320 MT. Further, it was assumed that the recreational catch was zero in 1959, and that catches increased linearly to the estimated 1992 value. For 2006+ telephone surveys continue to be the only method available to assess the quantity of recreational catches.

3. Poaching estimates

No associated direct estimates are available. The total poaching take for the resource is assumed to start in 1950. The poaching trend for the resource is discussed in detail in in MARAM/IWS/2019/WCRL/P1. The current range of poaching trend estimates for the resource are shown in Figure 2.

4. Trap:hoopnet ratio for source of catches

These data are available from the DAFF catch records for 1969+ for all areas. The fishery was entirely a hoop fishery until 1969, when traps were first introduced. Super-area 1-2 has remained a hoop-only fishery.

5. CPUE

a) Trap CPUE

These data are available for 1981+ for super-areas A3+4, A7 and A8+.

b) Hoop CPUE

These data are available for 1986+ for super-areas A1+2, A3+4, A5+6 And A8+.

c) FIMS CPUE (from a Fisheries Independent Monitoring Survey)

These data are available for 1992+. These data are collected for Super-areas 3+4, 5+6, 7 and 8+ only.

The trap and hoop CPUE estimates used are standardised by GLMs which take into account season, month and area as covariates for the trap data; season, month, and fishing type as covariates for the hoop data. The FIMS CPUE data are weighted mean CPUEs.

6. Catch Size Structure

All catch size structure information is available for males and females separately, and by 5mm size classes for the legal portion of the catch. Data for traps and hoops are available from 1976, and from FIMS since 1992. Trap sublegal size data are available for Super-area 8+ over 1994 to 1998.

7. Percent females in catch (F%)

These data are calculated from the catch-at-size data and are thus available for the same periods as for the catch size structure data described above. They relate to the percentage females (by number) in the catch for traps, hoops and FIMS.

8. Minimum legal carapace length

The minimum legal carapace length has changed over time. The minimum legal carapace length for the recreational sector is currently 80mm, and is different from that for the commercial sector (for more recent years). These size limits are the same for all areas, except for Area 1-2. The current commercial legal carapace length is 75mm.

9. Somatic growth data

These data are available from 1968-2018 for all Areas – although there are data gaps for some areas. The data relate to adult male lobsters. Annually 28 000 lobster (collectively) are tagged and released in all areas to estimate male somatic growth of lobsters 75-100 mm CL. A moult probability analysis (OLRAC 2008a and b) which allows for the treatment of area*season interactions as random effects is applied to the somatic growth data to estimate season trends for each super-area.

10. Assessments

Assessments are based on a length structured framework linked to a model of annual length increment distributions. The model is fit to the data detailed above.

Trajectories of male biomasses relative to K_{sp} estimated for each Super-area and for the resource as a whole are shown in Figure 3a and b respectively, with those for the corresponding annual catches (with and without poaching) shown in Figure 4.

References

OLRAC, 2008a. Use of the posterior mode of West Coast Rock Lobster male somatic growth rate estimates as an alternative to the posterior mean. MCM/2008/JUN/SWG-WCRL/04.

OLRAC, 2008b. Methodology for estimating male somatic growth rate for input into the spatially disaggregated assessment for West Coast Rock Lobster. MCM/2008/JUL/SWG-WCRL/10.

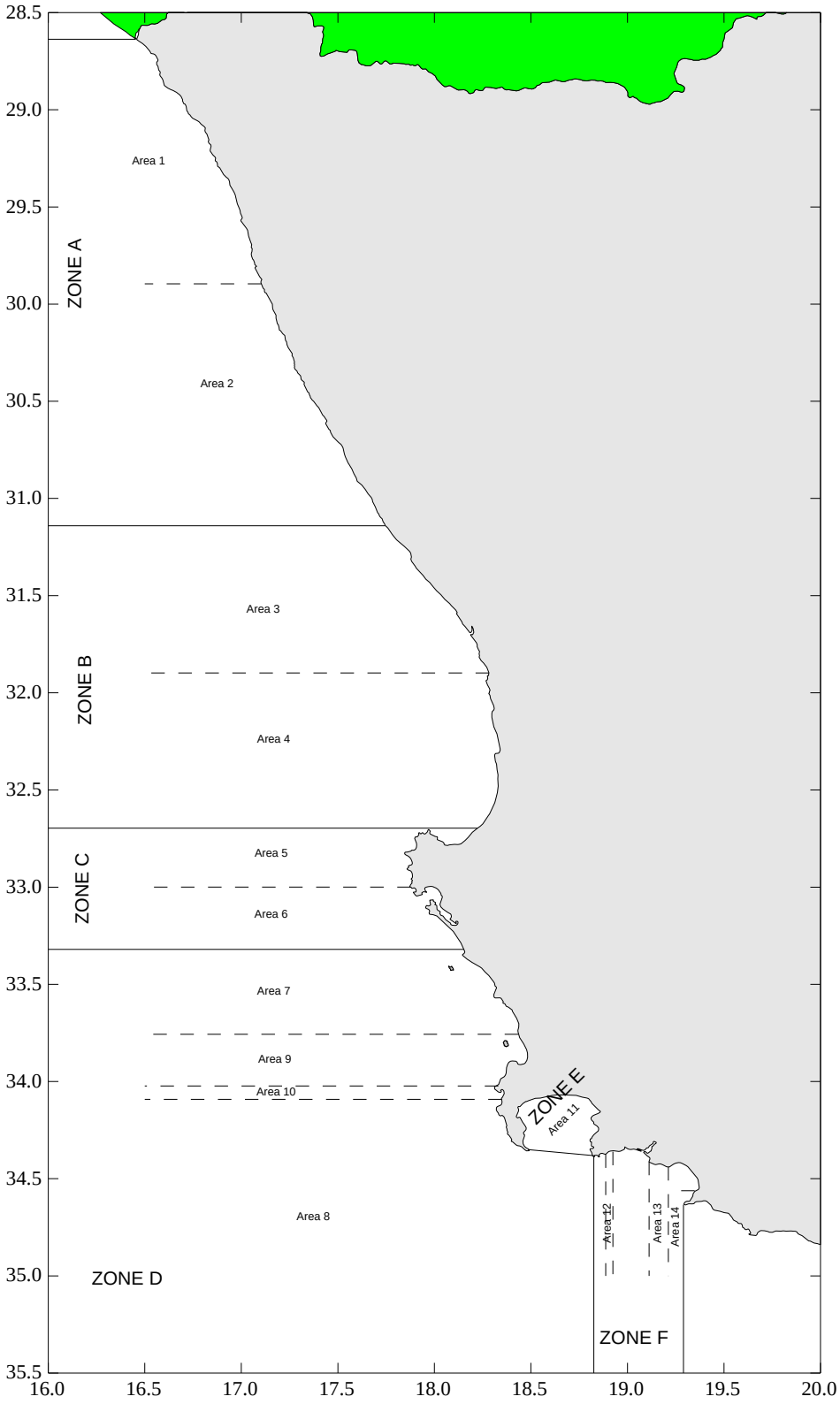

Figure 1: West coast rock lobster fishing Zones and Areas

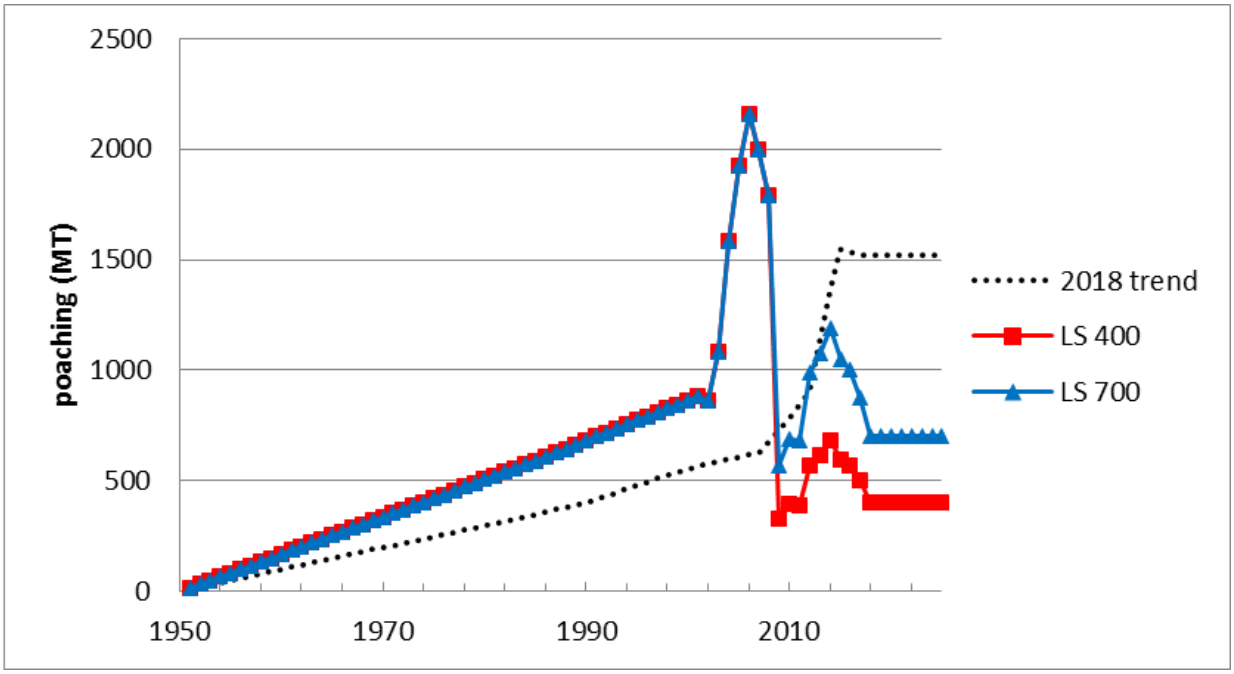

Figure 1: Poaching trends assumed for the 2018 assessments and for the two new 2019 scenarios (LS 400 and LS 700). The LS 700 trend was assumed for final projections and scientific recommendations.

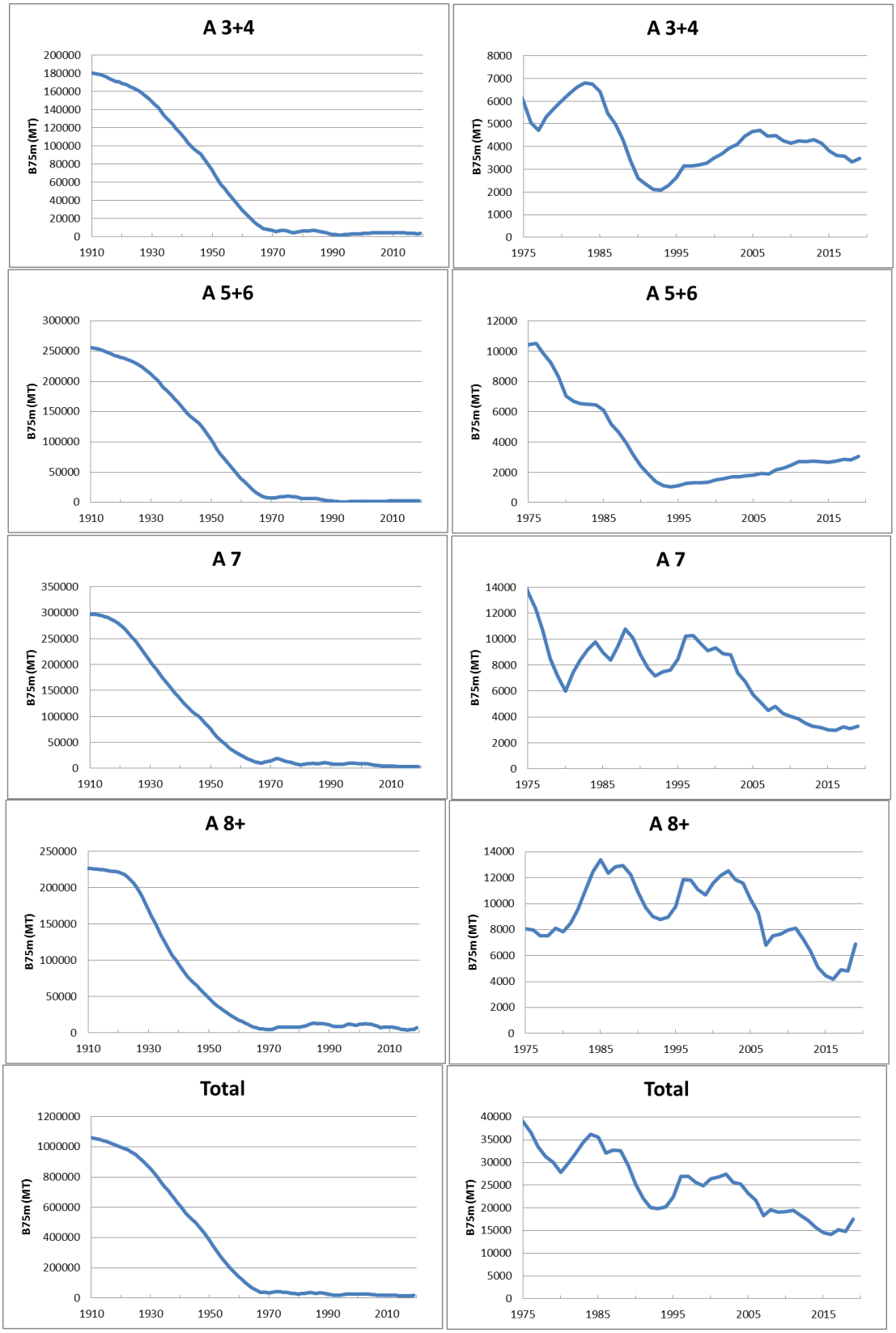

Figure 3: Trajectories of male B75m (MT) estimated from recent (2019) assessments for each super-area and for the resource as a whole. The left panel shows trajectories from 1910, whilst the right panel shows only the 1975+ period.

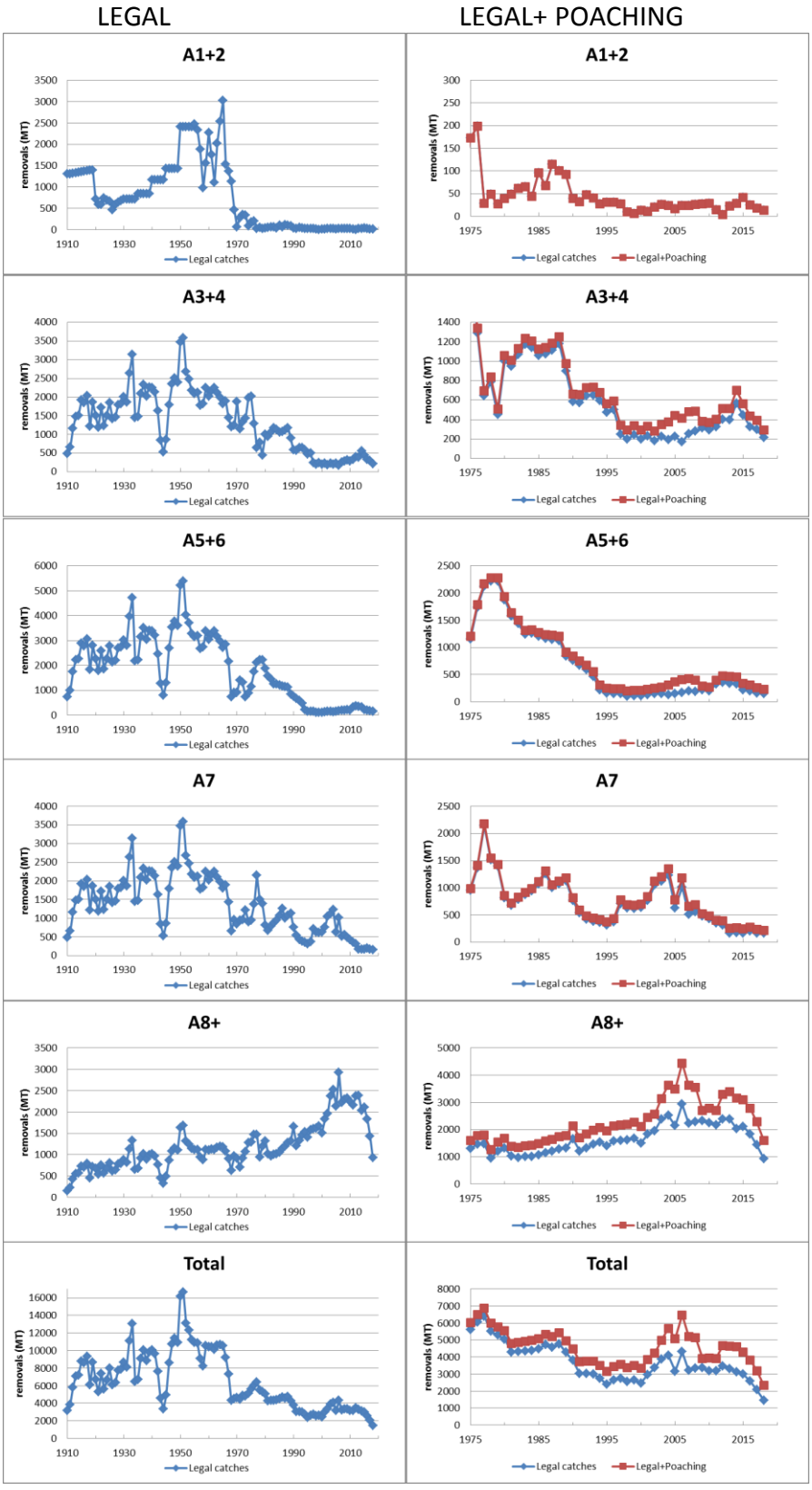

Figure 4: Trajectories of the catches (legal) for each super-area and the resource as a whole. Note the different vertical-axis scales. The left panel shows Legal catches from 1910 onwards, whilst the right panel compares the Legal with the Legal+poaching estimates (shown as the extremes of the range considered plausible) for 1975 onwards.

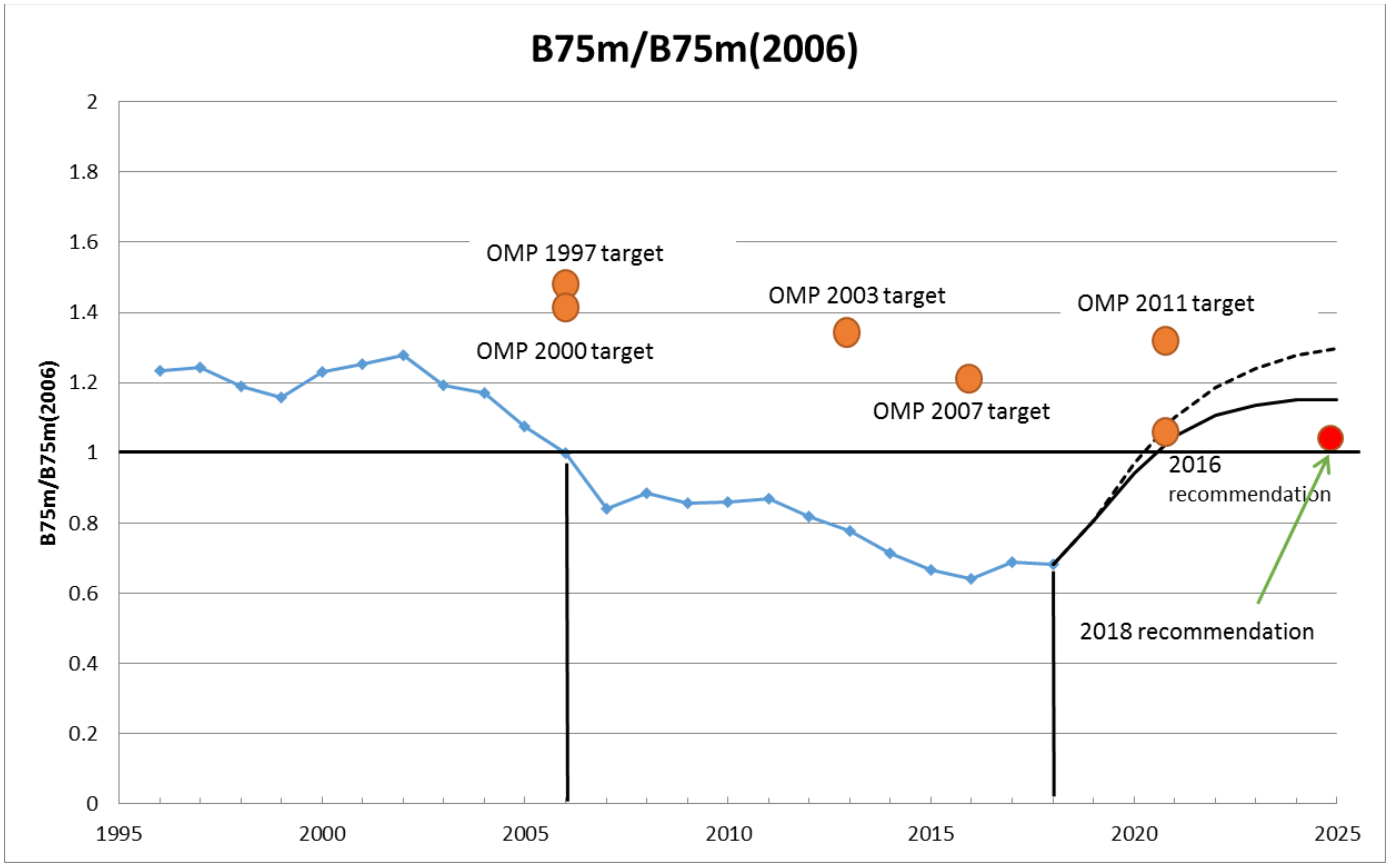

Figure 5: Current model biomass estimates relative to 2006 (B75m/B75m2006) and projections (2019+) assuming a future constant annual legal catch of CC= 640 mt (solid black curve) or zero (dashed black curve). Orange circles indicate previous OMP recovery targets (rescaled to current estimate of B75m(2006)). The red circle indicates the 2018 recovery target of 1.07; at that time the recovery estimated under zero legal catch was 1.13.