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Stock assessment of scallops in the D'Entrecasteaux Channel, 2006-2011

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IMAS
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Executive Summary

- The total number of scallops in the Channel declined by 87% between 2006 and 2011.
- Commercial scallops which have been the most abundant of the three endemic species that inhabit the Channel have declined by 93%.
- Queen scallops have declined by 75%.
- Doughboy scallops have decreased by 52%.
- Several small recruitment pulses for all three species have been identified over the six years of sampling, although very few of these cohorts appear to have survived in sufficient numbers to achieve a harvestable size.
- One significant recruitment pulse of Commercial scallops, first identified in 2007, was fished in 2010, but had declined significantly by 2011.
- This recruitment pulse still dominant available stock (greater than legal minimum size limit) in 2011 with only remnant populations of Queen scallops and low abundance of Doughboy scallops available.
- To open the D'Entrecasteaux Channel in 2012 for recreational fishing would pose a significant risk of fishing down the remaining adult stocks to unsustainable levels, which coupled with the lack of significant recent settlement would effectively result in the collapse of the scallop stocks and a protracted period of very low abundances in the D'Entrecasteaux Channel.
- Even if good settlement were to occur 2011/12, the cohort would not be expected to attain legal size (and maturity for several years), as a consequence consideration needs to be given to closures of the Channel to recreational scallop fishing for at least the next three years.

Introduction

This report summarises the findings of the IMAS dive surveys of scallop populations in the D'Entrecasteaux Channel from 2006 – 2011.

Method

Between 2006 and 2011 seven dive surveys were completed; the first was conducted in February 2006, prior to the opening of the recreational fishery in that year, and the remaining six were conducted as post-season (July-August) surveys annually between 2006 and 2011. On each occasion dive transects were sampled at 24 standard sites (Fig. 1). The standard sites were selected randomly from the areas where scallops were identified during the pilot surveys conducted in 2004 and 2005. A further 38 sites were added in 2008 (total of 62 sites); these new sites were intended to provide greater coverage of potential scallop habitat and to improve delineation of known beds, especially in Area 3 (Fig. 1). Since 2008 all 62 sites have been sampled

At each site (located by GPS) a weighted 100 m strip transect was deployed in a haphazard direction (or following the depth contour on sloping bottom). Two divers swam along either side of the transect line collecting all scallops within one meter of the line, representing a total searched area of 200 m^2. The scallops were brought to the surface, identified to species and shell length (SL) measured before being returned to the water.

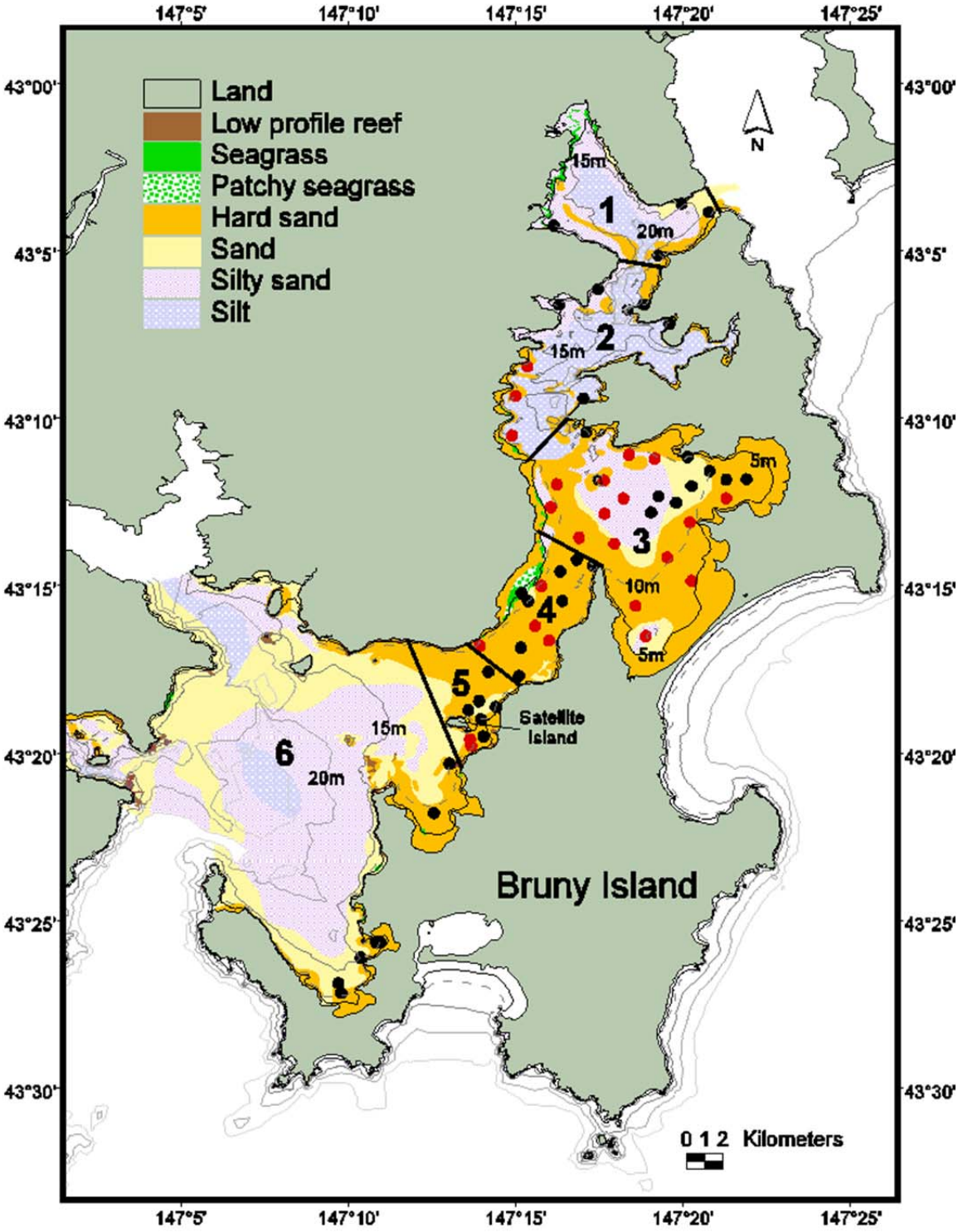

Fig. 1. Map of the D'Entrecasteaux Channel illustrating depth contours and substrate composition. The red points indicate the 24 replicated sampling sites from the 2006 pre-season survey through to the 2011 post-season survey. The black points indicate the additional 38 sites sampled during the 2008 - 2011 post-season surveys. Large numerals represent categorised areas.

Results

Since the pre-season survey in 2006 the total number of scallops sampled at each of the 24 replicated sites has declined by 87% (Fig. 2). This decline was mainly driven by an 93% decrease in the number of Commercial scallops which had been the dominant species in the Channel over the last six years (Fig. 2). Doughboy scallops have decreased in number by 52% (Fig. 2). Queen scallop numbers have decreased by 75% since 2006, but a small recruitment pulse evident in 2011 has doubled their numbers from 2010 (Fig. 2).

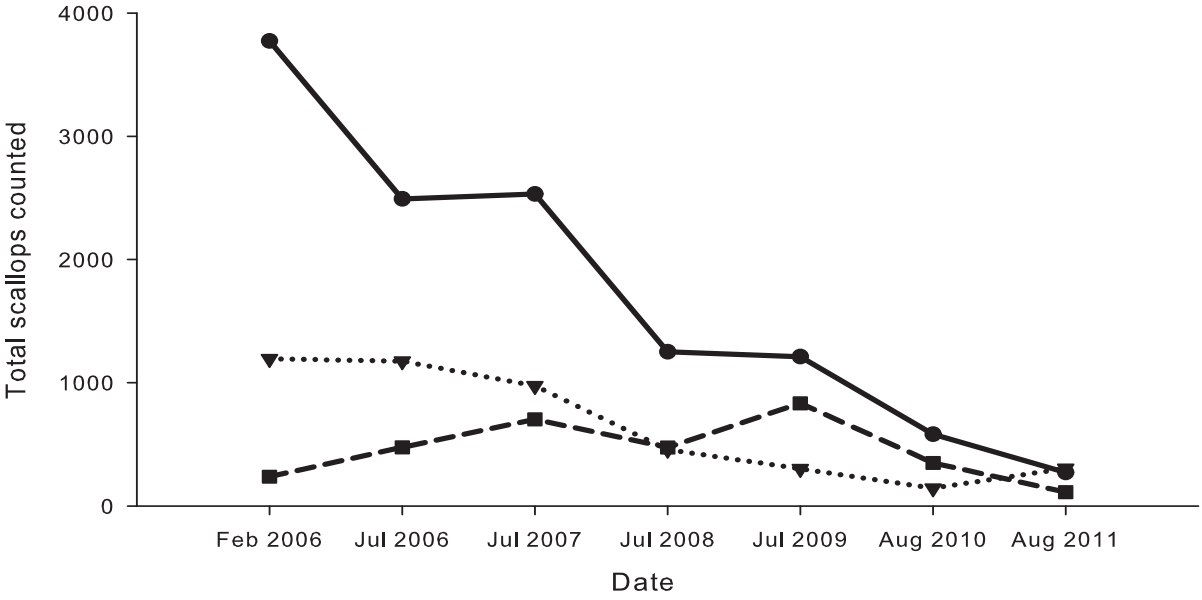

Fig.2. The total number of scallops collected by species, Commercial scallop (●), Queen scallop (▼) and Doughboy scallop (■), from the 24 replicated sites within the D'Entrecasteaux Channel.

Size composition of scallops in the D'Entrecasteaux Channel (from the 24 replicated sites)

During the 2006 pre-season survey a substantial proportion (66%) of Commercial scallops were above the minimum legal size limit (MLS) and there was evidence of a recent but relatively minor settlement event (mean SL of 18 mm) (Fig. 3). Most Queen scallops were also above the MLS (64%) but the distribution suggested that multiple cohorts of sub-legal scallops (smallest with a mean SL of 55 mm) were providing some evidence of recruitment to the population (Fig. 3). The size distribution of Doughboy scallops was much more uniform than the distribution of the other two species suggesting relatively constant but low levels of recruitment to this population (Fig. 3).

During the 2006 post-season survey season there had been a 34% reduction in the relative abundance of Commercial scallops (Fig. 2 & Fig. 3), and the newly settled cohort of Commercial scallops had attained a mean SL of about 40 mm. There was also evidence of a new but relatively small recruitment event for Doughboy scallops with a mean SL of 18 mm.

During the 2007 post-season survey a new and apparently strong Commercial scallop recruitment event (mean SL 44 mm) was identified. A further 53% reduction in legal sized Commercial scallops compared with post-season 2006 was also identified (Fig. 3). The recruitment pulse of Doughboy scallops had become more conspicuous and had increased in in size to a mean of 50 mm (Fig. 3). The majority of Queen scallops were now above the MLS and available to the fishery.

During the 2008 post-season survey the cohort of Commercial scallops first identified in 2007 dominated the distribution of undersize scallops (Fig. 3). In less than two years (based on peak spawning in the austral spring of 2006) this cohort had increased in size to a mean of 90 mm (Fig. 3). The relative abundance of Queen scallops had declined by half compared with 2007, the vast majority (94%) being above the MLS. The Doughboy scallop settlement pulse identified in 2007 had increased in size to a mean of 75 mm and there was evidence of more recent settlement (mean SL of 20 mm).

During the 2009 post-season survey the dominant Commercial scallop recruitment pulse had attained a mean SL of 103mm, with a size distribution straddling the MLS, and accounted for the vast majority of legal sized scallops in the DEC. By comparison, legal sized Queen scallops were present in very low numbers (Fig. 3) but, for the first time since surveys commenced, there was evidence of a recent, albeit relatively minor, settlement event (Fig. 3). A comparatively large recruitment pulse of Doughboy scallops was also identified during 2009 (Fig. 3).

During the 2010 post-season survey there was no evidence of significant recruitment for any of the three species. The abundance of Commercial scallops had declined by 52% compared with 2009 while only a remnant population of Queen scallops comprised mainly of large scallops remained and Doughboy numbers were also present but in lower numbers than previous surveys.

During 2011 the single cohort of Commercial scallops was now predominately greater than the 100 mm size limit, although their numbers had declined significantly presumably due to natural mortality. There was no evidence of any significant Commercial scallop recruitment. There were very few legal sized Queen scallops sampled but there was evidence of a small recruitment pulse of Queen scallops with a mean size of approximately 36 mm. The numbers of Doughboy scallops had also declined with the majority of scallops measured above the minimum size limit with no evidence of new recruitment.

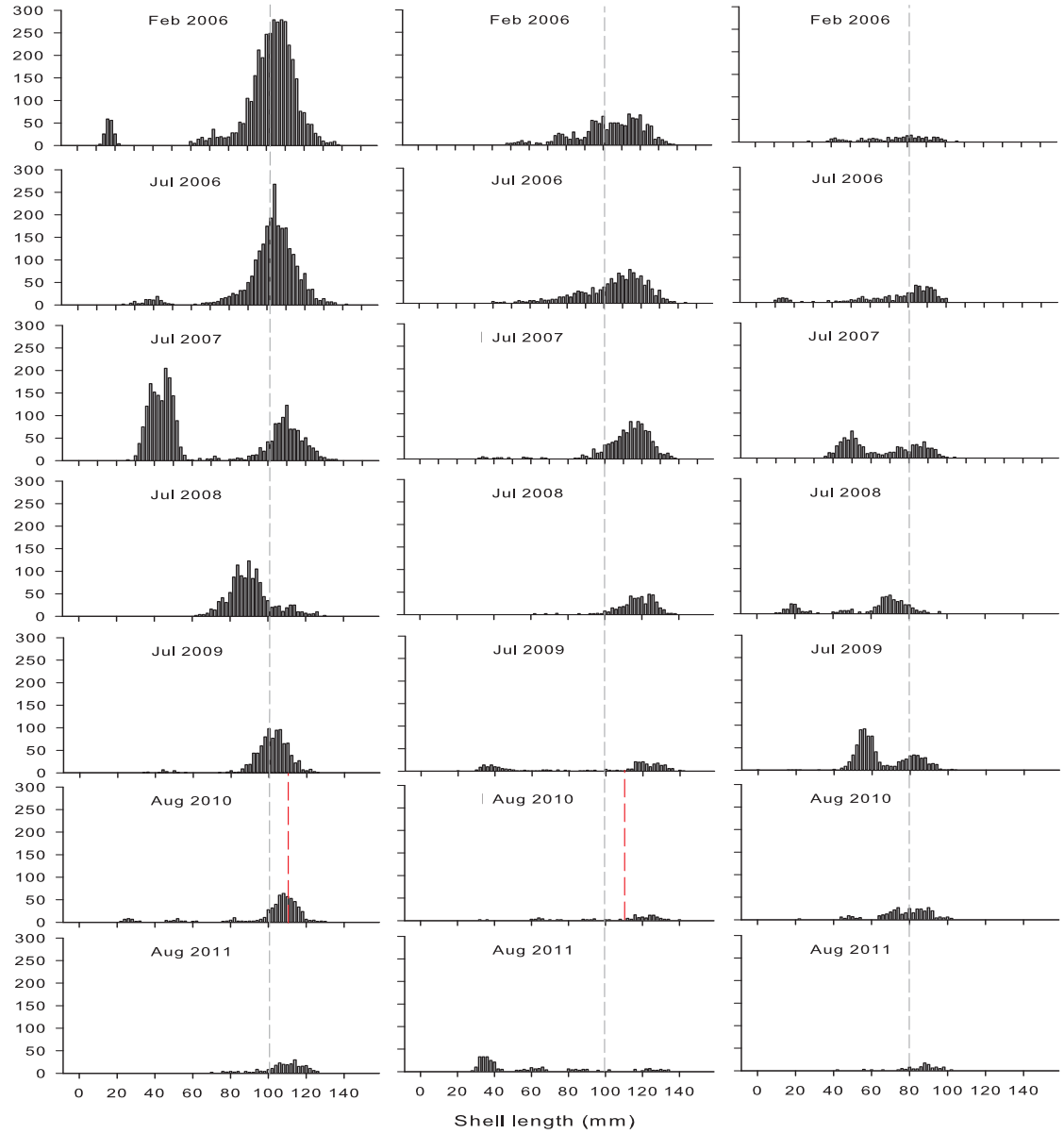

Fig. 3. The relative size composition of Commercial (Column 1), Queen (Column 2) and Doughboy (Column 3) scallops sampled from the 24 replicated sites within the D'Entrecasteaux Channel over 7 sampling periods from 2006 - 2011. The dashed vertical line indicates the minimum legal size limit for each species. The dashed red line indicates the revised size limit for Commercial and Queen scallops in 2010 (110 mm SL).

Size composition of scallops in the D'Entrecasteaux Channel (from the 62 sites sampled from 2008 – 2010)

The addition of 38 sites since 2008 allowed for a more comprehensive survey of the D'Entrecasteaux Channel which not only increased the resolution of the size frequency composition of scallops but also acted to validate the sampling of the 24 sites replicated since 2006.

The results of sampling the 62 sites confirmed that the trends in size composition identified from the 24 replicated sites were sound with no significant differences in the size composition identified with the exception that in 2009 a recruitment pulse of Commercial scallops was detected (Fig. 4). By 2010, however this cohort had declined to very low numbers. There are two possible causes for this, firstly, Commercial scallops have an annual natural mortality rate of 40% and this may have contributed to the significant decline in the abundance of this recruitment pulse. Alternatively this recruitment cohort being distributed in a very small localised area that was not surveyed by chance. Whatever the cause, it is evident that the cohort represented a very minor settlement event which has not contributed in any significant way to the population in the Channel. Moreover, by 2011 there was virtually no remnants of the 2007 cohort detected

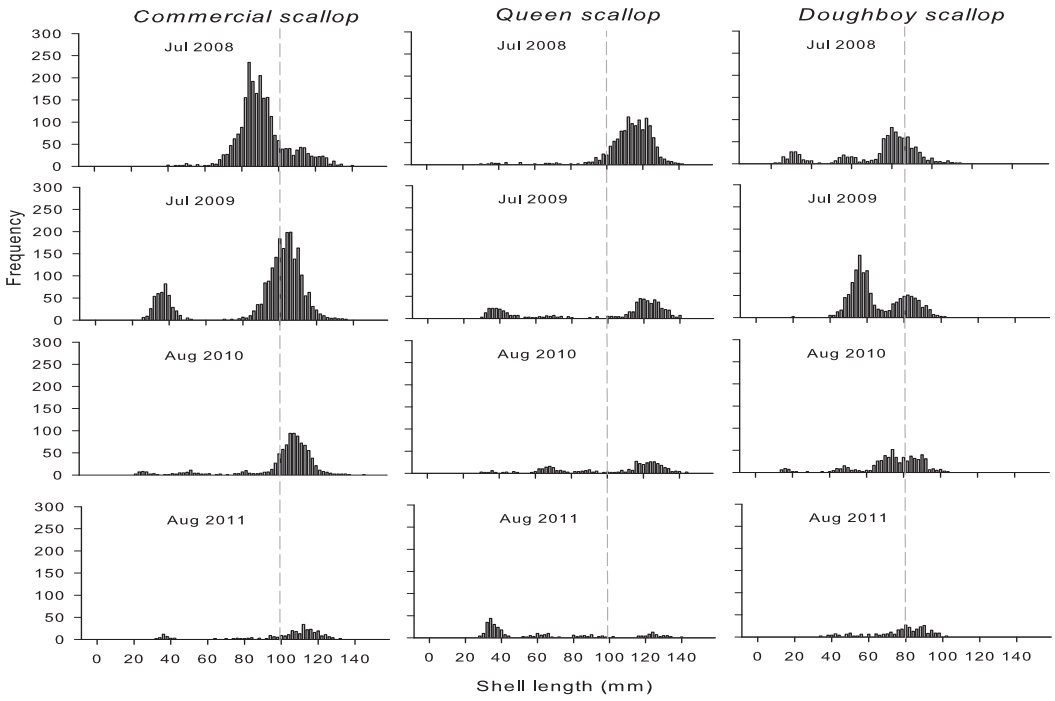

Fig. 4. The relative size composition of Commercial, Queen and Doughboy scallops sampled from the 62 replicated sites within the D'Entrecasteaux Channel from 2008 - 2011. The dashed vertical line indicates the minimum legal size limit for each species.

Spatial distribution of scallop beds

Prior to the 2006 fishing season, legal size (harvestable) scallops were distributed throughout the southern end of Area 2 and Areas 3-5, with highest mean densities in Area 5 (1.12 sc.m^2) and highest density at a given site of 2.46 sc.m2, located in Area 4 (Fig. 5). The distribution and density of undersize scallops was also relatively homogeneous throughout the study domain (Fig. 5).

At the end of the 2006 fishing season there was no obvious change in the distribution of scallop beds, however the mean densities of legal sized scallops had declined (Fig. 5).

By the end of the 2007 fishing season, the new and apparently strong Commercial scallop recruitment event was evident in the northeast and eastern region of Area 3 where overall scallop densities had increased (Fig. 5). Changes in the distribution of scallops were also observed, the most conspicuous being decreases in relative abundance at the southern end of Area 2 and the southeast of Area 3 (Fig. 5).

Scallop densities had declined further at the completion of the 2008 fishing season. The most conspicuous decline was in Area 3; dense beds of legal size scallops observed during previous surveys on the western side of the DEC were virtually absent while those on the eastern side had been reduced to levels of less than 0.2 sc. m2 (Fig. 5). The higher density areas in Area 4 were dominated by Queen scallops (Fig. 6a), with legal sized Commercial scallops scarce (Fig. 6b). Scallop densities within Area 5 were also very low (< 0.05 sc.m2) (Fig. 5). The cohort of Commercial scallops first identified in 2007 dominated the high densities in the northeast and east of Area 3 (Fig. 5).

By 2009, the dominant Commercial scallop recruitment pulse accounted for the vast majority of legal sized scallops in the DEC. By comparison, legal sized Queen scallops were present in very low numbers (Fig. 6e) with the distribution of Queen scallops contracted into Area 4, with only patchy remnant distribution remaining through Area 5 (Fig. 6e). The distribution of Doughboy scallops was unchanged, although there were lower densities of this species in Areas 4 and 5 compared with 2008. The new recruitment pulse was mainly located in the northern region of Area 3 around Green Island (Fig. 6f).

By 2010 the distribution of legal size scallops in Area 3, comprised almost exclusively of the Commercial scallop cohort first identified in 2007, had contracted and the density of the bed had also declined (Fig. 5). The only other area that held scallops in higher densities straddled Areas 4 and 5 and was mainly comprised of Queen scallops (Fig. 6). The distribution of sub-legal sized scallops had also become sparse, with the only bed holding more than 0.5 scallops per m^2 located around Green Island in Area 3 and comprised exclusively of Doughboy scallops (Fig. 5).

In 2011 the majority of legal size scallops were in the northeast corner of Great Bay dominated by the remnant population of the recruitment pulse first identified in 2007. The density and spatial distribution of which had contracted 2007 (Fig. 5 & Fig. 6). The majority of undersize scallops were located in Area 4 and were mainly the newly recruited Queen scallops (Fig. 5 & Fig.6).

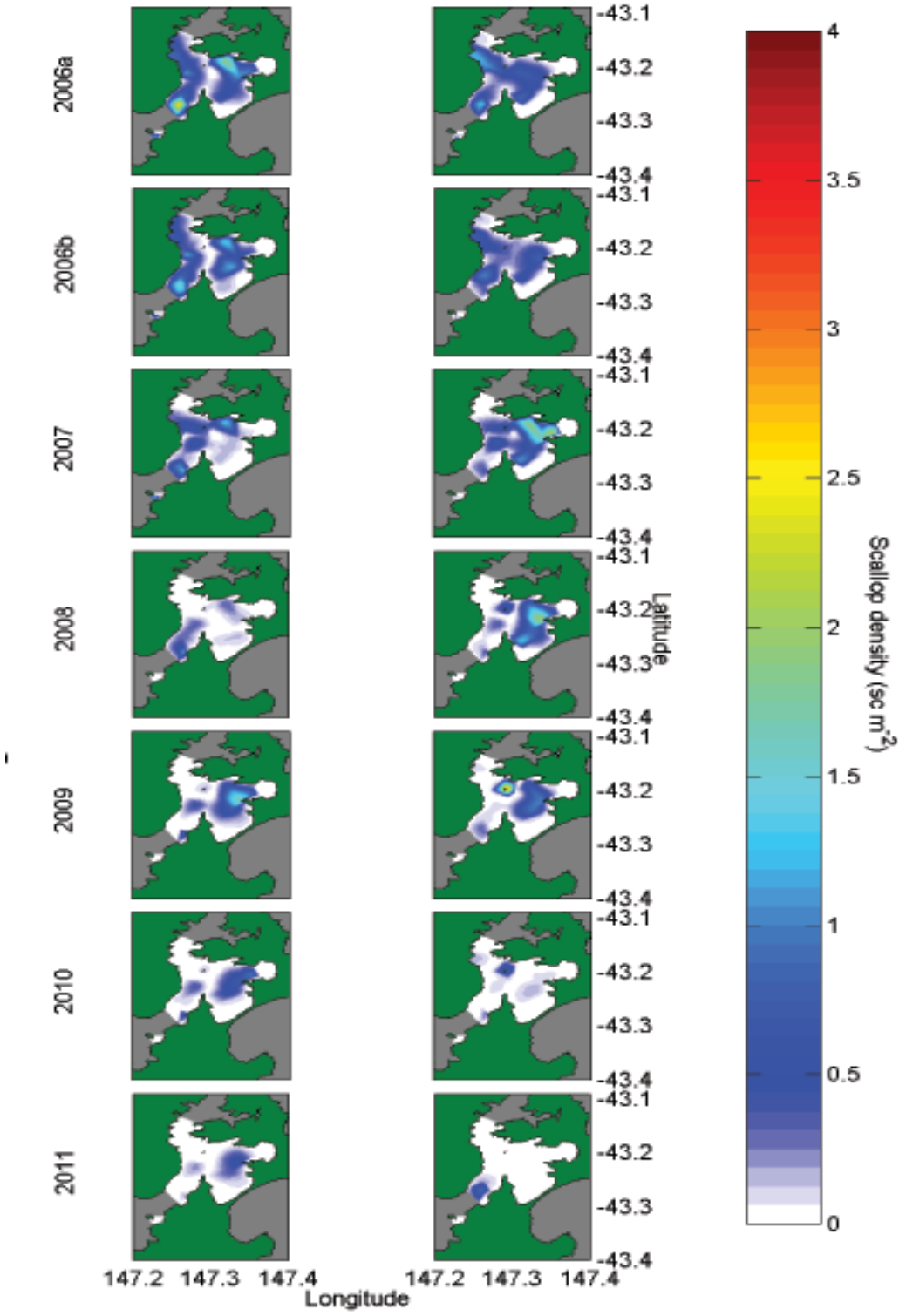

Fig. 5. The left column presents interpolated densities (scallops m^2) of all scallop species combined that were above the minimum legal size limit based on data from the 24 replicated sites for each sampling period. The right column presents interpolated densities of all scallop species combined below the minimum legal size limit based on data from the 24 replicated sites for each sampling period. Grey areas were not sampled and were considered outside the model interpolation domain.

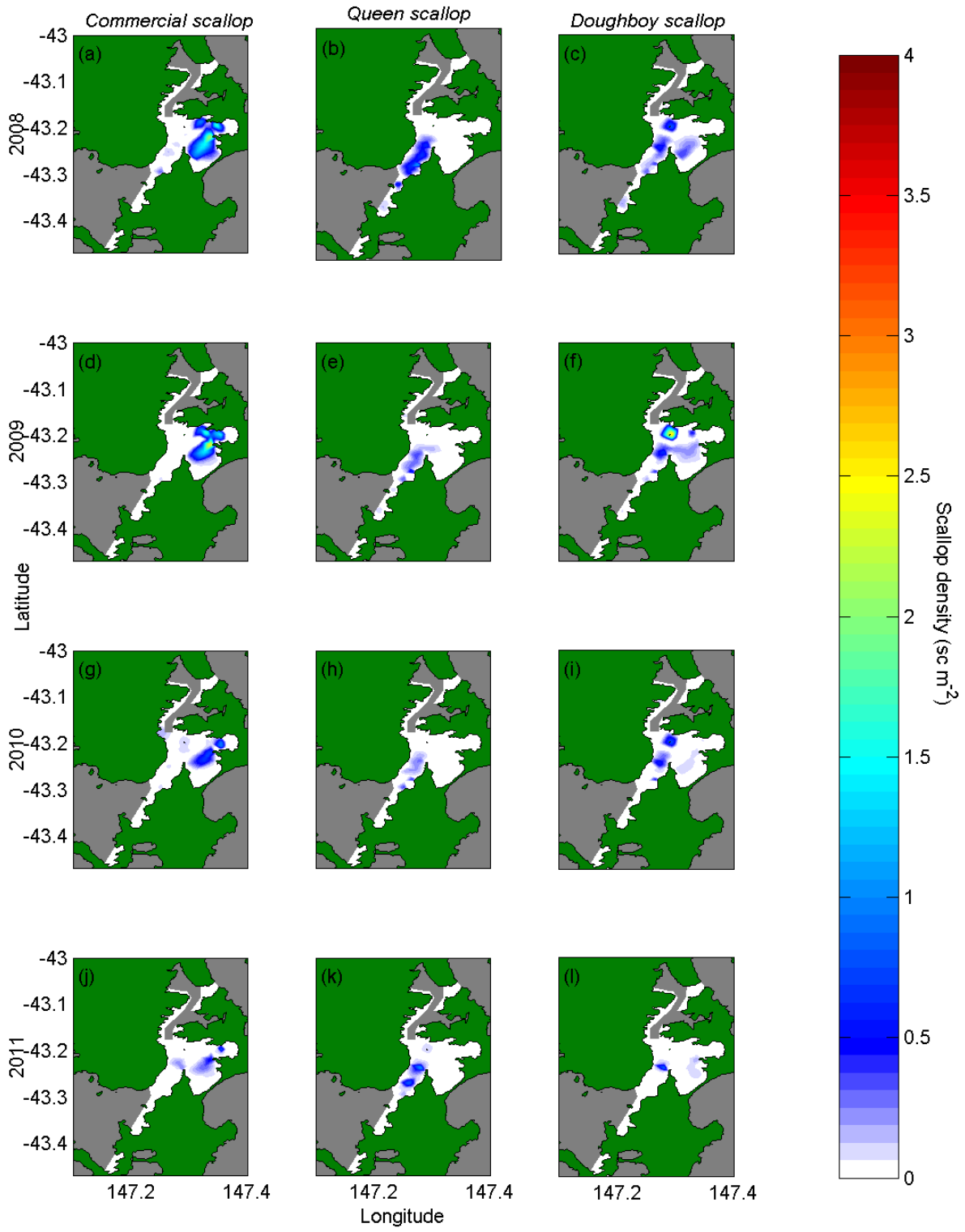

Fig.6. The interpolated densities (scallops m^2) of the three endemic scallop species from the D'Entrecasteaux Channel based on data from 62 sites collected at the completion of the 2008 -2011 mid-year sampling. Grey areas were not sampled and were considered outside the model interpolation domain.