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Assessment of scallop populations in the D'Entrecasteaux Channel, 2006-2012

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Executive Summary

- The total number of scallops in the D'Entrecasteaux Channel declined by 90% between 2006 and 2012.
- Commercial scallops, which have been the most abundant of the three endemic species that inhabit the Channel have declined by 95%.
- Queen scallops have declined by 73%.
- Doughboy scallops have decreased by 88%.
- Several small recruitment pulses for all three species have been identified over the seven years of sampling, although few of these cohorts 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 and 2012.
- There has been a lack of significant recruitment for each of the three species since 2007 in the D'Entrecasteaux Channel.
- Even if good settlement were to occur in 2012/13, the cohort would not be expected to attain legal size (and maturity) for several years.

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Introduction

The D'Entrecasteaux Channel was closed to recreational fishing in 2011 and 2012 due to an assessment of low stocks and poor recruitment. This report summarises the findings of the IMAS dive surveys of scallop populations in the D'Entrecasteaux Channel from 2006 – 2012. Dive surveys have been designed to provide basic population information on the scallop stocks, including relative trends in population size.

Since the re-opening of the recreational scallop fishery in 2005 after more than a decade of closure, a 'conservative' management approach has been taken, with daily bag limits initially reduced to 40 scallops per diver and the season extended over approximately three months. This was in marked contrast to the management of the previous D'Entrecasteaux Channel scallop fishery (1992) where a daily bag limit of 200 scallops applied and the season lasted just 15 days, promoting a rush to take the catch.

Management arrangements were further altered in 2008; with an increase in the daily bag limit from 40 to 50 scallops, and a decrease in the possession limit from 200 to 100 scallops, and an increase in the length of the season by 45 days. These changes were made in part to address fisher concerns (social values) indicated in post-season telephone surveys of scallop licence-holders whilst balancing the conservation requirements of the scallop stocks. These surveys indicated that an increased bag limit would make engaging in this fishery more feasible in light of increasing fishing costs.

In 2009, the decision was made to close the D'Entrecasteaux Channel to recreational scallop fishing, based on a decline in scallop numbers and a lack of recruitment identified by the 2008 IMAS survey. In 2010 the Channel was re-opened to fishing, but with a shorter (1 month) season and a 10mm increase in the minimum size limit of Commercial and Queen scallops. This was intended to allow the remaining spawning stock biomass a greater chance of producing a successful recruitment pulse. The post-season survey in 2010 indicated that there had been no significant recruitment to the Channel and with further spawning stock biomass decline the Channel was closed to recreational scallop fishing in 2011 and 2012.

Method

Between 2006 and 2012 eight 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 seven were conducted as post-season (July-August) surveys annually between 2006 and 2012. 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). From 2008 through 2011 all 62 sites were sampled. In 2012 the number of sites was reduced to 52 to rationalise survey costs at a time when scallop abundance was low.

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 m². The scallops were brought to the surface, identified to species and shell length (SL) measured before being returned to the water.

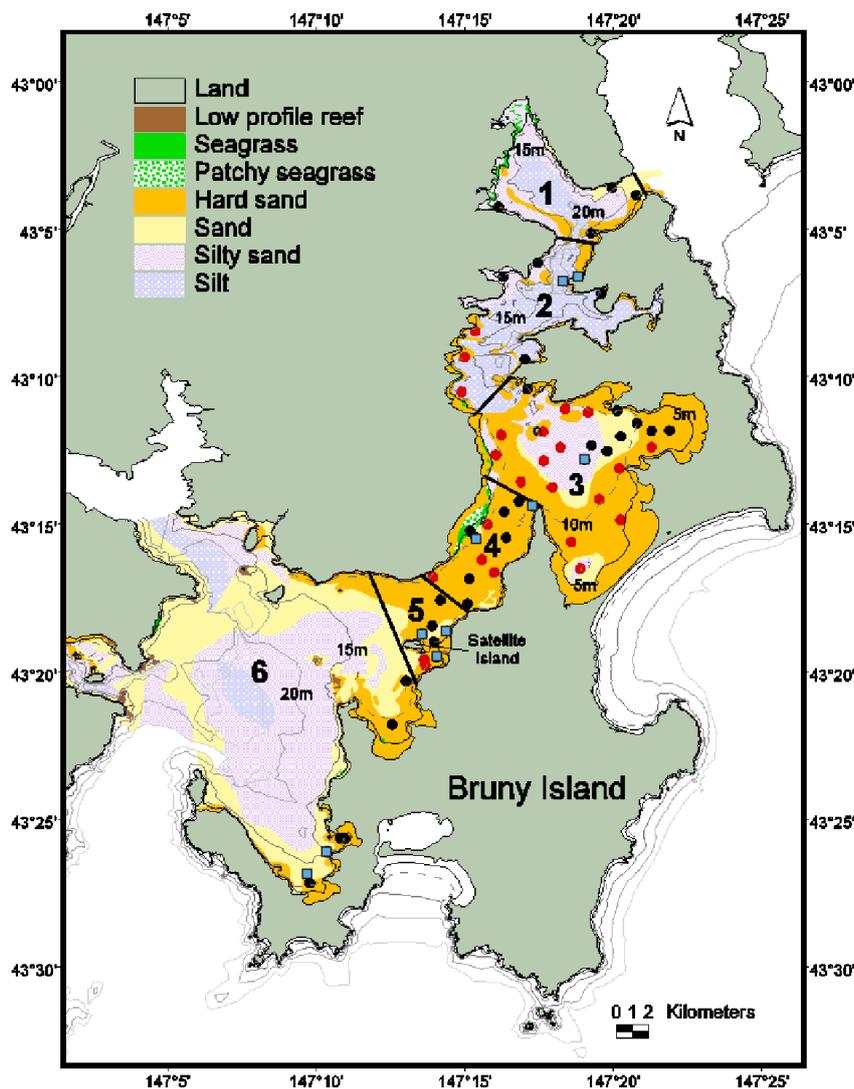


Fig. 1. Map of the D'Entrecasteaux Channel illustrating depth contours and substrate composition. The red points indicate the 24 replicated sampling sites from the 2006 pre-season survey through to the 2011 post-season survey. The black points and blue squares indicate the additional 38 sites sampled during the 2008 - 2011 post-season surveys, and the blue squares indicate the sites that were excluded in 2012. 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 90% (Fig. 2). This decline was mainly driven by an 95% 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 88% (Fig. 2). Queen scallop numbers have decreased by 73% since 2006, but a small recruitment pulse evident in 2011 has doubled their numbers from 2010 and has persisted into 2012 (Fig. 2). It should be noted that the decline in Commercial and Doughboy scallop numbers has persisted despite closure of the fishery; this is due to natural mortality, offset by very limited recruitment.

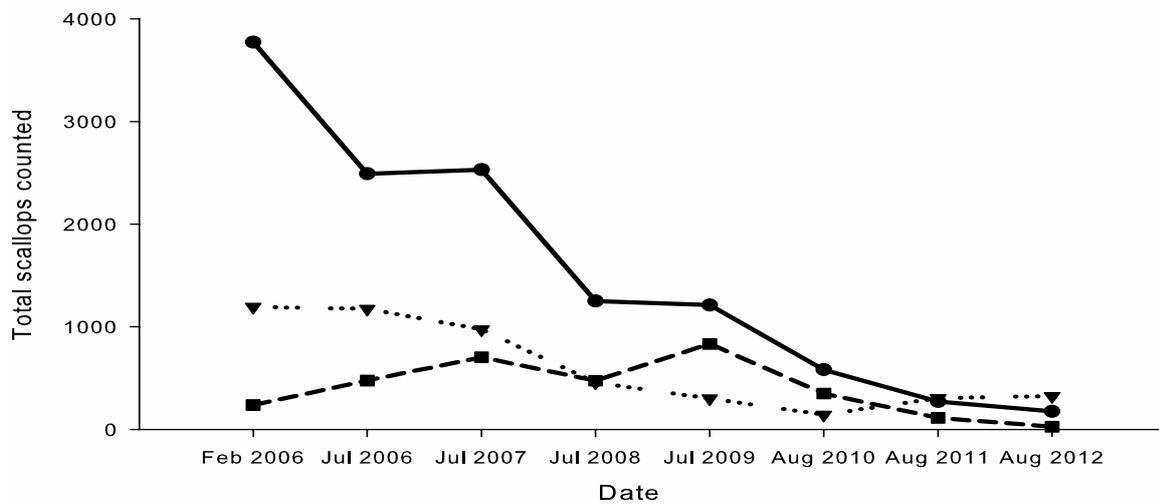


Fig.2. The total number of scallops collected by species, Commercial scallop (●), Queen scallop (▼) and Doughboy scallop (■), from the 24 replicated sites within the D'Entrecasteaux Channel.

Size composition of scallops in the D'Entrecasteaux Channel (*from 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).

2006 Survey Summary

The post-season survey results indicated that 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.

2007 Survey Summary

The post-season survey results indicated 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 size to a mean of 50 mm (Fig. 3). The majority of Queen scallops were now above the MLS and available to the fishery.

2008 Survey Summary

The post-season survey results indicated 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).

2009 Survey Summary

The post-season survey results indicated 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).

2010 Survey Summary

The post-season survey results indicated 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.

2011 Survey Summary

The survey results indicated 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.

2012 Survey Summary

Two distinct cohorts of Commercial scallops were identified, although both were in very low numbers relative to abundances detected after the 2007 recruitment pulse. One cohort had an average size of 118 mm with the majority of individuals in this cohort well above the 100 mm minimum size limit. The second cohort had an average size of 64 mm. There was no evidence of any significant Commercial scallop recruitment in 2012. There were very few legal sized Queen scallops sampled but there was evidence of growth of a small recruitment pulse of Queen scallops with a mean size of approximately 64 mm almost a doubling from an average size of 36 mm in 2011. The numbers of Doughboy scallops had declined significantly with only a remanent population detected in 2012. There was no evidence of new recruitment of Doughboy scallops.

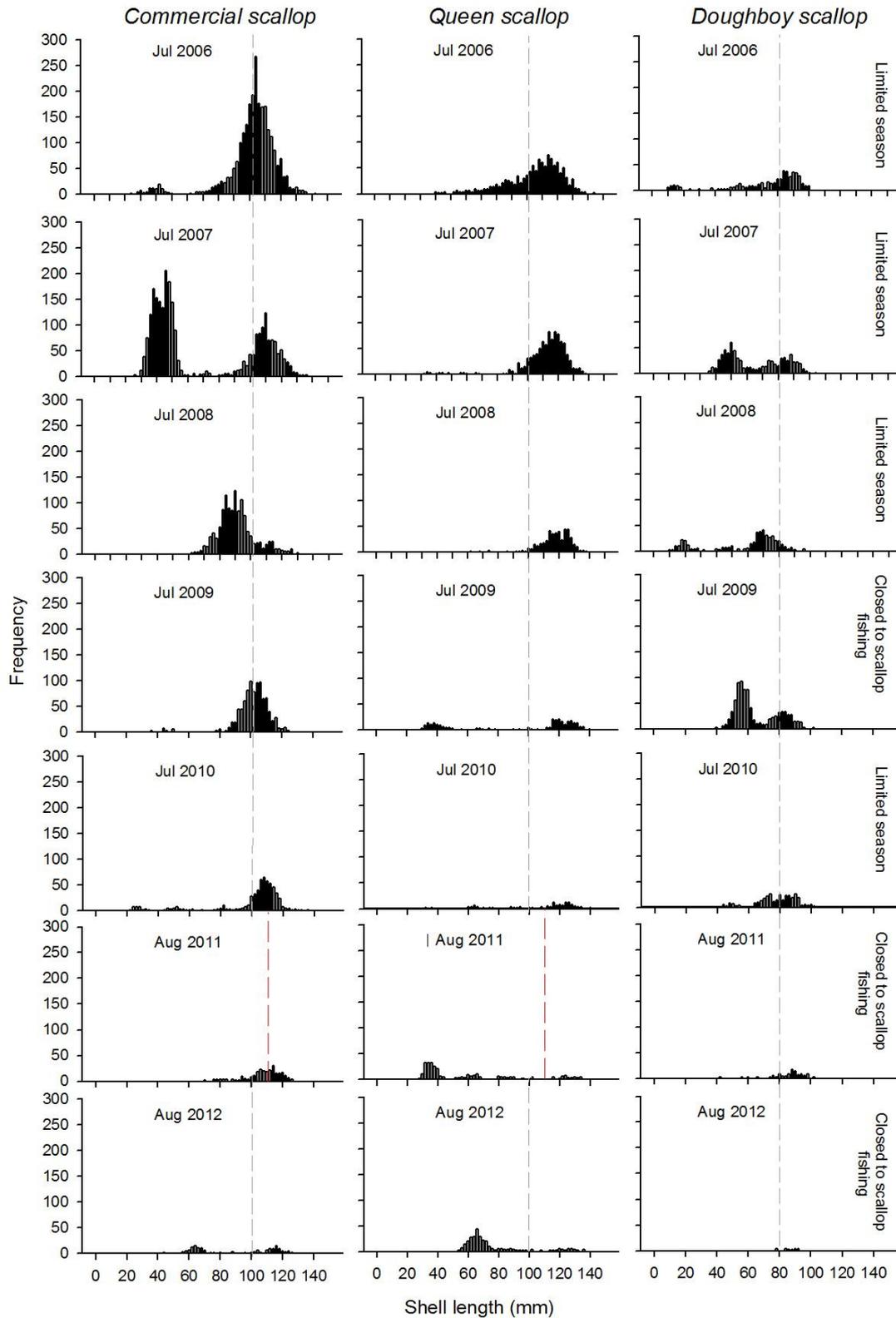


Fig. 3. The relative size composition of Commercial, Queen and Doughboy scallops sampled from the 24 replicated sites within the D'Entrecasteaux Channel over 7 sampling periods from 2006 - 2012. The dashed vertical line indicates the minimum legal size limit for each species. The larger dashed line indicates the revised size limit for Commercial and Queen scallops in 2010 (110 mm SL).

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.m^2 , 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. m^2 (Fig. 5). The higher density areas in Area 4 were dominated by Queen scallops, with legal sized Commercial scallops scarce. Scallop densities within Area 5 were also very low ($< 0.05 \text{ sc.m}^2$) (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 with the distribution of Queen scallops contracted into Area 4, with only patchy remnant distribution remaining through Area 5 (Fig. 5). 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. 5).

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. 5). 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). The majority of undersize scallops were located in Area 4 and were mainly the newly recruited Queen scallops (Fig. 5).

In 2012 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, but numbers have declined progressively in this area since settlement in 2007 (Fig. 5). The majority of undersize scallops were located in Area 4 and were mainly newly recruited Queen scallops (Fig. 5).

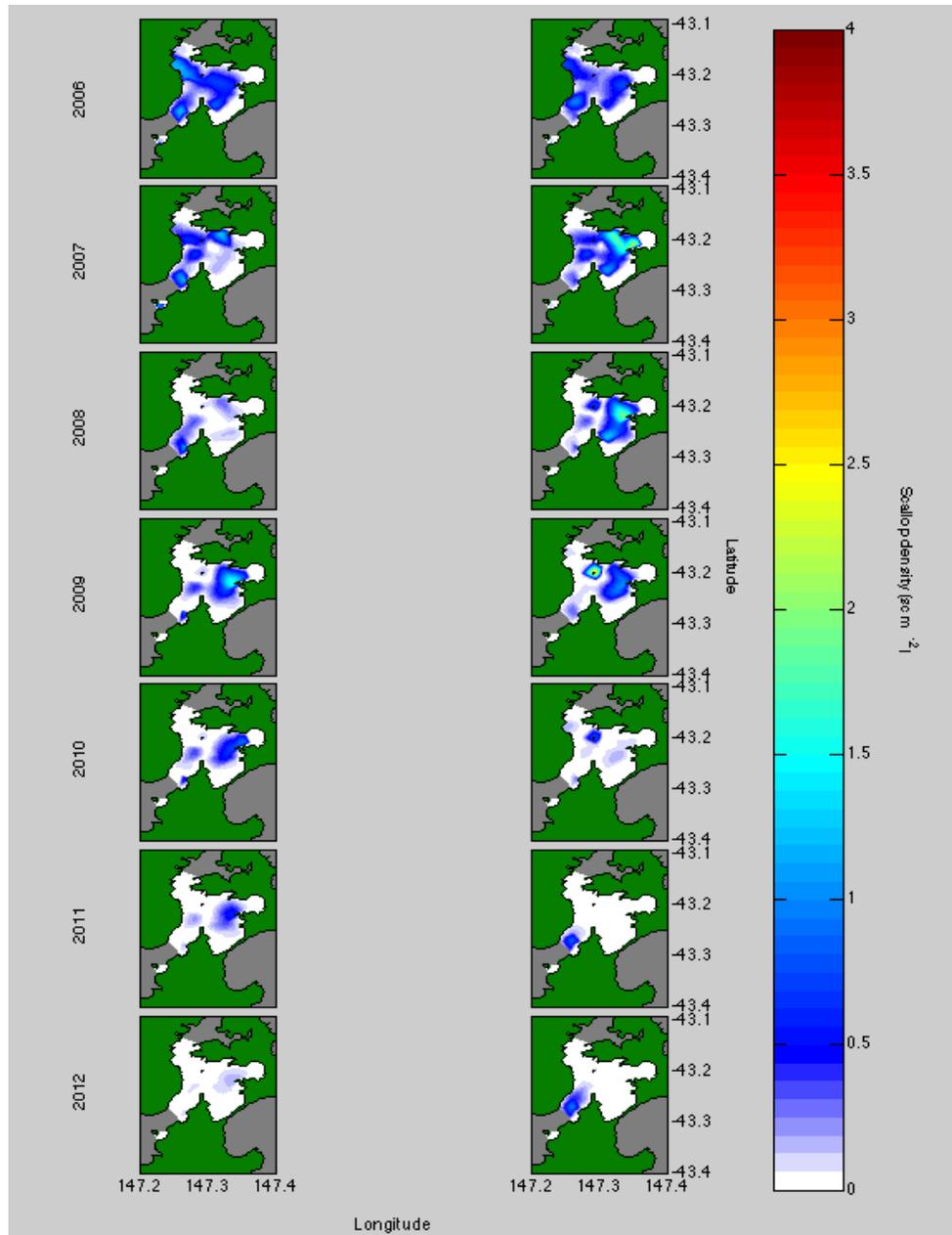


Fig. 5. The left column presents interpolated densities (scallops m^2) of all scallop species combined that were above the minimum legal size limit based on data from the 24 replicated sites for each sampling period. The right column presents interpolated densities of all scallop species combined below 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.

Summary

The 2012 dive survey has provided further evidence of a decline in the number of scallops within the D'Entrecasteaux Channel since 2004. This is due to the combined effects of temporally and spatially erratic recruitment, natural mortality and targeted fishing pressure from 2005 to 2010. The most notable change has been the decline in abundance and contraction in distribution of Commercial scallops. The previously high density beds of Commercial scallop located throughout the northern and mid-Channel, the mainstay of the fishery between 2005 and 2008, were all but absent.

Queen scallop numbers have declined since the surveys began, although their distribution appears to have remained relatively constant. Queen scallops are the only species to have produced a successful recruitment pulse over the last two years. This recruitment pulse is not expected to provide a fishable biomass by the time it reaches the legal minimum size limit, due mainly to the high rate of natural mortality experienced by scallops.

Doughboy scallop numbers remained relatively unchanged from 2006 through 2009. In 2010 however, the Doughboy scallop numbers began to decline rapidly, and during the 2012 survey they were at their lowest numbers since the survey began.

Overall there has been a lack of significant recruitment for each of the three scallop species in the D'Entrecasteaux Channel since 2007. Even if good settlement were to occur in 2012/13, the cohort would not be expected to attain legal size (and maturity) for several years.