

Assessment and advise of snow crab in west Greenland 2011

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Assessment and advice of Snow Crab in West Greenland 2011

Introduction

This report documents the scientific basis for the assessment of snow crab (*Chionoecetes opilio*) stocks in West Greenland. Snow crabs are patchily distributed and commercially exploited along the coast and within the fjords. The fishery is managed by quotas and assessed when data are available within the inshore and offshore of 6 management areas (Upernavik, Uummannaq-Disko Bay, Sisimiut, Maniitsoq-Kangaamiut, Nuuk-Paamiut and Narsaq-Qaqortoq). The report briefly updates and summarizes the historical background of commercial crab fishing, which includes catch, effort, CPUE and spatial distribution of the fishery, as well as the results from scientific surveys undertaken by the Greenland Institute of Natural Resources (GINR).

There are no specific long-term management objectives for the snow crab resource in West Greenland. However, since 2004 the main objective of recommendations from GINR has been to stop the decline in biomass of the crab resource in the different management areas.

Summary

Management area Disko Bay - Uummannaq

- *The recommended catch level for 2011 in Disko Bay inshore is 600 tons and unchanged from 2010. The quota should be divided on 200 tons in the southern part of Disko Bay, 200 tons in the Northern part of the bay and 200 tons in Vaigat.*

Management area Sisimiut

- *The recommended catch level for 2011 in Sisimiut inshore is 500 tons, divided on 200 tons in the traditionally fishing area and 300 tons in Ndr. Isortoq and Ndr. Stoemfjord.*
- *The offshore area are recommended closed for fishery in 2011*

Management area Nuuk - Paamiut

- *The recommended catch level for 2011 in Nuuk – Paamiut inshore is 200 tons.*
- *The recommended catch level for 2011 in Nuuk - Paamiut offshore is 1,000 tons. The recommended catch level was 1.600 tons in 2010.*

Management area Maniitsoq - Kangaamiut

- *Due to the lack of survey and fishery data no recommendation is given for Maniitsoq - Kangaamiut inshore and offshore.*

Management area Narsaq - Qaqortoq

- *Due to the lack of survey and fishery data no recommendation is given for Narsaq - Qaqortoq inshore and offshore.*

General recommendation and advice

- GINR recommends a seasonal fishery from April to July in all management areas to reduce discarding and associated mortality to soft-shelled crabs and to maximize recruitment to the stock. Such a seasonal fishery will also promote the most optimal and sustainable utilization of the crab resource.

Resource status in each management area derived from fishery data

An overview of GINR's recommendations and the imposed quota and fishing status (open or closed) of the management areas in 2011 are given in Table 1.

Table 1. Summary of catch recommendations for the crab fishery in 2011 from the Greenland Institute of Natural

	Recommended catch Inshore 2011 in tons	Recommended catch Offshore 2011 in tons	Catch in tons 2009 Inshore	Catch in tons 2009 Offshore	Recommended catch Inshore 2010 in tons	Recommended catch Offshore 2010 in tons
Disko Bay	600	130	471	186	600	130
Sisimiut	500	Closed	597	354	500	200
Maniitsoq	No advice	No advice	88	171	No advice	No advice
Nuuk-Paamiut	200	1.000	435	676	200	1.600
Narsaq - Kap Farvel	No advice	No advice	187	-	Ingen	Ingen
Recommended catch in all	1.000	1.330	1.778	1.387	1.300	1.930

Resources and total catch from 2009 (catch statistics for 2010 are incomplete at this time).

Species biology

Snow crab habitat include sites where bottom is covered by mud/sand and rock. Their diets include brittle stars, shrimp, younger stages of snow crab (cannibalism), clams, polychaete worms and other crustaceans. Predators are various ground-fish, snow crab and human.

Snow crab hatchling their broods in spring and larvae undergo two planktonic larval stages and settle to bottom during fall. Benthic juveniles snow crab males as well as females molt frequently and become sexually mature from > 50 mm carapace width (CW) depending on bottom temperature.

Snow crabs tend to molt during spring and continue until terminal molt at adulthood is reached within a size range of 50 – 130 mm CW for males and 40 – 95 mm CW for females. At the terminal molt males developing enlarges claws improving their mating ability. Only a portions of any given cohort recruit to the fishery at 100 mm CW, where the males is approx. 9 to 10 years. Recruitment is periodic or episodic and varies considerably over a cycle of 8 to 12 years.

After the molt to adulthood legal sized males remain soft/new shelled having low meat yield for the rest of the year. In the following year, meat yield would have increased to a suitable level for the industry. Discard of soft shell and new-shelled, due to their low yield contents is resources wastage.

Historical fishery background

Snow crabs are distributed along the West coast of Greenland and are commercially exploited primarily from Disko Bay in the North (up to 71° 30N) to Paamiut in the South (60° 45N). Commercial fishery for snow crab began primarily in inshore areas (within basis-line) in the mid-1990s and from 1999, also included offshore areas (outside basis-line).

Since 2004, the crab resource in Greenland has been managed in 6 areas (from North to South - Upernavik, Uummannaq-Disko Bay, Sisimiut, Maniitsoq-Kangaamiut, Nuuk-Paamiut and Narsaq-Qaqortoq, see Fig. 1). The fishing fleet is made up of two components; small vessels (less than 75 GRT), which have exclusive rights for fishing inshore within the basis-line as well as offshore. Small vessels are, however, restricted to fishing in only 2 management area during the year. Large vessels (greater than 75 GRT) may only fish in all offshore areas (outside the basis-line), but not within the "Crab Boxes". Quota restrictions have been imposed to each of the 6 management area since 1995 and individual quotas to vessels larger > 75 GRT, but have only limited the catch in 2004. Management decisions allow increasing quota in each of the 6 management area, when the catch achieved the first fixed quota. Un-used quota from larger vessels is re-allocated to the inshore fleet (small vessels < 75 GRT). Basically, there is now quota restriction for the small vessel.

The fishery is regulated by prohibitions to land females and undersized males (<100 mm CW), logbooks for all vessels larger than 10 meters and closure of the fishery north of 64°N for 3 months (1 January to 31 March). There is also a regulation that states movement of the fishing effort when soft-shelled crabs exceed 20% of the catch, however the term "movement" is not specific and this is not monitored. From 2005 to 2007, the offshore crab fishery was closed in the management areas Maniitsoq-Kangaamiut and from 2005 to August 2007 in the offshore area of Sisimiut except for dispensation to 1 vessel that was allowed to fish in 2005. Only in 2006, the fishery was closed for 2½ months (July 1 to September 15) in all areas except Uummannaq-Disko Bay (closed only 1 month from July 1 – August 3) to protect soft-shelled crabs.

The number of vessels with licenses to participate in the snow crab fishery increased by more than a factor of 3 from approx. 120 to 374 boats from 1999-2002. Since then the number of both large and small vessels have decreased substantially as the abundance of the resource has also declined. In 2008 the number license holders amounted 74 in all management areas an 80% reduction compared to 2002. In 2009 number of license increased to 117.

Greenland Institute of Natural Resources (GINR) provide stock assessment and total allowable catch (TAC) advice for the stock both inshore and offshore within each management area when sufficient data is available. The decision to give advice for both inshore and offshore areas was based on the assumption that snow crab migration is limited (tagging studies have indicated approx. 10 km per year) and therefore the resource in different areas is considered to be spatially independent.

Commercial fishery data

Logbooks from the large vessels >75 GRT have been mandatory since 1999 in conjunction with the start of offshore fishing with vessels of this size. Logbooks for the small vessels (<75 GRT) were first mandatory from July 2002, and thus first covered the annual fishery in 2003. Only landing statistics are available from boats less than 10 meters as they are not required to report catches in logbooks.

Catch, Effort and CPUE

The historical development of the crab fishery in Greenland is shown in Figure 2. Landings increased from approx. 1,000 tons in 1995 to a peak of approx. 15,000 tons (Quota 26,800 tons) in 2001 (based on landings from small vessels and catch from logbook data from large vessels >75 GRT). From 2001 to 2007 total catch decreased by approx. 89% to 2,189 tons (Quota 4,380 tons). Landings increase to 3,191 tons

(Quota 4,680 tons) in 2009 and preliminary data indicate an additional decrease in landings in 2010 (approx. 1.800 tons ultimo October 2010, Quota 4,050 tons).

In 2008 and 2009 quota was increased from 500 tons to 800 tons in the management area Sisimiut and from 700 tons to 1000 tons in Nuuk - Paamiut management area (only in 2009). The increasing quota was based on re-allocation (removing a part of the quota from five vessels > 75 GRT) allowing small vessel < 75 GRT to increase catches inshore as well as offshore.

The distribution of landings and geographic distribution of the fishery in each management area in Fig. 3 and Fig. 4, show that most of the landings in 2008 have predominately come from management Sisimiut (42%), where as Disko Bay-Uummanaq and Nuuk-Paamiut amounted 27% and 26% respectively of the total landings.

The total fishing effort (trap hauls) has declined by 91% since 2001 (from 3,416 to 323 thousand trap hauls during 2001-2008) (Fig. 3). The decline has been mostly due to a declining number of participants in the fishery. Preliminary and incomplete logbook data for 2010 shows total effort is 220 thousand trap hauls. The overall distribution of the fishery along the West coast of Greenland from 2003-2009, derived from available logbook data is shown in Figure 4.

Research Surveys

Since 1997, trap surveys have been conducted annually in inshore areas of Disko Bay and Sisimiut. In 2000, a Sisimiut offshore area (Holsteinsborg Dyb) was included in the Sisimiut trap survey. In 2002, annual offshore trap surveys were initiated in areas between Nuuk and Paamiut and in 2003 were extended north to include the offshore in the Maniitsoq-Kangaamiut management area.

Methods

Snow crabs are sampled with Japanese-style conical traps with large (70 mm) and small (21 mm) mesh sizes. Sampling stations are at predetermined fixed positions for all years and soak times range between 14-24 hrs depending on weather conditions. Bottom temperatures are recorded at each station.

For males, the carapace width (CW) and chela height (CH) are measured (± 0.01 mm) to determine size and molt status (adolescent or adult). Male snow crabs stop growing after their terminal moult. Sexually mature males are referred to as adolescents (recognized by their small claws) prior to the terminal molt and as adults after their terminal molt (large claws). Males reach legal size (≥ 100 mm CW) at about 9 years of age. The range of carapace widths defining the adolescent male groups which are presumably 1, 2 and 3 years from recruitment to legal size are: ADO⁻¹, 82.2-100mm CW; ADO⁻², 67.3-82.2mm CW and ADO⁻³, 53.2-67.3mm CW.

For females, the CW and abdomen width (AW) are measured (± 0.01 mm) to determine size and maturity. Females that have mated once and are carrying their first clutch of eggs are called primiparous, while females that are carrying their second clutch and have mated more than once are called multiparous. They are distinguishable by the number of scars on their legs caused by mating and by shell conditions. Shell condition in both males and females is determined on a scale of 1-5 according to guidelines by Sainte-Marie (1993).

Data from trap survey catches of males are used to determine CPUE (kg/trap), mean CW of legal-size males, shell condition and NPUE (number/trap) of adolescent males to assess recruitment prospects. Male and females size distributions are also described to follow the progression of size modes through the populations and determine pri-

miparous/multiparous ratios within the female population.

Inshore surveys in Disko Bay and Sisimiut

In Disko Bay, 43 stations are sampled annually (Fig. 5a) and in Sisimiut, 40 stations are sampled (Fig. 5b), from May to June. The sampling gear consists of a longline of 10 large-mesh (70mm) and 2 small-mesh (21mm) conical traps fished at depths ranging from 100-600m. Traps are placed approx. 40m apart and baited with squid.

Offshore surveys in Sisimiut, Maniitsoq and Nuuk-Paamiut

Fifteen stations are sampled annually in Sisimiut offshore (Fig. 5b) in June and a total of 30-60 stations are sampled in the Nuuk-Paamiut and Maniitsoq offshore areas in August-September (Fig. 5c). The sampling method in Sisimiut offshore is the same as the method used inshore in Disko Bay and Sisimiut. In 2002, the sampling in the Nuuk-Paamiut offshore survey was also the same as the method inshore. In 2003, however, the offshore sampling method used in Nuuk-Paamiut and Maniitsoq was changed such that each station was then sampled using a long line of 16 traps, eight large-meshed traps alternating with eight small-meshed traps at approx. 40m apart and baited with squid.

Input data from commercial fishery to assessment

No sampling from the commercial fishery has been conducted since the fishery began in 1996.

Available logbook and landing statistics is used in data analysis from the commercial fishery. Logbooks nominal catches has since 2003 covered more than 85% of the total landings in Greenland. Before 2003 less than 20% of the fishing fleet were using logbooks.

In order to calculate a standardised CPUE index, a GLM analysis (multiadditive model) was carried out using haul by haul logbook information

including zero catches. The model includes year, month and vessel effects.

Management area: Uummannaq-Disko Bay

The historical catch, CPUE and effort data for the fishery in Uummannaq-Disko Bay in the inshore and offshore areas are summarized in Table 2. Data for 2010 are preliminary.

One of the most important fishing areas has been Disko Bay where catches are predominately from the inshore. Total catches peaked at 4,202 tons (94% inshore) in 2001 and since then have steadily declined to 657 tons (84% inshore) in 2009, approximately 16% of the 2001 catch.

Number of permits as well as number of active vessels has decreased over time. In 2003, 43 permits were given to the management area, but only 31 vessels were active that year. In 2009 there 22 permits were issued and 12 vessels were participated in the fishery.

Inshore - Disko Bay Fishery

The distribution of the fishery in Disko Bay from 2003 to 2008, according to available logbook data is shown in Figure 6. Fishing grounds include both Vaigat, area "Disko North" and "Disko South". The geographic distribution of the fishery has been homogeneous in the period from 2003 to 2008, although total catches, CPUE used effort has changed markedly. In contrast to the previous years, 2009 and 2010 preliminary data indicate a very limit fishery in the area "Disko North".

The fishery in Disko Bay starts in April, peaks during the summer months (June-July) and steadily declines towards the end of the year, except in 2007 when the fishery increased during fall and peaked in October (Fig. 7). The temporal pattern of CPUE in 2009 showed CPUE peaked in July and August and decreased as the season progressed.

A standardized CPUE index (Fig. 8), show a significant dropped in CPUE from 2001 to 2004 from approx. 7.6 kg/trap to 3.6 kg/trap ($F= 37.04$, $P < 0.0001$). In the following years CPUE has staidly increased to approx. 5 kg/trap in 2008 and 2009. Preliminary data for 2010 indicate stable trends in CPUE (Table 2) and (Fig. 8).

From 2000-2001 catches inshore increased from 2,940 – 3,950 tons as effort more than doubled (table 2). CPUE, however, decreased from 4.8 to 3.1 kg per trap. Catches and effort have significantly declined since 2001 by approximately 88% to 471 tons and 93 thousand trap hauls, respectively, in 2009 (Table 2 and Fig. 8).

Standardized soak time index (Fig. 9), shows a significantly decrease in soak time from 2001 to 2002. Since 2003 soak time increased steadily until 2007, at a level of average 72 hour per hauls and comparable to 2001 level.

Research Surveys

Research Surveys

Trap surveys have been conducted in 2 inshore areas of Disko Bay since 1997 (See Fig. 5a for maps).

Important: *Owing to the breakdown of the main engine at the research ship Adolf Jensen, the survey has been cancelled in 2009. In 2008 survey was only conducted in the Northern part of Disko Bay. No new survey data is available for the stock assessment and advice.*

Standardized CPUE of legal-size males (≥ 100 mm CW) in South decreased substantially since 2001 by more than 50% from 4.2-1.7 kg/trap. Subsequently CPUE steadily increase in 2007 comparable with the 2001 level. A decline in CPUE to xx kg/trap has been observed in 2010 (Fig. 10).

In North standardized CPUE declined from 7.5-2.3 kg/trap in North from 2001 to the lowest observed level in the time series in 2004 (Fig. 10). In 2005 CPUE was still considerably low, but increased to

6.4 kg/trap in 2006 followed by a decline in 2007 to 4.4 kg/trap. From 2008 to 2010 CPUE have remained stable at approximately 5 kg/trap.

The mean carapace width (CW) of legal-size males had continually declined in both survey areas to a minimum in 2004 (Fig. 11). CW subsequently increased in both areas in 2005 and remaining unchanged in South to 2007, while the mean CW has increased over the past 4 years in Disko Bay North to 116 mm CW in 2008. In 2010 CW dropped to 112 mm CW.

The abundance of adolescent males, 82.2 mm – 100 mm CW (ADO-1) measured as number per trap (NPUE) oscillate over the time series in both the Northern and Southern part of Disko Bay (Fig. 12). In South ADO-1 initially decreasing from 2002 – 2004 and increasing to a peak in 2008. In 2010, a minor decline has been observed.

In Disko Bay North, abundance of ADO-1 peaked at 2.6/trap in 2002 (Fig. 12). The NPUE of ADO-1 has since declined sharply and was at the lowest levels observed for the time series in 2004 and 2007. An additional peak was observed in 2008 followed by a decrease in 2010 to approx. 1.5/trap.

Annual trends in size distribution of adolescent and adult males are shown in Fig. 13. In South there was no further progression through the size range until 2006. Data from 2007 implies a recent increase in recruitment caused by increasing recruitment of small legal-sized new-shelled since 2005. In 2010 modal was 95mm CW as in 2007, but number of males > 100 mm was remarkably lower in 2007. In the Northern part of Disko Bay the recruitment pulse in 2005, resulted in increasing CPUE and mean CW as legal-sided adolescent pre-recruits molted and the 'recruitment pulse' progressed through the size range. The decrease in ADO-1 males in 2006 showed up clearly as a reduction of adult males in the size range from 100mm to 130mm CW. In

North there was progression through the size range in 2007 and 2008. Data from 2008 strongly implies a recent increase in recruitment caused by increasing recruitment of small legal-sized new-shelled since 2006. Further more in 2008, the highest proportion of adolescent males from 60 mm to approx. 80 mm CW has been observed in North (i.e. a mix of ADO2 and ADO3, expected to recruit to the fishery with in 2 and 3 years from 2008). In North the recruitment pulse since 2008, didn't results in increasing CPUE in the two following years. There is no data on recruitment available from 2009, but an increasing modal at approx. 100 mm compared to 2008, suggesting fair recruitment from 2009 to 2010, which also is confirmed by number the of ADO-2, 67.3 – 82.2 mm CW, in 2008. Data from 2010 show removals of males > 120mm CW, suggesting that the fishery is dependent on males from 100 – 115 mm CW.

Increasing proportion of legal-size soft and new-shelled males (shell condition 1 and 2) have been observed from 2001-2006 (Fig. 14) and have peaked at around 70% in 2006 in both South and North. The continuously high proportion of soft and new-shelled males suggests a continuous removal of the older shelled males by the fishery, which was becoming increasingly dependent upon recruitment in the years from 2001 to 2006. Proportion of soft and new shelled males (shell condition 1 and 2) decreased in 2008, probably an effect of a substantial decreased in fishery removals in the Northern part of Disko Bay. In 2010 number of soft shell males increased to approx. 55%, as an effect of incoming new recruitment.

The ratio of primiparous and multiparous females, used to support trends in recruitment, decreased sharply in South from 2000 to 2003, remained low in 2004 and has increased until 2006 and decreased again from 2006 to 2007 (Fig. 15). The increase in South in 2005 and 2006 could either

reflect the loss of a large group of mature females from the population or that a recruitment wave could be forthcoming. In 2007 a minor decrease has been observed but is at the 2005 level. In North the ratio of primiparous and multiparous female has remained constant at a level of 0.45 from 2004 to 2006, decreased to 0.26 in 2007. In 2008 the ratio of primiparous and multiparous females increased to approx. 0.5, indicating a recruitment of mature females to the stock. In 2010, the ratio dropped to low levels, supporting trend in decline in recruitment to the stock.

Outlook - Disko Bay Inshore

Both catch rate (CPUE) from the fishery and survey abundance as well as recruitment indices have oscillated throughout the time period since 1997. Available fishery and survey data agree that the crab resource in Disko Bay declined from 2000 to 2004, and has since recovered somewhat. Total catch and effort have declined during 2001-2009 by 88% and 93% respectively. The commercial catch rate has increased since 2004 and in 2009 was at around 5 kg/trap. Survey CPUE in Disko Bay South increased from 2004 to 2007 and dropped again in 2010. The recruitment index (ADO-1 males from 82.2 – 100 mm CW who will enter into the fishery the following year) increased in Disko Bay South from 2004- 2007 followed by a decrease in 2010 (no surveys in 2008-2009). Survey CPUE in Disko Bay North decreased from 6.4 kg/trap in 2006 to 4.4 kg/trap in 2007. A minor increase has been observed in 2008 and it changed little in 2010 (no survey in 2009). Recruitment potential, (ADO-1) improved significantly from 2007 to 2008 in the northern part of Disko Bay but decreased again in 2010. This suggests no increase in exploitable biomass in recent years and poor recruitment prospects in the near future. Recruitment indices for a long-term prognosis are uncertain. The percentages of new shelled adult male's approx. (50 %) males in Disko Bay indicate that the fishery in Disko Bay

has become more sustained by crabs recruited two to three years ago. The recent commercial CPUE trend, indicates that there has been no increase in commercial crab biomass despite declining fishery removals in both parts of Disko Bay (especially in the area covering the southern shore of Disko Island (survey area Disko Bay North)). Gradual improvement in fishery performance since 2004 is not primarily due to change in the exploitable biomass, but due to the significant reduction in the fishery removals from 2001 – 2009 and reduced fishing effort, which might have resulted in reduced fishing mortality.

Recommendations for the 2011 fishery

Disko Bay Inshore

Data obtained by logbooks and landings indicates that the quota has never been fully taken since quotas were introduced in 2005. The catch has never been regulated, but the fishery has been self regulating. Despite a big decrease in removals by the fishery, both commercial and survey CPUE has only increased a little and very gradually. Data from research surveys in the Northern part of Disko Bay suggest some improvement in recruitment prospects to the resource in 2008 that will probably not be available to the fishery until 2011. An increase in catch in 2011, above 600 tons, could impose high handling mortality on soft/shelled crabs that would harm the forthcoming recruitment. Prospects for an increase in the future are still uncertain.

The recommended catch level for 2011 in Disko Bay inshore is 600 tons. The status quo is recommended for 2010 and should help stabilize the commercial biomass. The quota should be divided on 200 tons in the southern part of Disko Bay, 200 tons in the Northern part of the bay and 200 tons in Vaigat.

Offshore - Disko Bay

Fishery

Catches in offshore Disko Bay have increased from 112 tons in 2000 to 349 tons in 2003 (Table

2). Meanwhile, effort increased about 500% from 20-116 thousand trap hauls. Concurrently, CPUE steadily declined from 5.5 to a low of 2.6 kg/trap in 2003. Catches in 2006 and 2007 were 126 tons and 123 tons respectively, and increased to 186 tons in 2009. CPUE decreased from 6.7 to 5.1 kg/trap in 2007 and has changed little since.

Outlook - Disko Bay Offshore

Catches have been between 120-350 tons since 2001 and CPUE has varied between 2.6 and 6.7 kg/trap. The fishery in recent years has almost exclusively concentrated effort around the south-western part of Disko Island with some sporadic fishing in the far South. Recruitment is unknown because there are no surveys undertaken in this area.

Recommendations for the 2011 fishery Disko Bay Offshore

CPUE from the fishery indicates increasing biomass since 2004 and there are signs of stable stock. A catch level of 130 tons is recommended, which is the same recommendation since 2008.

Management area: Sisimiut

The commercial fishery for snow crab in the Sisimiut area began inshore in 1996 and expanded to include the offshore area, primarily in Holsteinsborg Dyb, in 1997. Historical catch, CPUE and effort data of the fishery in Sisimiut in the inshore and offshore areas are summarized in Table 2. Data for 2010 is only preliminary and incomplete. Owing to a markedly decrease in biomass from 2002 to 2004, the offshore area has been closed for fishery from January 2005 to October 2007, were the area was reopened, despite reopen criteria was not meet. In the closure period 2 boats has been fishing on derogation.

In 2006 the fishery from were closed in all sites from mid July to primo September in order to protect soft shell crabs.

The distribution of the fishery over the last years shows fishing effort has moved outside the fjords in the traditional fishing grounds near Sisimiut. North from Sisimiut two fjords (Ndr. Stoemfjord and Ndr. sortoq) has been exploited since 2004 (Fig 16).

Inshore Sisimiut Fishery

Number of license holders has varied since the beginning of the fishery and implementation of management areas. In 2005 there were 12 license holders and increased to 21 in 2009 and 19 in 2010. Number of active vessels followed the same trend and have increased since 2006, were 10 were fishing in that management area, to 20 active vessels in 2009. Preliminary and incomplete data from 2010 indicate that 16 vessels have attending in the fishery in 2010.

In the period from 2000-2004 inshore catches steadily increased from 491 to 1,111 tons (Table 2 and Fig. 18). From 2005 to 2009 catch levels have been fluctuating annually from 559 - 765 tons. Effort decreased from 2000 to 2002, increased again in 2003, and declined by approx. a factor of 4 to a historical low level of 71 thousand trap hauls in 2009.

Monthly trends in catches, CPUE and effort from 2004-2009 and preliminary data for 2010 are shown in Fig. 17. The temporal pattern of CPUE in 2009 is identical with trends in 2007 were CPUE peaked in May and decreased as the season progressed and total catch for the area increased. A similar pattern was seen in data for 2008, except for a peak in both August and December. Preliminary data for 2010 suggest lower catch rates in the beginning of the season in

May and June compared to the previous years (Fig. 17).

A standardised CPUE index (Fig. 18), show a significant dropped in CPUE from 2002 to 2004 from approx. 5.2 kg/trap to 3 kg/trap ($F=73.05$, $P < 0.0001$). CPUE increased at a level of 8.7kg/trap in 2008, remain stable in 2009. The distribution of the fishery changed from 2004 to cover new fishing areas in fjords in the northern part of the area (Fig. 16), which have comparatively high CPUE. Thus, these new areas are largely responsible for the increase in the overall commercial CPUE from 2005 - 2008. Preliminary and incomplete catch indicate a 36% decline to 5.6 kg/trap in 2010.

Standardised soak time index (Fig. 19), shows a steadily significant increase in soak time from approximately 48 hour 2002 to 74 hour in 2008 ($F=17.87$ $P < 0.0001$). Preliminary data for 2010 indicate declining soak time for the past two years.

Research Surveys

Inshore

Annual snow crab trap survey is conducted in late May to mid June, but owing to technical problems with *r/v Adolf Jensen*, survey in 2009 was carried out early August.

The survey CPUE inshore increased steadily from 2.9-6.7 kg/trap from 1997 to 2001, and was followed by a decline by a factor of 3 to a record low level of 2 kg/trap in 2005. During 2004-2006 survey CPUE was stable at a comparatively low level and below the re-opening/closure criteria of 6 kg/trap (Fig.20). In the historic fishing area (the fjord: Amerloq, Ikertoq, Kangerluarsuk, Ittilleq and the area outside the fjords but inside the basisline), a standardize CPUE index, show significant increasing catch rates to 10.9 kg/trap in 2008, a record high level in the time series, followed by a continuously sharp decline to 8.3

kg/trap in 2009 and 4 kg/trap in 2010 ($F=5.2$, $P < 0.001$).

Mean CW of legal-size males inshore decreased from 2004 to 2006 (Fig. 21), remained stable at 113 mm CW from 2007 – 2009, and dropped to 2206 level in 2010 at 112 mm CW. Average carapace of legal-sized snow crab are somewhat larger in Ndr. Stroemfjord at approx. 115 mm CW.

Abundance of ADO-1 (82.2-100 mm CW) males in Sisimiut inshore was comparably high the first 3 years of the survey (2000-2002) (Fig. 22). Since 2003, the abundance of ADO-1 males, declined sharply to approx. 1 ADO-1 per trap in 2004. The abundance of ADO-1 remained low but stable from 2004 to 2007. A significant increasing of ADO-1, to a record high level of 6.1 ADO-1/trap, was observed in 2008. The increasing CPUE as well as increasing number of ADO-1, suggested some positive recruitment to the stock. However, estimated abundance of pre-adults in 2009 show a decline to 4.6 ADO-1/trap, and a continuously sharp drop to 1.8 ADO-1/trap in 2010 (Fig. 22). Number of ADO-1 is now at the time series average based on available observations for adolescent males.

Annual size distributions of adolescent and adult males in Sisimiut inshore (Fig. 23) show evidence of recruitment progressing through to the legal size range (≥ 100 mm CW) from 2007 to 2008. Modal has been during the entire time series been constant at around 95 mm CW, exception was in 105 mm CW as observed in 2007. The recruitment pulse in 2008 and 2009, resulted in increasing CPUE and mean CW as legal-sized adolescent pre-recruits molted and the 'recruitment pulse' progressed through the size range. Data from 2010 show removals of males $>$ that 120mm CW, suggesting that the fishery is dependent on males from 100 – 120 mm CW.

Legal-size males of shell condition 2 (new shelled males) has for 2006 and 2007 comprised 50% of survey catches (Fig. 24) and positively showing a tendency of increasing number of intermediate shelled (SC3) adult males. For past two years proportion of soft shell and new shelled males (SC2) increased to approx. 70 % in 2009 and 2010, probably because of incoming recruits.

The ratio between primiparous: all mature females declined sharply from 2000-2002 (Fig. 25), and has remained low up to the present with the exception of a slight increase in 2005. An increasing is observed in 2008 and 2009, suggesting new mature female recruiting to the stock. An additional decline has been observed in 2010 suggesting low recruitment with prospect for decrease in the exploitable biomass in the near future.

In the northern fjord Ndr. Stroemfjord, catch rate was approx. 9 kg/trap in 2007, increased to 12.5 kg/trap in 2009 and decreased to 8 kg/trap in 2010.

Average mean CW was 116 mm in 2007 and dropped to 114 mm CW in 2009. The proportion of new shell males comprised 58% in 2007 and 70% in 2009. Intermediate males amounted (SC3) 42% and 30% respectively of the adult males exceeding the minimum legal size of 100 mm CW.

Abundance of ADO-1 was at a low level of 0.1 per trap but has been increased to 2.6 ADO-1/trap in 2009 followed by a 50% reduction to 1.2 ADO-1/trap in 2010. Number of recruits is lower than compared to the other inshore areas of Sisimiut. In 2008 survey was not conducted in this fjord.

Outlook - Sisimiut Inshore

The survey data showed some improvement in the stock from 2005 until 2008. In the same period fishery removals decreased from 1111 tons in 2004 to 559 tons in 2007. Biomass showed sign

of recovering, but all available indices from the fishery as well as survey, have shown declining trends over the past two years (2009 and 2010). However, in 2008 observed levels of survey CPUE and pre-recruits were higher than during the previous peak, 2001-2002 (Fig. 20 and Fig. 22). The increase in CPUE from 2007 to 2008 can be attributed to improved catch rate and fishery performance close to the boundary (the dividing line between inshore and offshore areas and in the more northern fjords Ndr. Stroemfjord and Ndr. Isortoq). However, fishery and survey CPUE indices as well as the abundance index of pre-recruits based on survey data continued the decreasing trend in 2010. If this trend continues in 2011 (and beyond) the commercial biomass will decrease over the next few years.

Recommendations for the 2011 fishery - Inshore Sisimiut

All available data from surveys have shown oscillating trends over the entire time series. For the past two years, a declining trend has been observed in biomass (catch rates from both fishery and survey) and recruitment. Historic data showed the same pattern from 2001 – 2004. It is recommended that TAC be 500 tons for the entire inshore area in 2011, which may be sustainable at the existing biomass and recruitment levels.

The quota should be divided with 200 tons in the traditionally fished area (Amerloq, Ikertoq, Kangerluarsuk, Itilleq and the site outside the fjords but inside the boundary with the offshore and 300 tons in Ndr. Stroemfjord and Ndr. Isortoq.

Offshore Sisimiut

After a significant decline in commercial biomass and catches in 2004, the fishing area was recommended closed for fishery in attempt to re-build the stock.

The area remained closed from January 2005 and re-opened during 15 August to 31 October in 2007. Re-opening criteria were not reached, when a political decision allow fishery.

The area stayed closed from January 2005 and re-opened during 15 August to 31 October in 2007. Re-opening criteria were not reached, when a political decision allowed a fishery.

The following re-opening criteria were established in July 2007 in an agreement with KNAPK the fishermen's organization and Greenland Institute of Natural Resources:

- An average CPUE of 6 (kg/trap) obtained from logbooks and survey data
- An average carapace width of 115 mm for commercial sized males
- An average abundance of pre-recruits (Ado-1; 82 – 100 mm CW) of 2 per trap obtained by survey
- A maximum level of 50% new shelled males in commercial as well as survey catches

Fishery

In 2000 to 2002 Sisimiut offshore area, were the most important fishing area with commercial catches between 2,043-2,275 tons (Table 2 and Fig. 26), which was approximately 52-55% of the total offshore catch during that time. Catches declined sharply to 321 tons in 2004. In the subsequent 2.5 years this area were closed for fishery in an attempt to promote the recovery of the resource (one vessel fished on derogation that period) until re-opening in fall 2007 were catches amounted 225 tons and at were the same level in 2008. Catches increased in 2009 with approx. 40% to 354 tons.

The standardised CPUE index (Fig. 26), declined significantly from 9.5 kg/trap in 2000 to 2.7 kg/trap in 2004 ($F=7.64$, $P < 0.0001$) indicating that high catches were sustained by an increase in effort (from 319 to 643 thousand trap hauls, 2000 - 2003). Within two years (2002 – 2004) effort was reduced with 90%. In the closure period, 2005 to august 2007, CPUE increased significantly from

4.7 kg/trap in 2005 to 10.3 kg/trap in 2007. CPUE level was maintained in 2008. The previous years of increasing catch rates was in 2009, followed by a substantial reduction, with 30% to 7.3 kg/trap and preliminary data for 2010 indicate a continuously decline to 5.1 kg/trap. Thus, within two years CPUE is dropped with 50%, despite catch level remain stable in 2007 to 2008 at approx. 230 tons. However, the decline in CPUE probably is an effect of the increased catch level in 2009.

Monthly trends in CPUE in the entire time series show highest values of CPUE in the beginning of the season in April when the fishery open and a sharp decreased as the season progressed in September. Seasonal trend in CPUE (Fig. 27) shows a rapid depletion to September in 2009 and 2010 compared to the previous years. It appears that depletion began in 2008 and that the high overall CPUE for 2008 (Fig. 26) is misleading. Standardised soak time index (Fig. 28), show stability in soak time since 2006 ($F= 57.31$ $P < 0.0001$).

Research Surveys

A steady increase in the survey CPUE were observed over the period from 2004 (0.6 kg/trap) to 13 kg/trap in 2008 (Fig. 29). In 2009 and 2010 CPUE have declined significantly to 6.9 and 3.5 kg/trap respectively ($F=5.1$, $P < 0.0001$). Survey CPUE level is now below the 6 kg/trap as prescribed for the re-opening/closure criteria.

The mean CW of legal-size males (≥ 100 mm CW) offshore decreased considerably from 120 to 112 mm from 2003-2005, but has increased to 117 mm CW in 2008 (Fig.21). Only a minor decrease was observed in 2009 to 116 mm CW and an additionally increase to 118 mm CW in 2010.

Annual size distributions of ADO-1 (82.2-100mm CW) showed some evidence of these adolescents progressing through to legal-size from 2005 to 2008 (Fig.23). In 2009 and 2010 progression was

not particularly obvious, possibly disguised by the large drop in the overall biomass of legal-size males for the past two years. However, increase in abundance in males from 100 – 120 mm CW, especially in 2008, might be accumulation of several year classes, during the closure period. In general, there is no apparent trend corresponding to progression of length distributions in the most recent years except for 2007 and 2008 (see Fig. 23). Comparison to the inshore area also indicates that in 2008 and 2009 modal size of adults and mean size of adolescents were much larger in the offshore than inshore, supporting the idea that (offshore) the most recent recruitment pulse has fully entered the fishery and is being removed while there is no strong recruitment following.

The abundance of ADO-1 in Sisimiut offshore declined markedly from 2000 to a record low level below 0.2 ADO-1/trap in 2004 (Fig. 30). From 2005 the abundance of ADO-1 rose to approx. 1.5 per trap in 2006. In 2007 and 2008 abundance of ADO-1 has declined to the 2005 level of 1.2/trap. In 2009 and 2010 abundance of ADO-1 is estimated to 0.4 /trap and have declined significantly compared to 2005 - 2008. Number of recruits is below the re-opening/closure criteria of 2 ADO-1/trap.

The percentages of new-shelled crabs within the legal size range decreased from almost 90% in 2004 to about 25% in 2008 (Fig. 24). This sharp decrease in percent of new-shelled crabs in the survey is primarily likely due to the closure of fishery in the offshore area in the period from 2005 to 2007 and the very low level in commercial catches in that period (Table 2). The subsequent increase in percent new-shelled males in 2009 and 2010, however, may have been due to increasing recruitment into the stock, as ADO-1 had increased in 2005 to 2008 and fishery removals of large hard shell crabs in 2008 - 2010. However, it is unclear to what extent the changes

in shell condition ratios and CPUE are due to reduced catch versus increased recruitment. Caution must be taken, while number of hard shell crab and recruitment to the stock is low. The high number of new shell with low meat contents crabs in the survey catches in 2010, indicate a high fishery pressure on the stock for the past two years.

The ratio of primiparous:multiparous females declined sharply from 2000-2002, then increased from 2003 to 2005 (Fig. 31). A drop in this ratio occurred in 2006 and continued in 2007, with an increase in 2008 and 2009. A sharp drop was observed in 2010 and indicating poor recruitment may be forthcoming in the future.

Outlook - Offshore Sisimiut

Survey and fishery data indicate signs of recovery until 2008. The increase in biomass was largely attributable to greatly reduced removals due to the large reductions in commercial catches, from 2004 up to 2007. Nevertheless, all available indices show a significant drop from 2008 to 2010. Recruitment indices for the offshore area are poor and indicate low recruitment prospects in the short term. Caution must be exercised as CPUE from the fishery and survey substantially declined since 2008 and the recruitment is at a very low level. Those results might be effects of increased removals by the fishery after the re-opening and suggesting that the biomass has not recovered. Furthermore, it appears that the biomass fished upon after re-opening in 2007 may not be able to support catches as large as those landed in 2007 – 2009 in the longer term. It is quite possible that the biomass will not recover to the same high levels as existed initially. It should be emphasized that re-opening of the fishery in 2007 occurred before the re-opening criteria were met.

Recommendations for the 2011 fishery - Offshore Sisimiut

In 2010 there is no sign of progression in the biomass and the sign of recovery has turned to a significant decline in the biomass and recruitment. It is therefore recommended to close offshore area in 2011 and until the stock has more fully recovered.

Special comments: Harvesting should be monitored using a precautionary approach, careful monitoring of the populations response to the fishery and implementation of re-open /re-closure criteria.

Management area: Maniitsoq-Kangaamiut

The historical catch, CPUE and effort data of the fishery in Maniitsoq-Kangaamiut inshore and offshore areas are summarized in Table 2.

Overall catches of snow crab from the fishery in Maniitsoq-Kangaamiut area increased from 944 tons in 2000 to 1,835 and 1,775 tons in 2001 and 2002, respectively, as effort was doubled. Catches then decreased considerably to 486 tons in 2003 and steadily decrease to 130 tons in 2008. In 2009 catches reached 259 tons.

Inshore Maniitsoq-Kangaamiut

Fishery

Catches in Maniitsoq-Kangaamiut inshore peaked in 2001 and 2002 at approx. 1,000 tons both years but in the subsequent years the fishery have been very limited and in 2009 the catch level amounted to 88 tons. CPUE increased with decreasing catch and effort (Table 2). No standardized index of CPUE and soak time has been prepared, owing to the lack of data and irregularly recurring fishery in this area.

Outlook - Inshore Maniitsoq-Kangaamiut

It is not possible to determine the biomass of the resource in the area, and data from the fishery are

limited. There is no survey in the inshore area and comparative biomass and recruitment prospects are unknown.

Recommendations for the 2011 fishery - Inshore Maniitsoq-Kangaamiut

Due to the lack of survey and fishery data no advice is given for Maniitsoq-Kangaamiut inshore.

Offshore Maniitsoq-Kangaamiut Fishery

Catches in Maniitsoq-Kangaamiut offshore peaked in 2001 at a catch level of 826 tons and a CPUE of 5 kg/trap. Annual catches subsequently declined sharply to 11 tons in 2005. Continued poor state of the resource, as confirmed by data from a biological survey led to the recommended and implemented closure of the offshore area in 2005 and again in 2006 to promote the recovery of the resource. In 2007 CPUE has increased to approx. 10.2 kg/trap, as well as catches and effort increased to 174 tons in 2007. In 2008 the catch decreased to 111 tons but increased to 171 tons in 2009. CPUE decreased from to 9.0 kg/trap in 2008 to 5.9 kg/trap in 2009. Preliminary data for 2010 indicate no fishery in the offshore area.

No standardised index of CPUE or soak time have been prepared, owing to the lack of data and irregularly recurring fishery in this area.

Research Surveys

Owing to the breakdown of the main engine and continued technical problems with the research ship Adolf Jensen, the survey has been cancelled in 2007, 2008 and 2009. In 2010 no new survey data are available for the stock assessment and advice.

Outlook - Offshore Maniitsoq-Kangaamiut

Fishery data is very sparse and those available suggest a decreasing tendency since 2007.

Recommendations for the 2011 fishery - Offshore Maniitsoq-Kangaamiut

No new data are available for 2010. Due to the lack of survey and fishery data no advice is given for Maniitsoq-Kangaamiut offshore.

Management area: Nuuk-Paamiut

The historical catch, CPUE and effort data of the fishery in Nuuk-Paamiut inshore and offshore areas are summarized in Table 2.

The Nuuk-Paamiut area has been an important fishing area where total catches peaked at more than 5,000 tons in 2001 (Table 2. And fig. 32). In the successive years catch and effort declined substantially to 512 tons in 2006. Over the past two years catches have been steadily increasing to a level of 1,111 tons in 2009 (Table 2 and Fig.32).

Inshore - Nuuk-Paamiut

Fishery

Catches peaked at 4,157 tons in 2001 and then declined by more than 97% to 111 tons in 2007 (Table 2 and Fig. 33), while fishing effort declined by 98%. Over the past two years catches and effort have increased with approx. 75% to 435 tons in 2009.

From the standardised CPUE index (Fig. 33) it appears that CPUE has gradually increased during this period from a low of 1.8 kg/trap in 2000 to 8.4 kg/trap in 2006 ($F= 23,76$, $P<0.0001$) and remained somewhat stable at approx. 7kg/trap from 2007 to 2009. Preliminary CPUE for 2010 indicate a minor decline to 6 kg/trap. During the past 3 years average soak time have been declining to from approx. 80 to 55 hour per hauled traps fleet (Fig. 34).

Outlook - Inshore Nuuk-Paamiut

There is no survey undertaken in Nuuk-Paamiut inshore thus recruitment indices and other biological

parameters are not available. The commercial CPUE has been somewhat stable since 2005 as total catch and effort have remained at a low level; less than 250 tons until 2008. An increase in catch to 435 t in 2009 did not result in reduced CPUE that year. However, there is concern regarding sustainability of the resource at such higher catch levels, due to the lack of biological data.

Recommendations for the 2011 fishery - Inshore Nuuk-Paamiut

There had been indications of increase in the exploitable biomass over the last several years in a scenario of decreasing commercial exploitation. It is however, difficult to determine the extent of the improvement in the resource due to the lack of other stock indices. It is therefore recommended that a catch level of 200 tons be set for 2011 and comparable to the approximate catch level from 2005 to 2008.

Offshore - Nuuk-Paamiut

Fishery

The distribution in the offshore fishery has changed slightly from a continuous distribution of effort along the inner edges of the offshore banks from the middle of the Nuuk-Paamiut area and northward in 2003 to effort concentrating around sub-areas Fiskenæs-Danasdyb and Frederikshåb-Ravnsdyb in subsequent years (Fig. 32). In 2005 - 2006, effort has also been allocated to a fishery along the outer edges of the banks (Fyllas bank) in the northern part of Nuuk-Paamiut.

In 2007 there were no landings of crab from ultimo June to mid October 2007 to the main industry component (Royal Greenland) in Paamiut.

Catches in Nuuk-Paamiut offshore declined from 1,339 in 2000 to 761 tons in 2002 (Table 2 and Fig. 35). Additionally, catch level more than doubled to 1,611 tons in 2003 and further increased to 2,033 tons as effort decreased to 302 thousand trap hauls in 2005. Since catches have declined

and was in 2008 (418 tons) approx. 80% of the 2005 level and effort decrease by 85%. However, catches and effort increase again with 38% (676 tons) and 48% (89 thousand) respectively.

A standardized CPUE index shown gradually increase to a level of 8.1 kg/trap in 2005 (Fig. 35), followed by a two years decrease in CPUE to 5.2 kg/trap in 2007. In 2008 CPUE increased to 7.9 kg/trap, probably as an effect of very low fishery removals that year. In 2009 CPUE remain stable (7.2 kg/trap), but preliminary and incomplete data indicate a drop to 6 kg/trap in 2010.

In the previous year the fishery starts in January and has the highest catch rates from February to May. In 2009 monthly trends in commercial data generally show substantial declines in CPUE during the year, suggesting the resource is being depleted as the fishing season progresses (Fig. 36).

Soak time has been quite stable and varied from approx. 60 to 77 hour per hauled trap fleet from 2000 to 2008. Average soak time has been declining in 2009 and 2010 to approx. 47 hour per hauled traps fleet (Fig. 36).

Research Surveys

Owing to the breakdown of the main engine at the research ship Adolf Jensen, the survey has been cancelled in 2007, 2008 and 2009. The trap survey in offshore area Nuuk – Paamiut has been successfully sustained in 2010.

After a period of very low survey CPUE of legal-size males from 2002-2004, CPUE increased from 1.4 to 3.3 kg/trap in 2006 (Fig. 38). In 2010 CPUE has dropped with 40% to approx. 2kg/trap. Owing to lack of survey data previous years trends in CPUE is unknown.

The average CW of legal-size males declined from approx. 120mm CW in 2003 to approx. 113mm in 2005 (Fig. 39). In 2006 the average CW

was slightly higher primarily due to an increase in CW in the northern area (Godthåbsdyb). Average CW was almost unchanged and 114 mm CW in 2010.

Abundance (NPUE) of adolescent males (ADO-1) 1 year from attaining legal size increased to 0.7 ADO-1/trap in 2006, after a period of decreasing values over several years to approx. 0.3 ADO-1/trap in 2005 (Fig. 40). The increase was, however, almost exclusively due to a greater abundance of ADO-1 in the sub-area Fiskenæs-Danasdyb. There is some uncertainty; to what extent abundance of ADO-1/trap have been decline annually since 2007, but in 2010 number adolescent to enter the fishery next year is reduced to 0.3 ADO-1/trap. Thus, indications of improved recruitment in the near future appear to be limited as the abundance of adolescents is at a low level (Fig 40).

Annual size distributions of male crabs in Nuuk-Paamiut area indicate there has been some progression of adolescent males into the legal-size of the stock as the width of the modal peaks of adults have extended beyond the legal-size (≥ 100 mm CW) and have gradually throughout the years until 2006 become broader (Fig. 41). In 2006 modal peak reached 105 mm CW whereas modal peak was reduced to 95mm CW in 2010. However, some fluctuation in the size modes between years indicate that there may be some variation in the annual catchability of crabs making it difficult to reliably compare these trends on a temporal scale.

The percentage of new-shelled adult crabs decreased considerably in 2006 (42% SC1+2) in comparison to the previous year high (> 60% SC1+2) in 2005 (Fig. 42). Percentage of hard shell males with high meat contents (SC3) remain high (70%) in 2010. Also, low occurrence of new shelled adult males indicates poor recruitment to the stock.

The ratio of primiparous:multiparous females in areas of Nuuk-Paamiut (Fig. 43), suggests that major recruitment to the fishery is not forthcoming and the improved recruitment at the moment might gradually decrease in the coming years.

Outlook - Offshore Nuuk-Paamiut

Catches and effort increased until 2005, but catches steadily declined by 89% to 418 tons in 2008. In 2009 catches increased by approx. 40% to 676 tons while CPUE decreased from 9.1- 7.6 kg/trap.

Survey CPUE of legal-sized crabs and a recruitment index both showed lower levels in 2010 when compared to survey indices in 2006. Due to cancelled surveys from 2007 - 2009, there is scanty fishery-independent data, to validate the exploitable biomass in this area.

Recommendations for the 2010 fishery - Offshore Nuuk-Paamiut

Despite a significant decline in catch level (67%) and effort from 2005 to 2009, available indices from logbooks as well as survey do not indicate significant improvement in biomass. Catches in 2011 should not exceed 1.000 tons. The recommendation is 600 tons less compared to 2010.

Management area: Narsaq – Qaqortoq

The historical catch, CPUE and effort data of the fishery in Narsaq-Qaqortoq inshore and offshore areas are summarized in Table 2.

Fishery

In 2001 catches reached 822 tons and then declined to 76 tons in 2005. No logbooks were available in that period, and therefore there is no information on effort and CPUE. From 2006 to 2008 there was no fishery in that management area. In 2009 a new industry was opened and a

small fishery was introduced at 187 tons and a CPUE of 9.2 kg/trap.

Narsaq-Qaqortoq Inshore and Offshore

Overall catches in Narsaq-Qaqortoq decreased 6-fold from 822-133 tons from 2001-2003. A fishery of 541 tons from landing data was reported for 2004 but only 34 tons of this was represented in logbooks thus giving little information on the historic geographic distribution of the fishery. From 2006 to 2008 there was no fishery in that management area. In 2009 a new industry was opened and a small fishery was introduced at 187 tons and a CPUE of 9.2 kg/trap. Preliminary catches for 2010 indicating increasing catch level and reduced CPUE.

The distribution of the fishery in 2004 and 2005 suggested that reported landings and catch predominately come from inshore. In 2009 and 2010 the geographically distribution of the fishery is mainly conducted in a limit part of the entire management area. Data obtained from logbooks shown in Fig. 44, indicate that the fishery occurring in a restricted area in the northern part of Julianehåbs Bay, in the adjacent waters close to Sydproeven and in a limit part of the fjord Tesermiut close to Nanortalik.

Outlook - Inshore Narsaq – Qaqortoq

It is difficult to determine the biomass of the resource in the area, while data from the fishery are limited. There is no survey in the inshore area and comparative biomass and recruitment prospects are unknown.

Recommendations for the 2011 fishery - Inshore Narsaq – Qaqortoq

It is difficult to determine the biomass of the resource in the area, while data from the fishery are limited. There is no survey in the inshore area

and biomass and recruitment prospects are unknown.

Outlook - Offshore Narsaq – Qaqortoq

It is difficult to determine the biomass of the resource in the area, while data from the fishery are limited. There is no survey in the inshore area and biomass and recruitment prospects are unknown.

Recommendations for the 2011 fishery - Offshore Narsaq – Qaqortoq

No new data are available. Due to the lack of survey and fishery data no advice is given for Narsaq – Qaqortoq offshore.

Tables

Table 2. Catches, catch rates (CPUE) and effort in management inshore and offshore areas from 2000-2010. *2010 data is preliminary and incomplete.

Management Area	Year	Total catch (tons)	Quota	Number of issued permits	Number of active vessels	Inshore catch (tons)	Inshore CPUE (kg/trap)	Inshore effort ('000)	Offshore catch (tons)	Offshore CPUE (kg/trap)	Offshore effort ('000)
Uummannaq-Diskobugt	2000	3,052	--	--	--	2,940	4.8	613	112	5.5	20
	2001	4,202	--	--	--	3,950	3.1	1,274	252	3.6	70
	2002	3,319	--	--	--	2,970	3.3	900	349	3.0	116
	2003	2,739	--	--	50	2,482	3.7	679	257	2.6	97
	2004	2,341	--	--	40	2,174	3.4	632	167	3.7	45
	2005	1,500	1718	43	31	1,404	3.9	363	96	4.0	24
	2006	1,134	1600	43	21	1,008	4.6	221	126	6.7	19
	2007	698	1530	39	17	574	4.2	138	123	5.1	24
	2008	627	1400	25	8	531	5.0	107	96	5.2	19
	2009	657	700	22	12	471	5.1	93	186	5.5	34
2010*	217	600	19	5	192	5.8	33	25	5.3	5	
Sisimiut	2000	2,534	--	--	--	491	2.8	175	2,043	6.4	319
	2001	2,602	--	--	--	327	2.9	113	2,275	4.6	495
	2002	2,724	--	--	--	473	4.6	103	2,251	3.5	643
	2003	1,633	--	--	34	692	3.7	187	941	3.1	304
	2004	1,432	--	--	19	1,111	3.9	286	321	4.9	65
	2005	1,125	900	12	13	891	6.5	137	234	6.4	37
	2006	736	750	12	10	725	8.3	87	11	11.1	1
	2007	784	850	9	12	559	7.4	75	225	12.8	18
	2008	979	700+300	11	12	765	8.8	87	214	13.1	16
	2009	951	500+300	21	20	597	8.4	71	354	7.6	47
2010*	470	800	19	16	220	8.6	26	250	8.3	30	
Maniitsoq-Kangaamiut	2000	944	--	--	--	563	4.3	131	381	7.6	50
	2001	1,835	--	--	--	1009	3.7	273	826	5.0	165
	2002	1,775	--	--	--	1032	3.8	272	743	2.7	275
	2003	485	--	--	12	40	3.5	12	445	2.8	160
	2004	116	--	--	9	78	2.4	33	38	2.1	18
	2005	73	200 (inshore)	12	6	62	4.2	15	11	3.6	3
	2006	72	100 (inshore)	16	6	61	4.3	14	11	4.3	3
	2007	187	300	11	4	13	2.9	5	174	10.2	17
	2008	130	300	13	8	19	5.9	3	111	9.0	12
	2009	259	250	21	11	88	6.2	14	171	5.9	29
2010*	140	300	18	2	140	7.3	19	--	--	--	
Nuuk-Paamiut	2000	3,769	--	--	--	2,430	5.3	458	1,339	5.4	248
	2001	5,077	--	--	--	4,157	5.3	784	920	3.8	242
	2002	2,531	--	--	--	1,770	2.8	632	761	2.8	272
	2003	2,315	--	--	26	704	3.4	207	1,611	4.2	385
	2004	1,795	--	--	22	180	4.5	40	1,615	8.0	203
	2005	2,295	--	26	22	262	8.0	33	2,033	6.7	302
	2006	1,173	1,800	24	18	204	7.3	28	969	3.0	328
	2007	521	1,600	25	10	111	7.2	15	410	7.4	56
	2008	617	1,600	24	6	200	7.2	28	418	9.1	46
	2009	1,111	700+300	31	13	435	7.5	58	676	7.6	89
2010*	519	1,000	22	9	141	7.7	18	378	7.1	53	
Narsaq-Qaqortoq	2000	2	--	--	--	0	--	--	2	--	--
	2001	822	--	--	--	822	--	--	0	--	--
	2002	643	--	--	--	642	--	--	1	--	--
	2003	133	--	--	11	123	--	--	10	--	--
	2004	541	--	--	10	32	3.9	8	2	1.0	2
	2005	76	--	7	6	76	8.3	9	--	--	--
	2006	0	--	3	--	--	--	--	--	--	--
	2007	0	--	4	--	--	--	--	--	--	--
	2008	--	--	--	--	--	--	--	--	--	--
	2009	187	?	12	5	187	9.2	20	--	--	--
2010*	273	300+150	15	6	266	7.9	34	9	8.7	1	

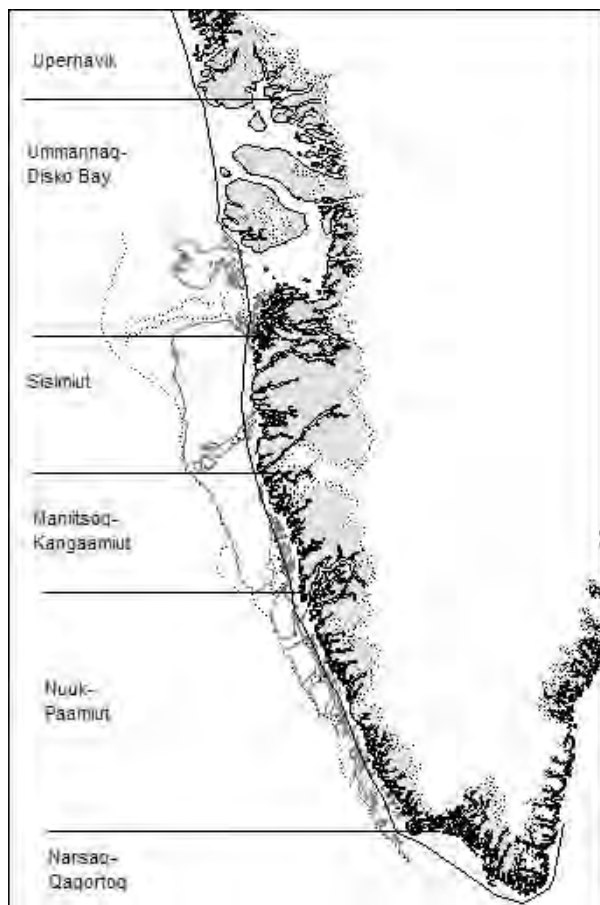
Figures

Fig 1. Map of West Greenland outlining the 6 management areas for the snow crab fishery.

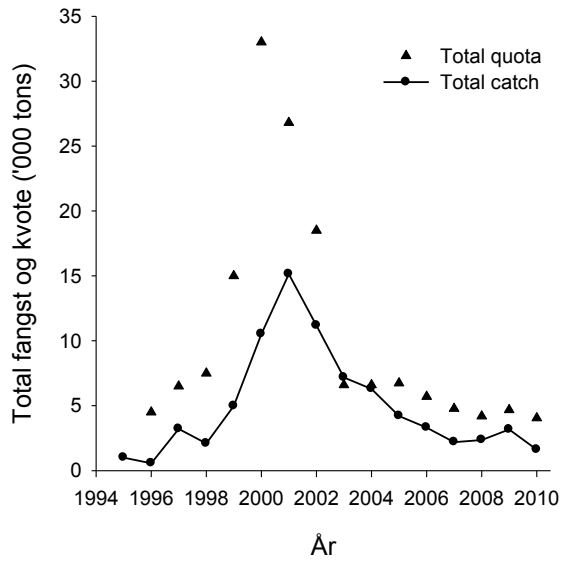


Figure 2. Total catch and quota size from 1995-2010. Data from 2010 is only preliminary and incomplete.

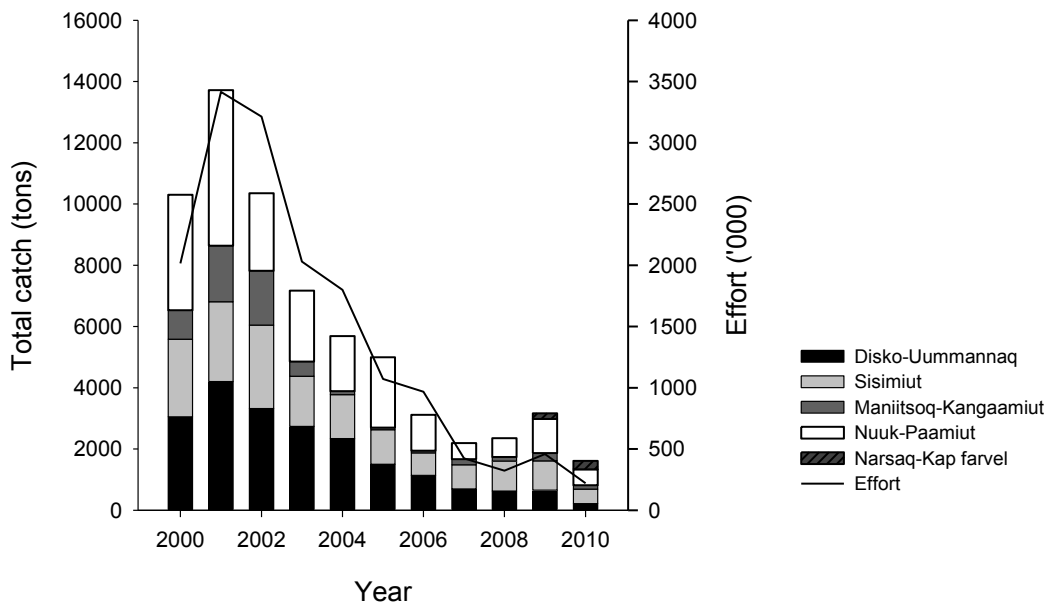


Fig. 3. Snow crab landings in the 4 most important management areas of West Greenland 2000-2010 and used total effort. Data for 2010 are preliminary and incomplete.

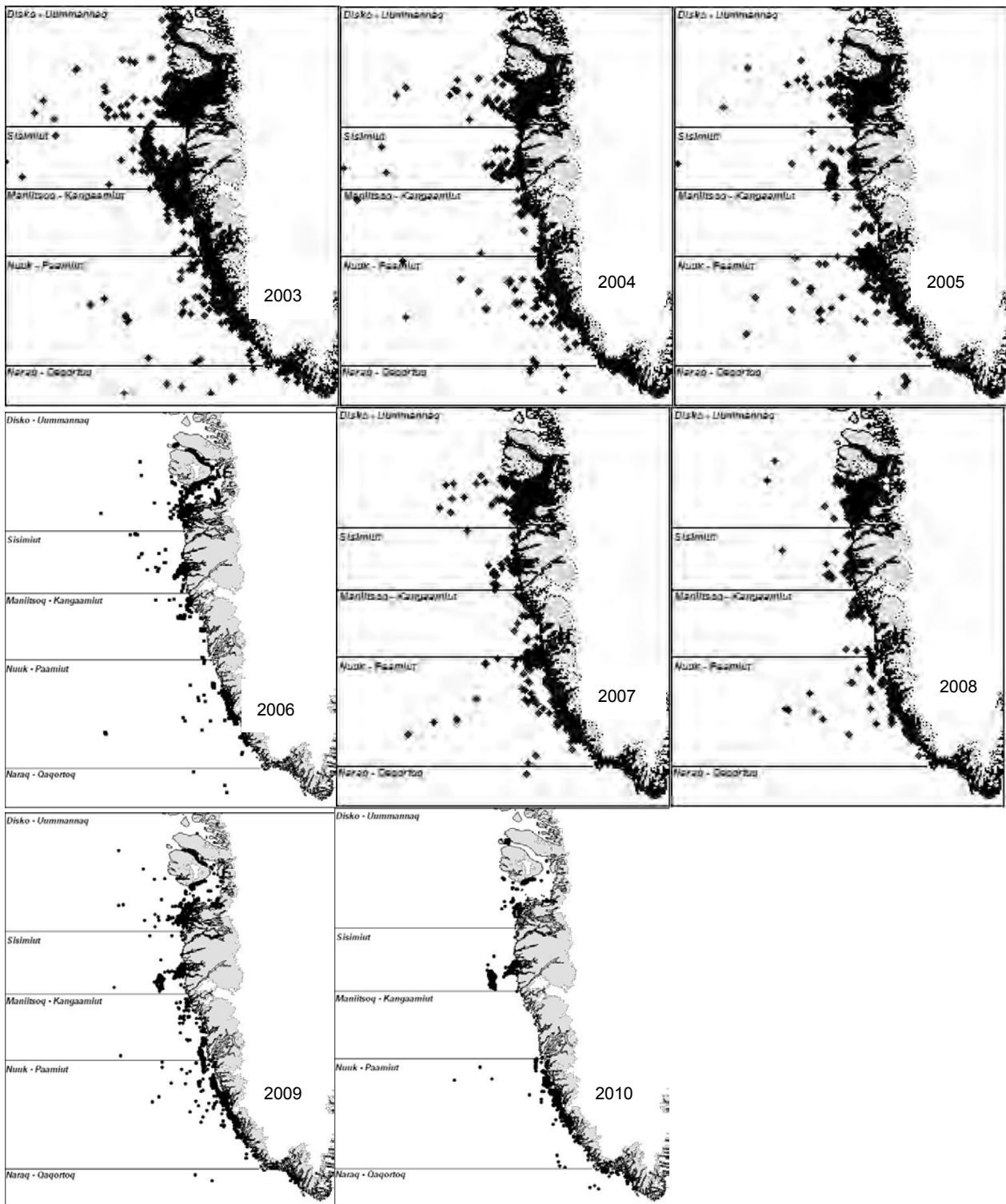


Fig. 4. Distribution of the crab fishery off West Greenland within each management area from 2003 - 2010, derived from logbook data. Lines are used to separate management areas.

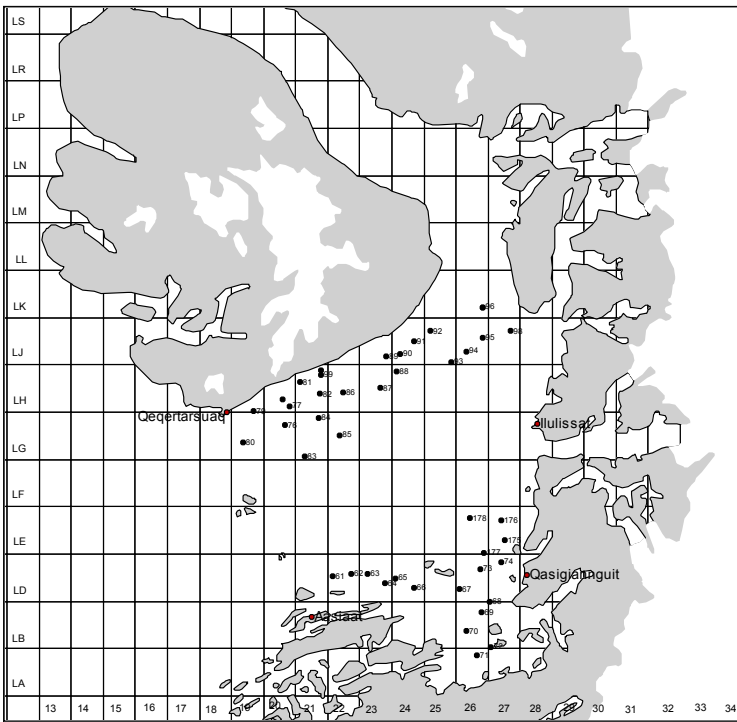


Fig. 5a. Map showing the location of survey stations in Disko Bay, Area 1 (North) and Area 2 (South).

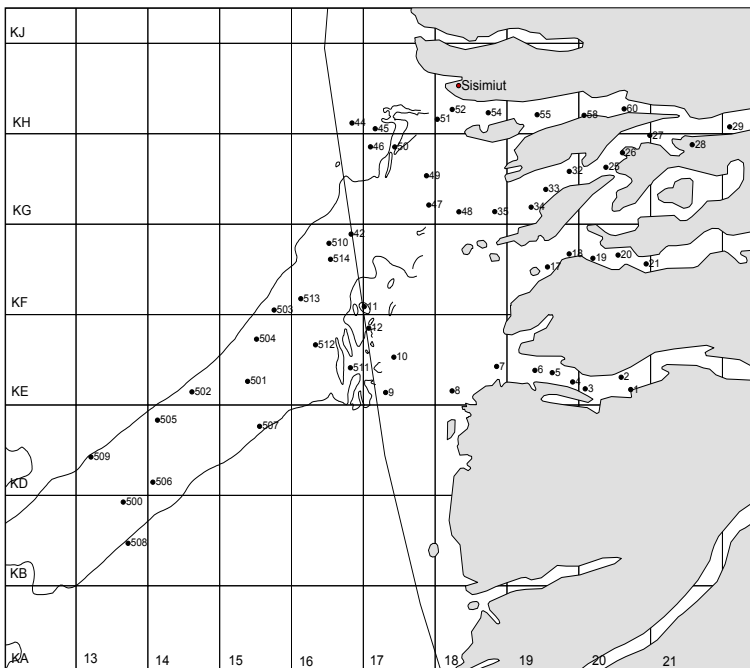


Fig. 5b. Map showing the location of inshore and offshore survey stations in Sisimiut.

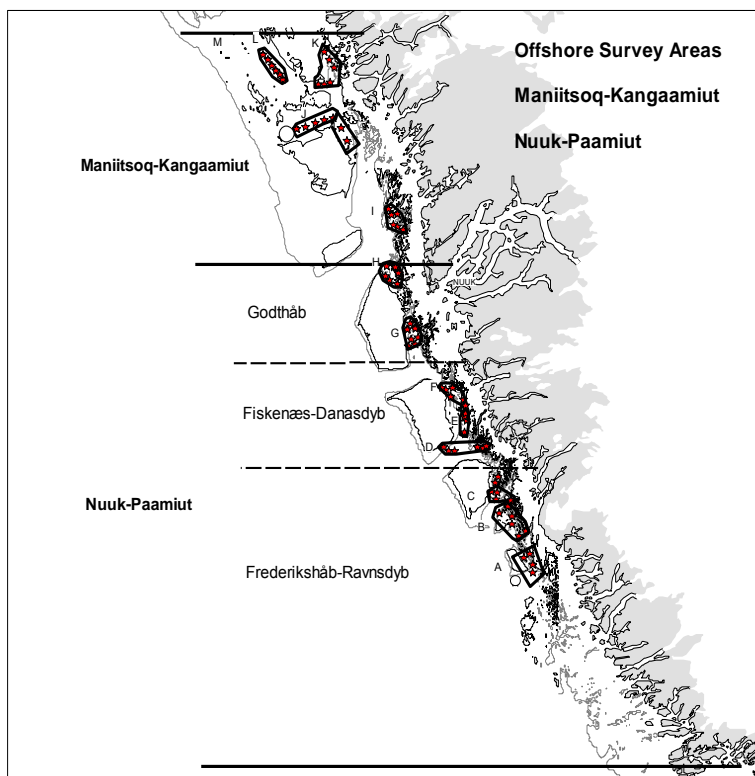


Fig. 5c. Map showing the location of survey stations from Maniitsoq-Kangaamiut and Nuuk-Paamiut (and sub-areas).

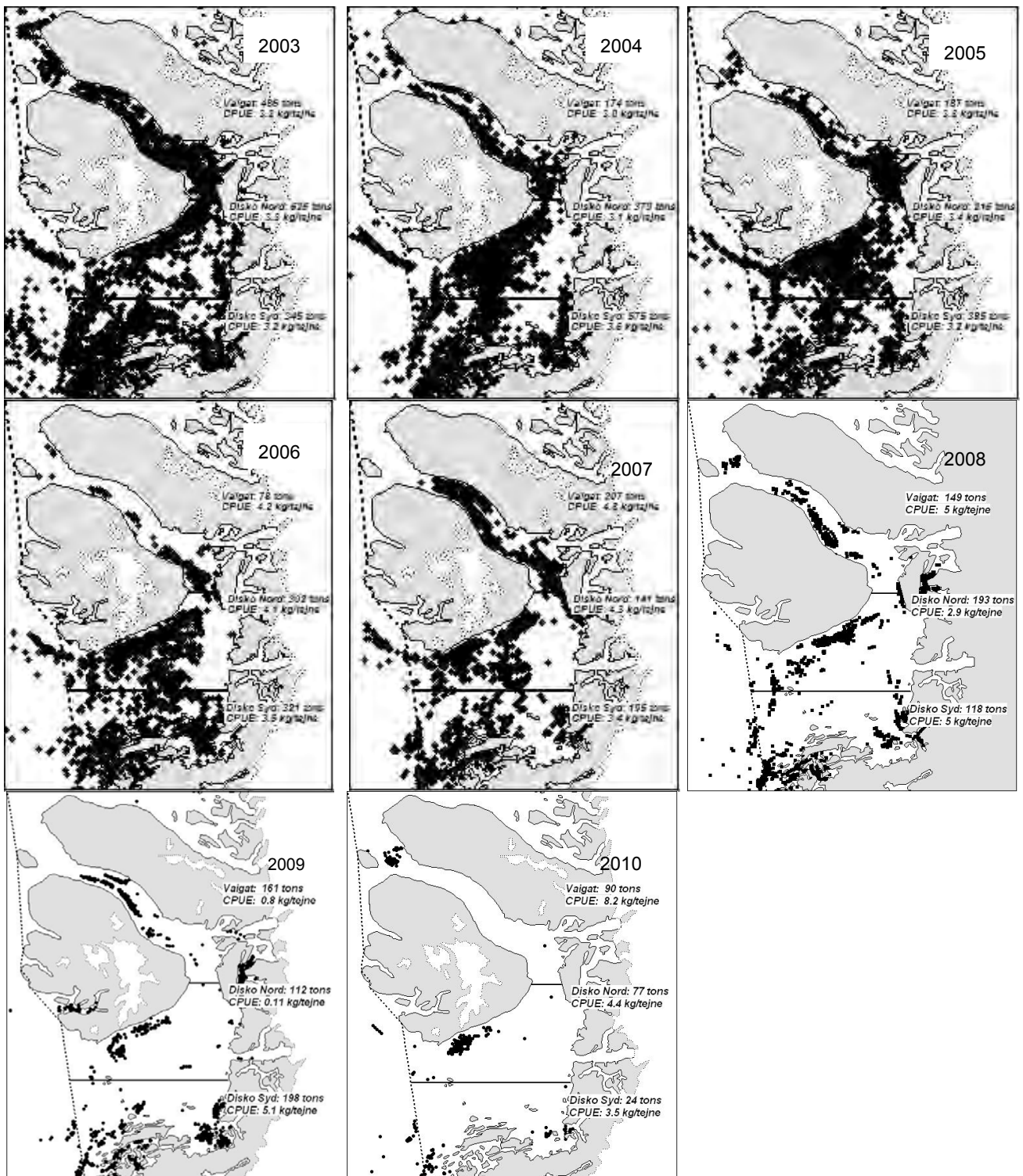


Fig. 6. Annual distribution of fishing effort in Uummannaq-Disko Bay from 2003-2010. Data for 2010 is preliminary and incomplete.

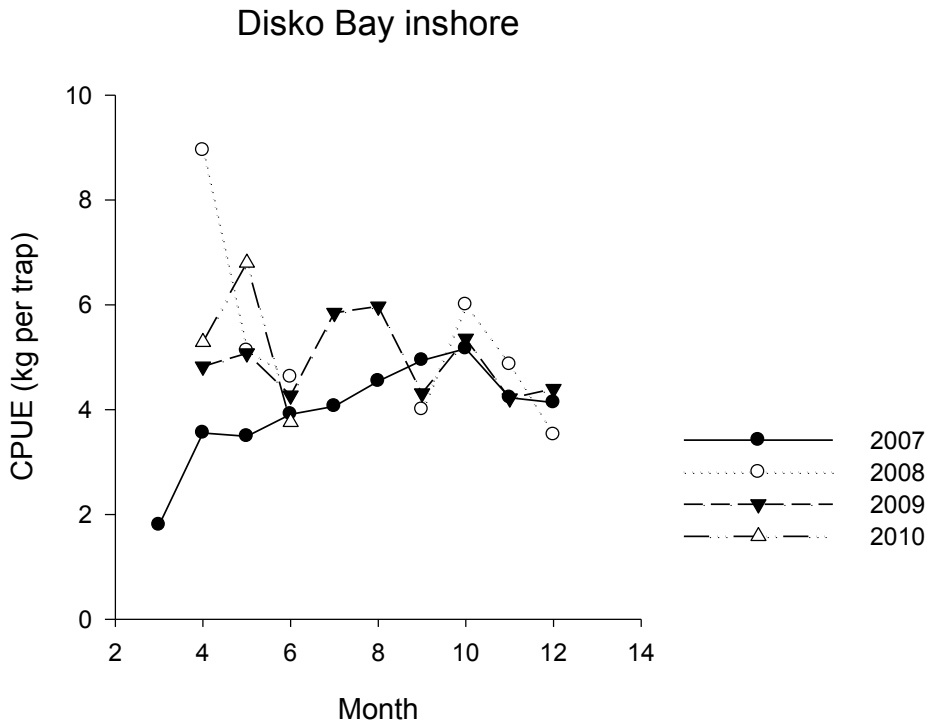


Fig. 7. Monthly trends CPUE (kg/trap) in Uummannaq-Disko Bay Area from 2007-2010. Data for 2010 is preliminary and incomplete.

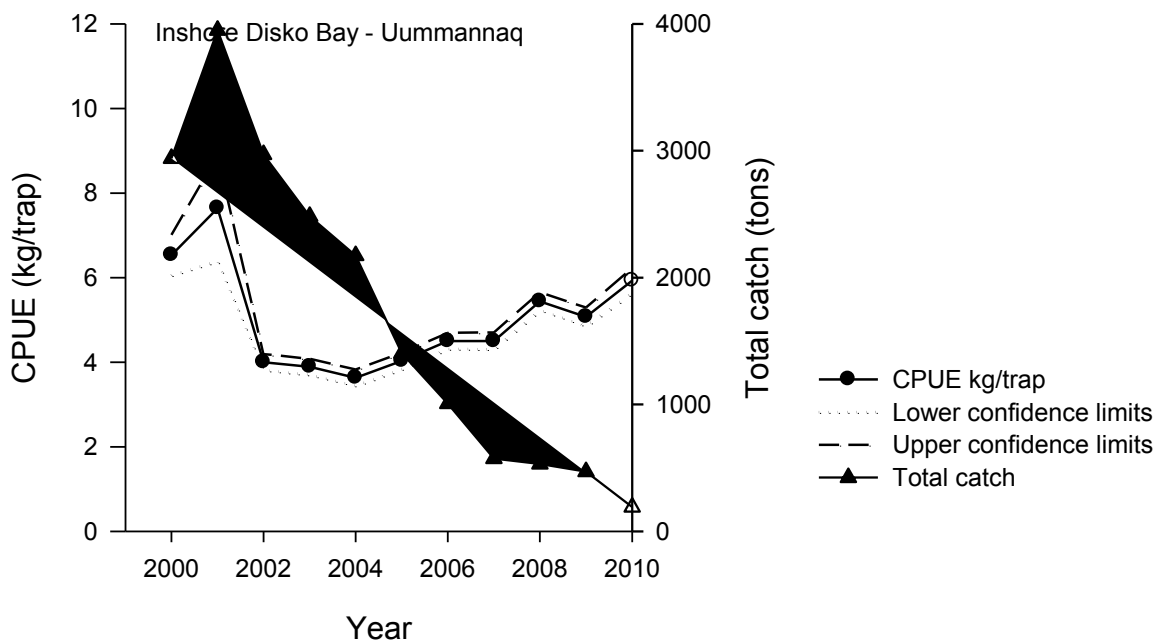


Fig. 8. Standardised CPUE index and total catch based on logbook information inshore Uummannaq-Disko Bay Area from 2000-2010. Data for 2010 is preliminary and incomplete.

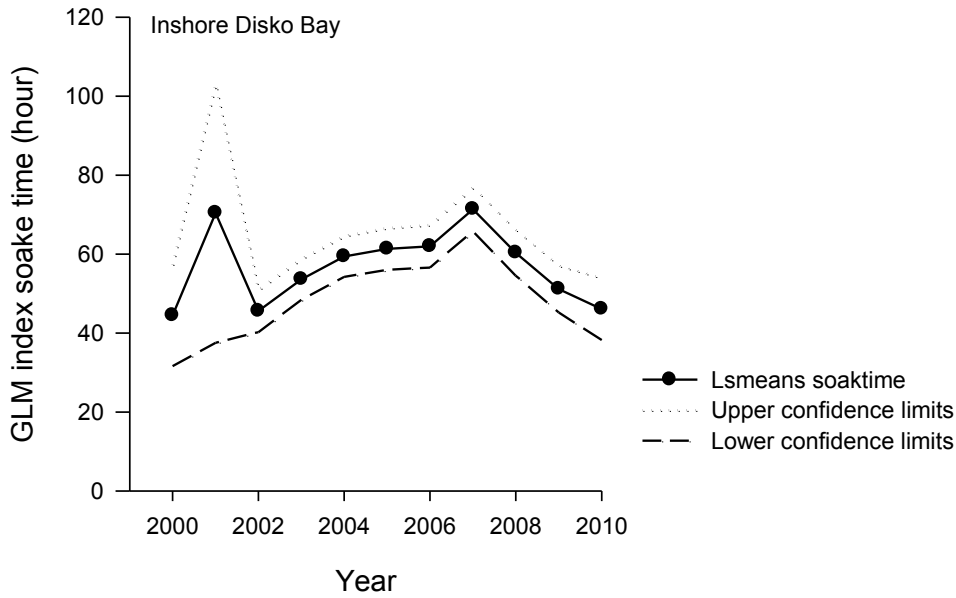


Fig.9. Standardised soaktime index on logbook information in inshore Uummannaq-Disko Bay Area from 2000-2010. Data for 2010 is incomplete.

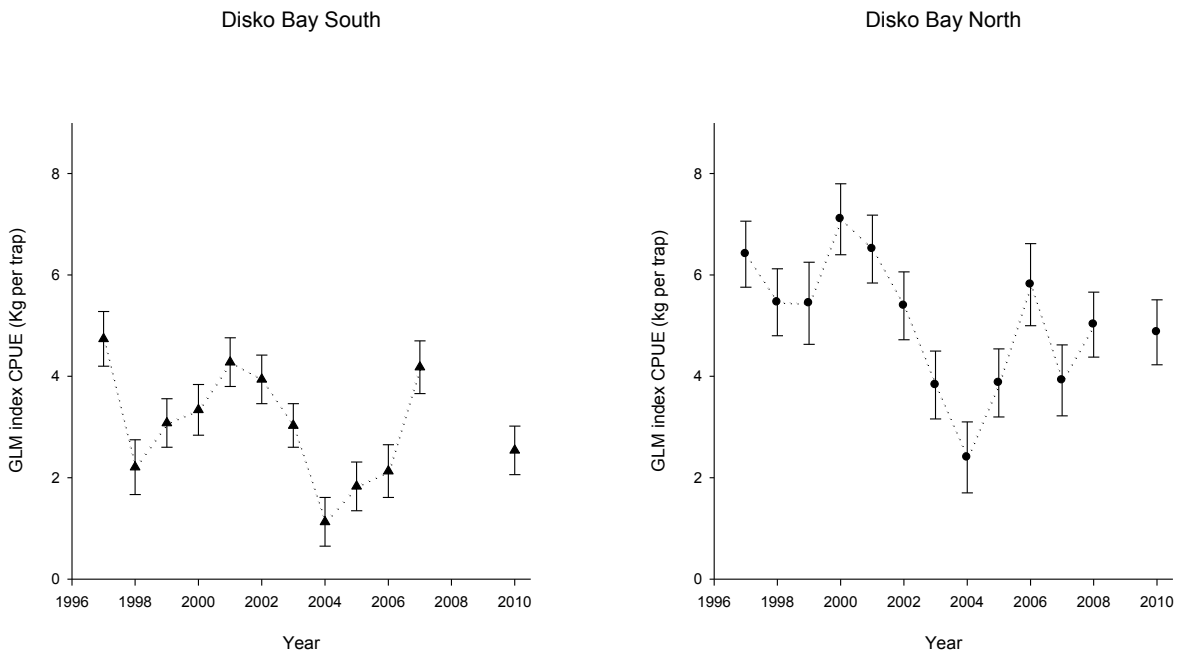


Fig. 10. Annual trends in CPUE (kg/trap) of legal-size males (≥ 100 mm CW) from trap surveys in Disko Bay Survey Area “Disko Bay South” and Area “Disko Bay Nord” (1997-2010).

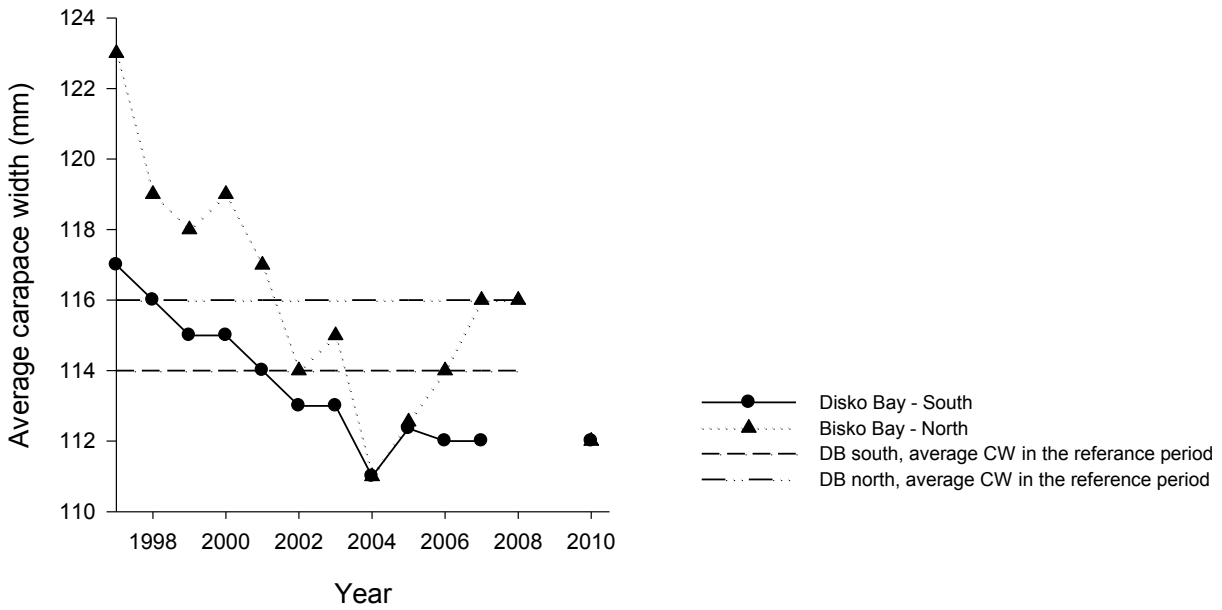


Fig. 11. Annual trends in the mean carapace width (CW) of legal-size males (≥ 100 mm CW) from trap surveys in area “Disko Bay South” and area “Disko Bay North” of Disko Bay 1997 to 2010. The dashed lines represent the mean CW for the time series in Disko Bay South and Disko Bay North during the reference period 1999 to 2002.

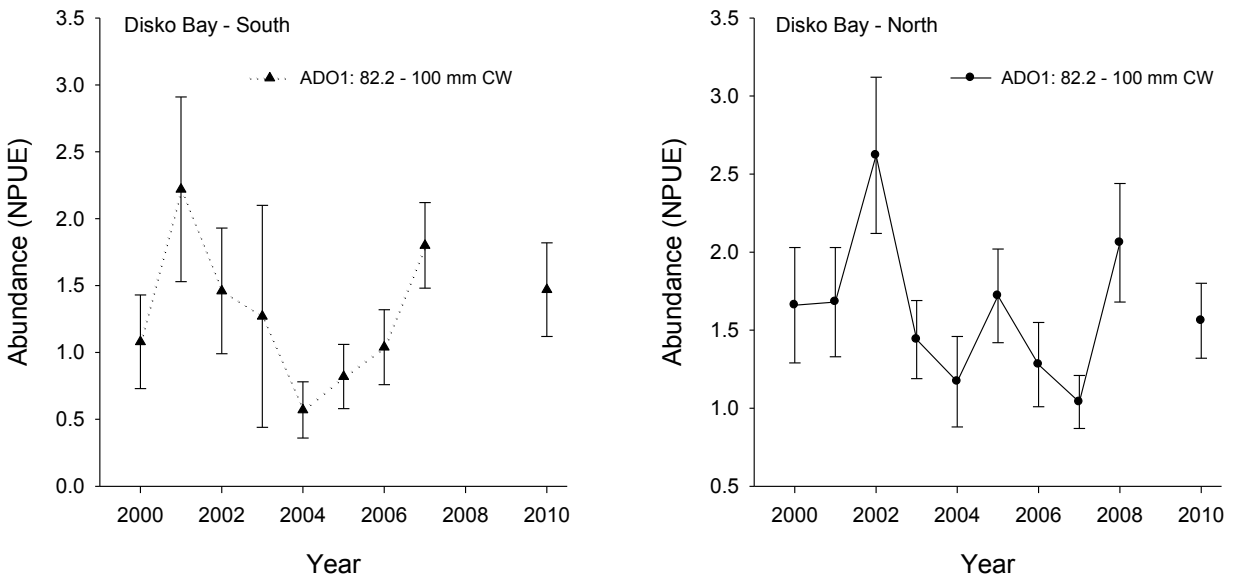
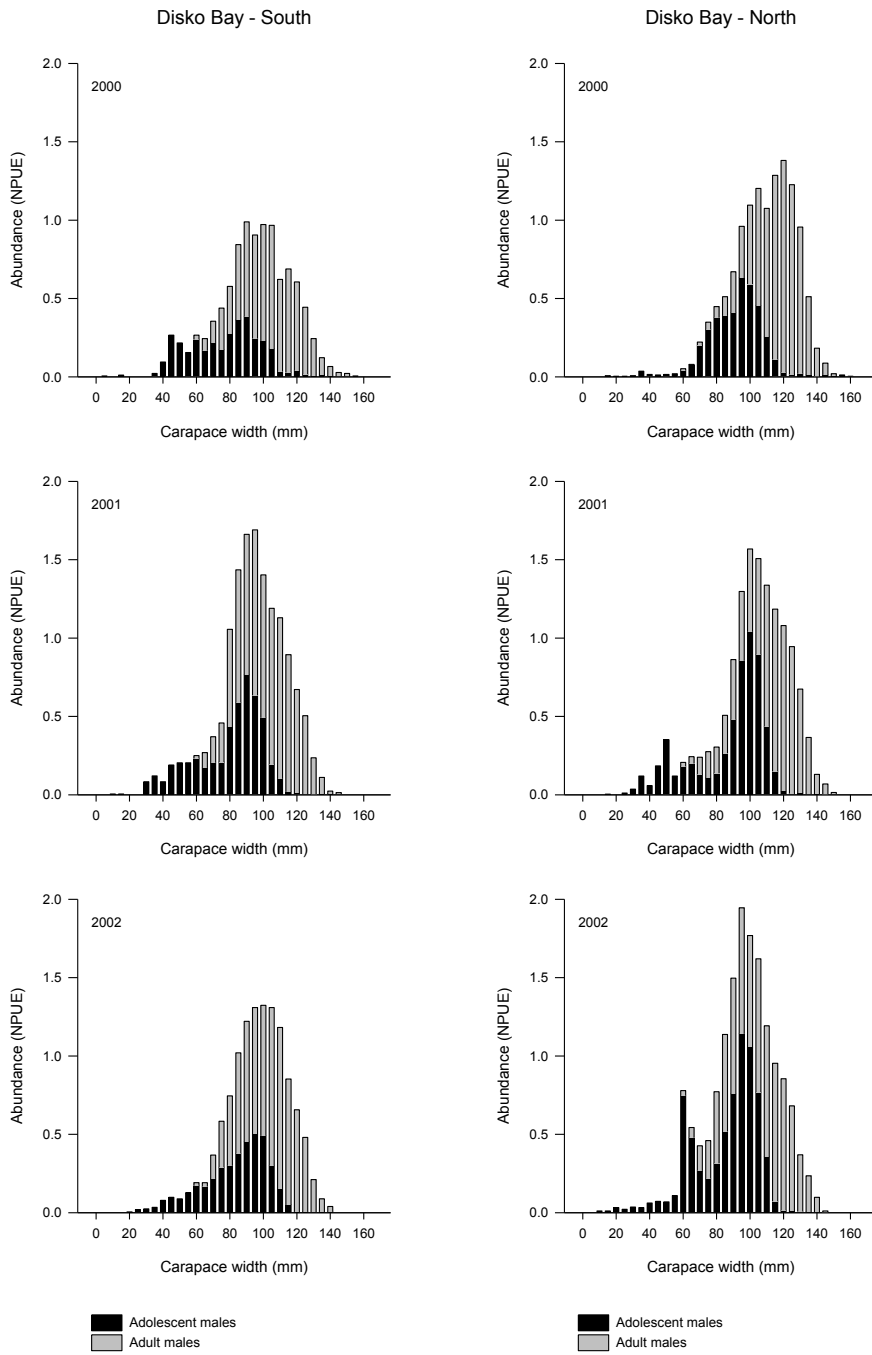
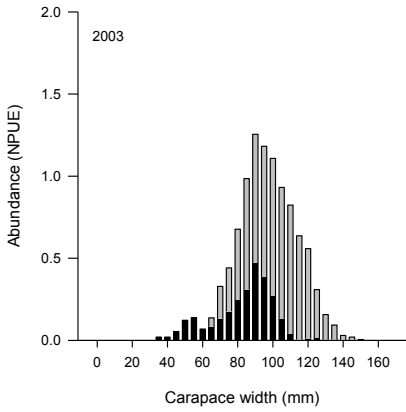


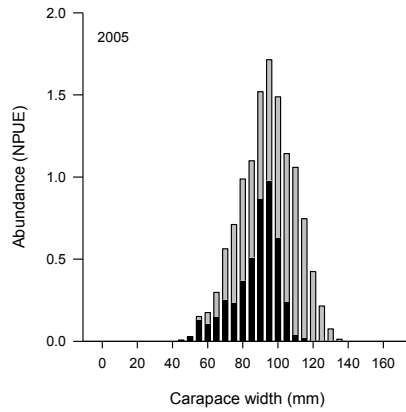
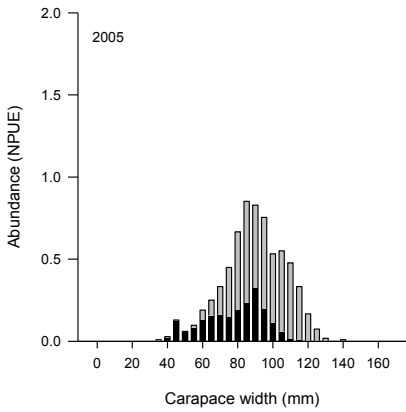
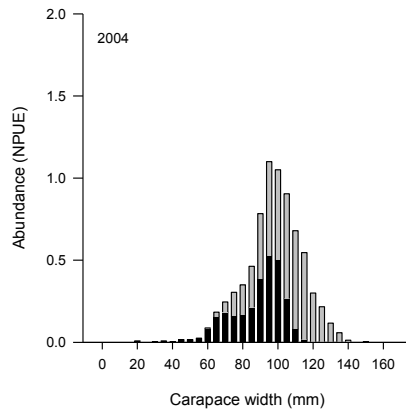
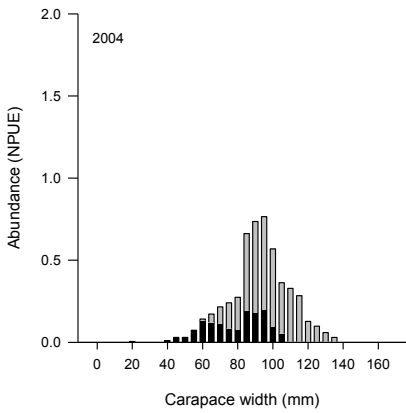
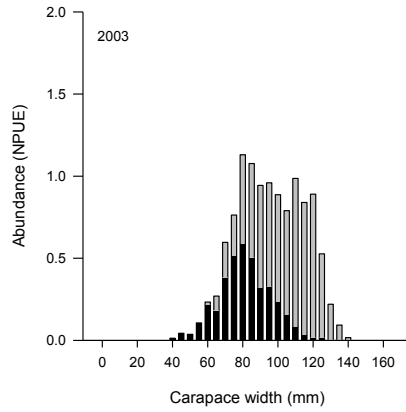
Fig. 12. Annual trends in NPUE (No. of crabs per trap) \pm S.E. of adolescent males (ADO-1: 82.2-100mm CW) in Disko Bay South and Disko Bay North, expected to recruit to the fishery the following year.



Disko Bay - South



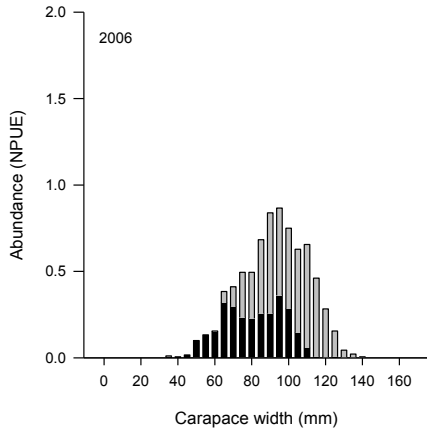
Disko Bay - North



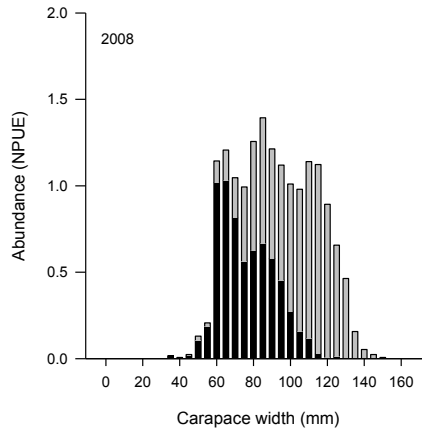
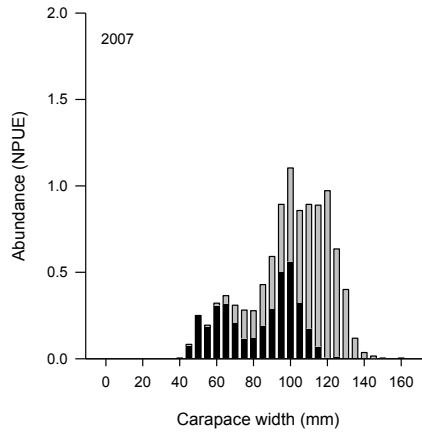
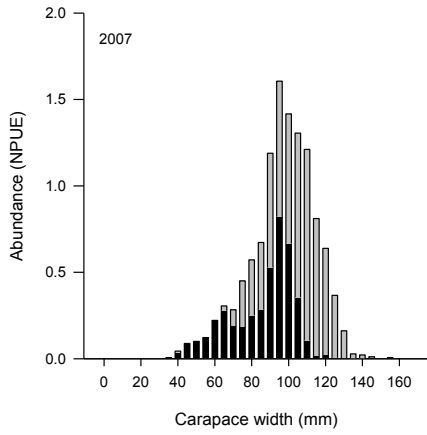
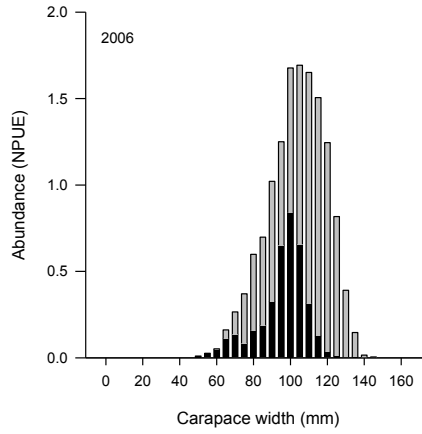
Adolescent males
 Adult males

Adolescent males
 Adult males

Disko Bay - South



Disko Bay - North



Adolescent males
 Adult males

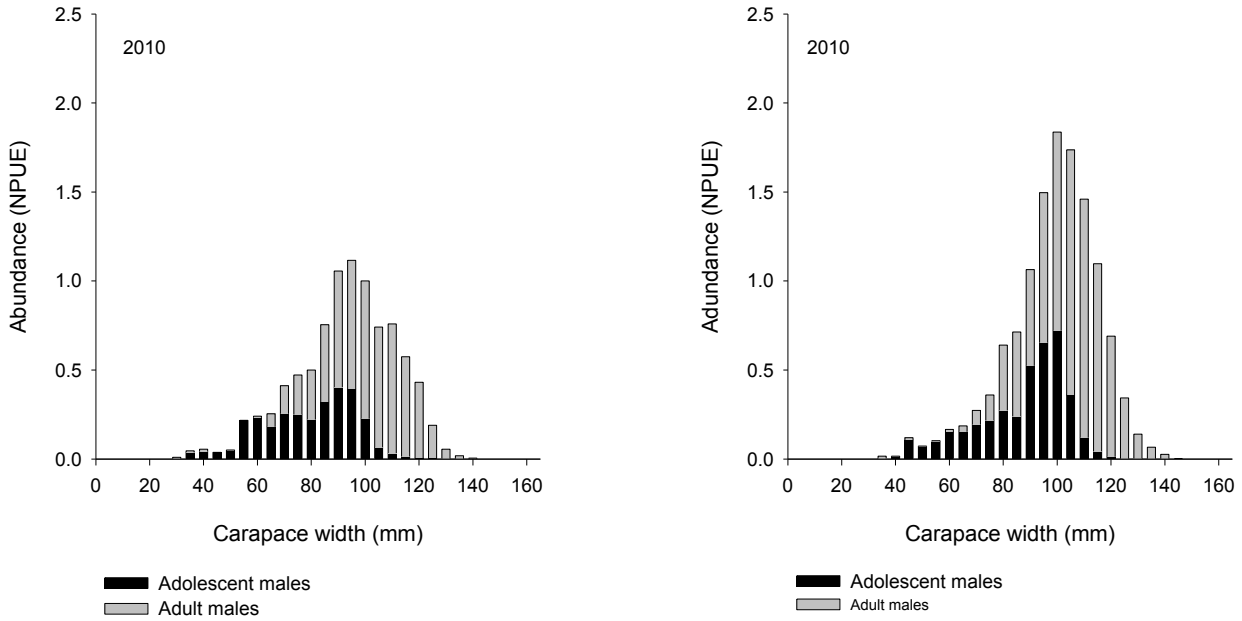


Fig. 13. Size distribution of adolescent and adult males from survey Disko Bay South and Disko Bay North in Disko Bay from 2000-2010.

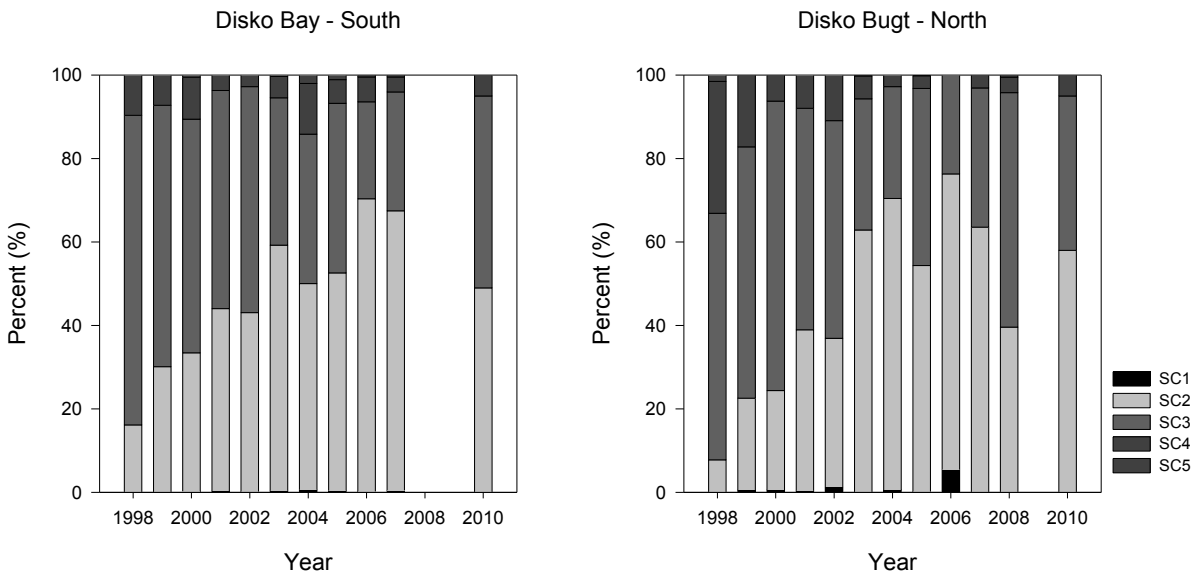


Fig. 14. The percentage of shell conditions (1-5) of adult legal-sized male crabs (≥ 100 mm CW) sampled in Disko Bay South and Disko Bay North, Disko Bay 1998 to 2010.

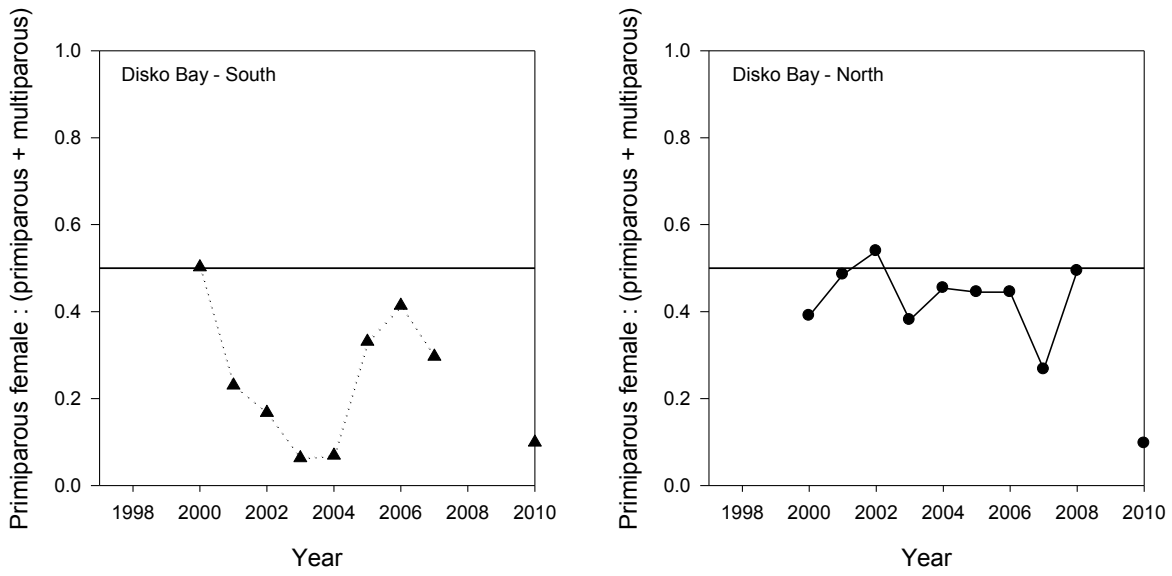


Fig. 15. Annual trends in the ratio between primiparous and multiparous in Disko Bay South and Disko Bay North, Disko Bay 2000-2010.

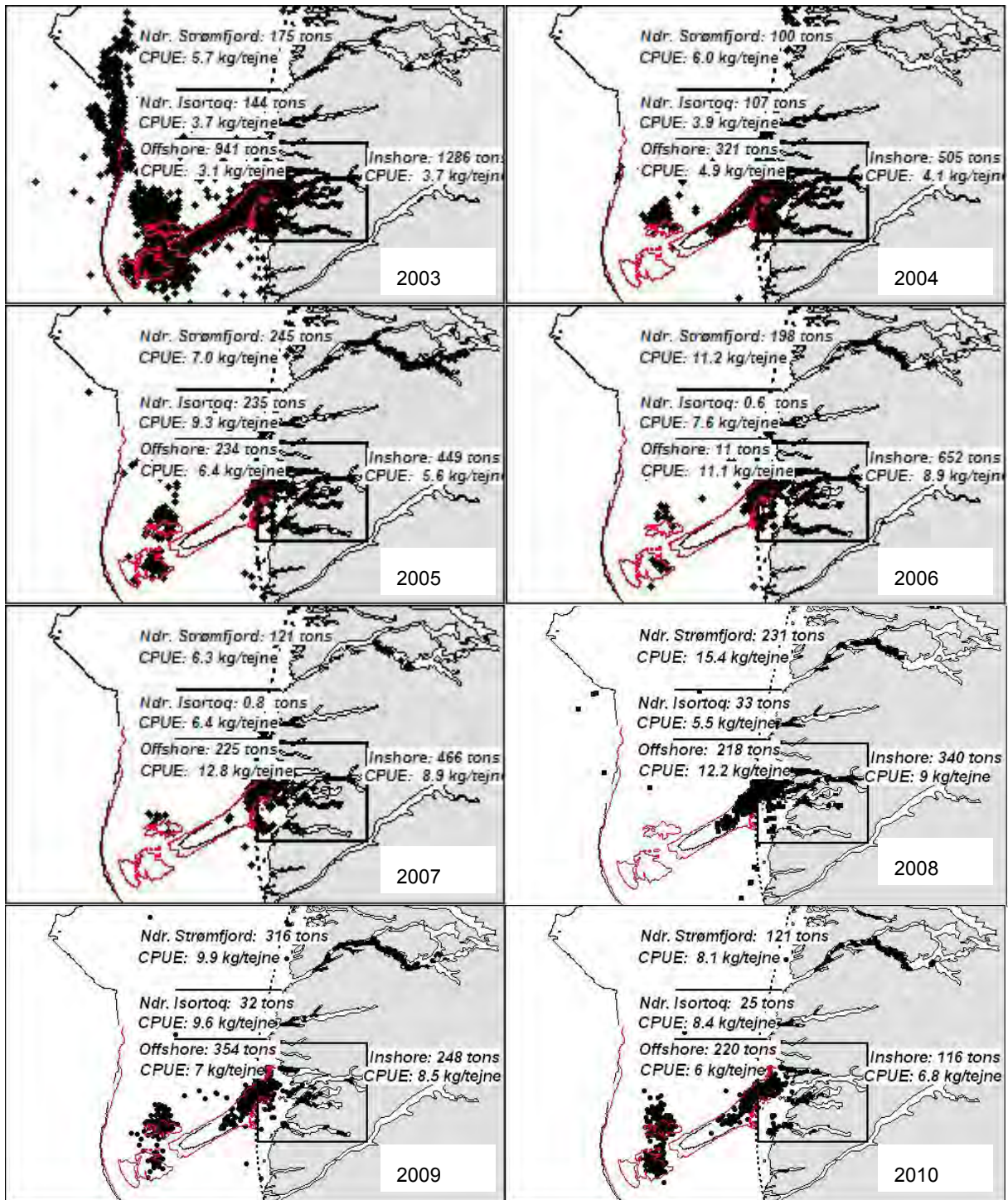


Fig. 16. The distribution and crab fishery in Sisimiut inshore and offshore in 2003 - 2010. The coastal line indicates the basis-line separating the offshore from the inshore. Data from 2010 is preliminary and incomplete.

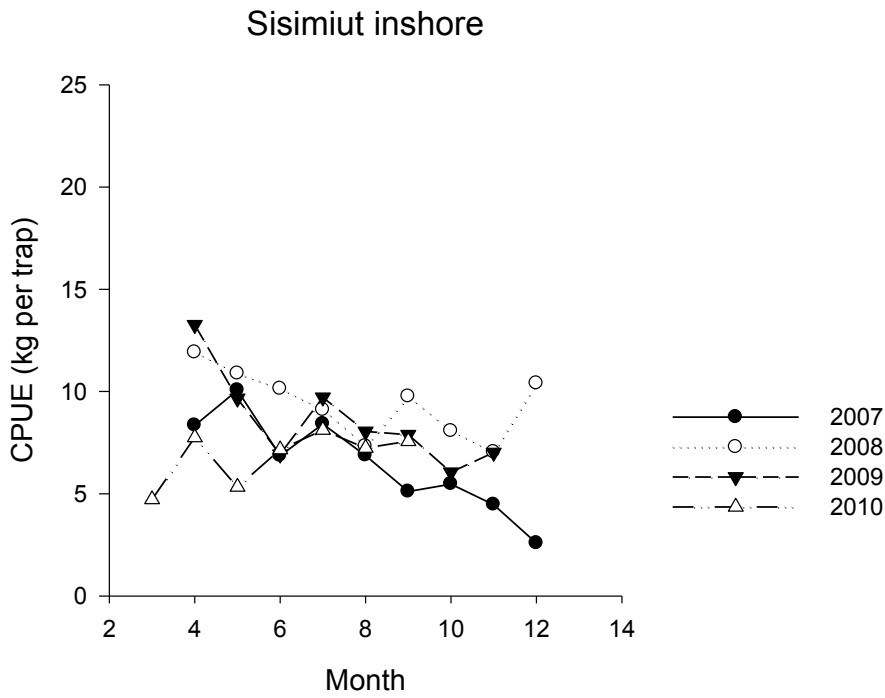


Fig. 17. Monthly trends in CPUE (kg per trap) from the fishery in Sisimiut inshore from 2007 to 2010. Data for 2010 is incomplete.

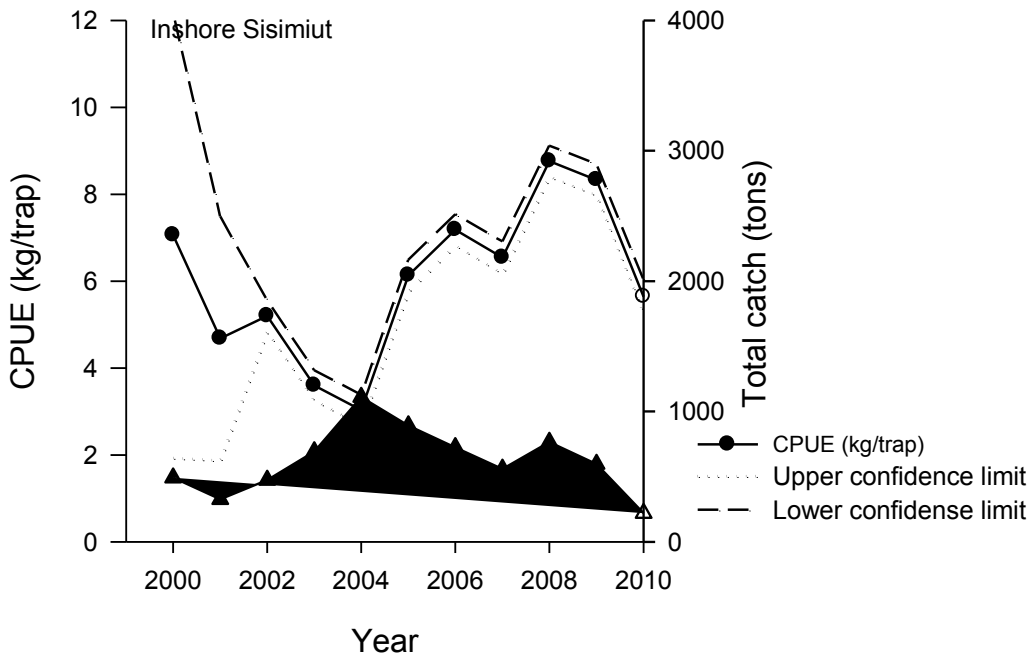


Fig. 18. Standardised CPUE index and total catch based on logbook information inshore Sisimiut from 2000-2010. Data for 2010 is incomplete.

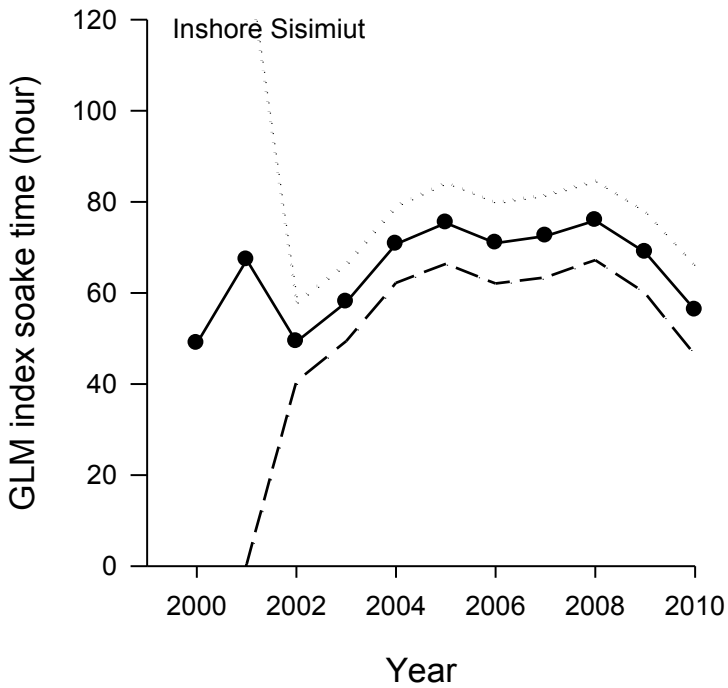


Fig. 19. Standardised soake time index based on logbook information inshore Sisimiut from 2000-2010. Data for 2010 is incomplete.

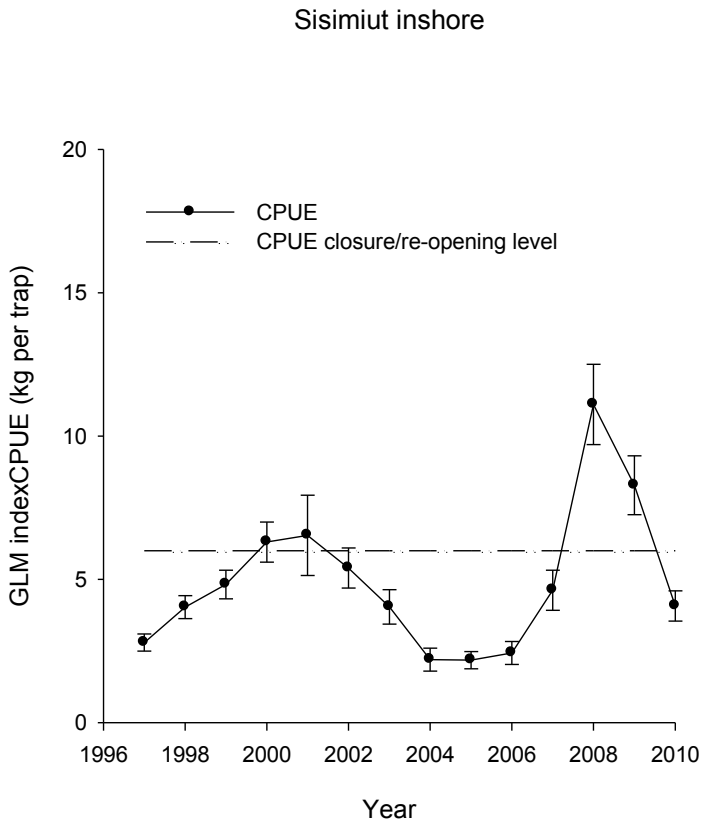


Fig. 20. Annual trends in CPUE (kg/trap \pm S.E.) of legal-size males (≥ 100 mm CW) from trap surveys in Sisimiut inshore from 1997 to 2010. The re-opening/closure criteria in Sisimiut inshore are indicated with a line.

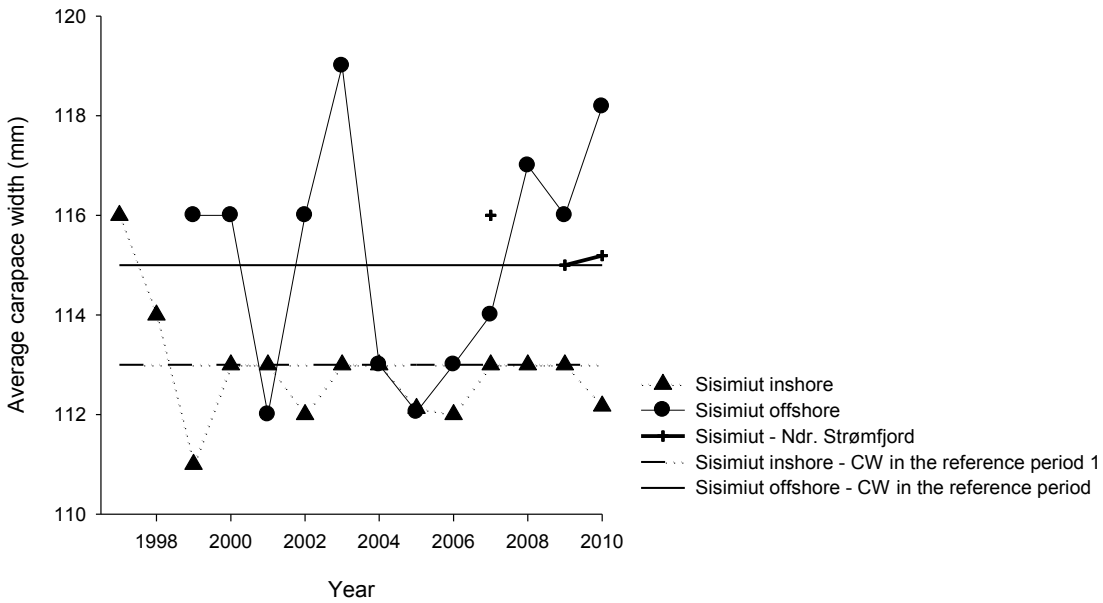


Fig. 21. Annual trends in the mean carapace width (CW) for legal-size males (≥ 100 mm CW) from trap surveys in Sisimiut inshore (1997-2010) and Sisimiut offshore (1999–2010). The mean CW for the reference period (1999–2002) in Sisimiut inshore and (2000–2003) in Sisimiut offshore is indicated with a line.

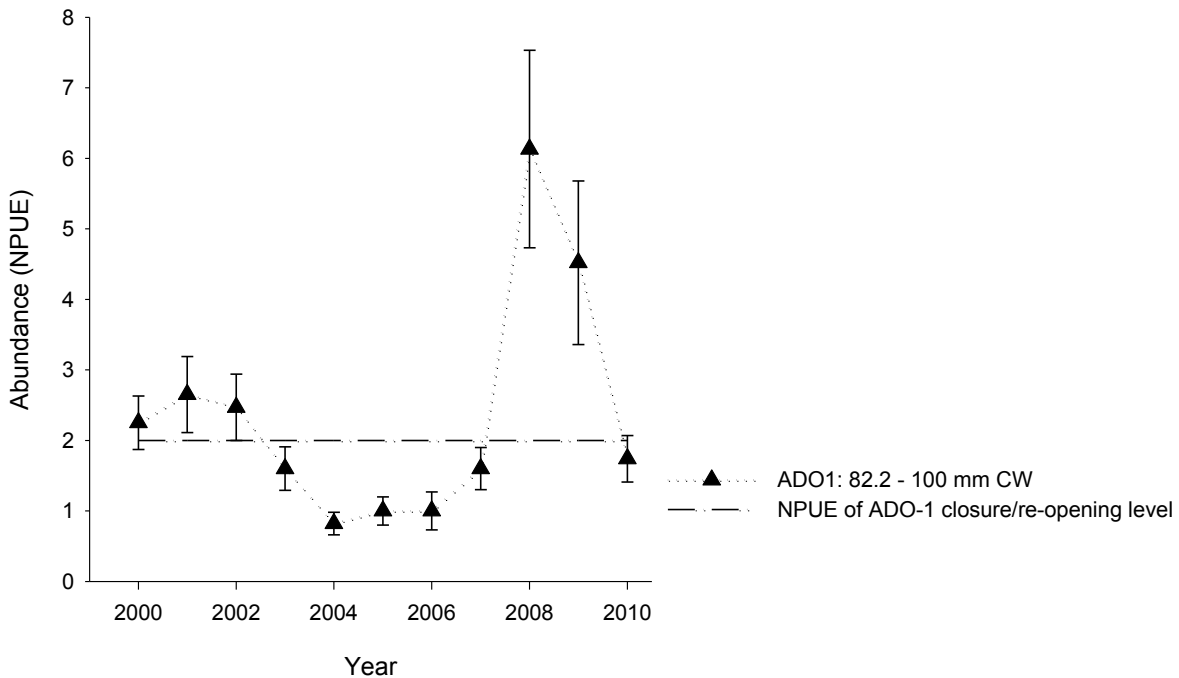
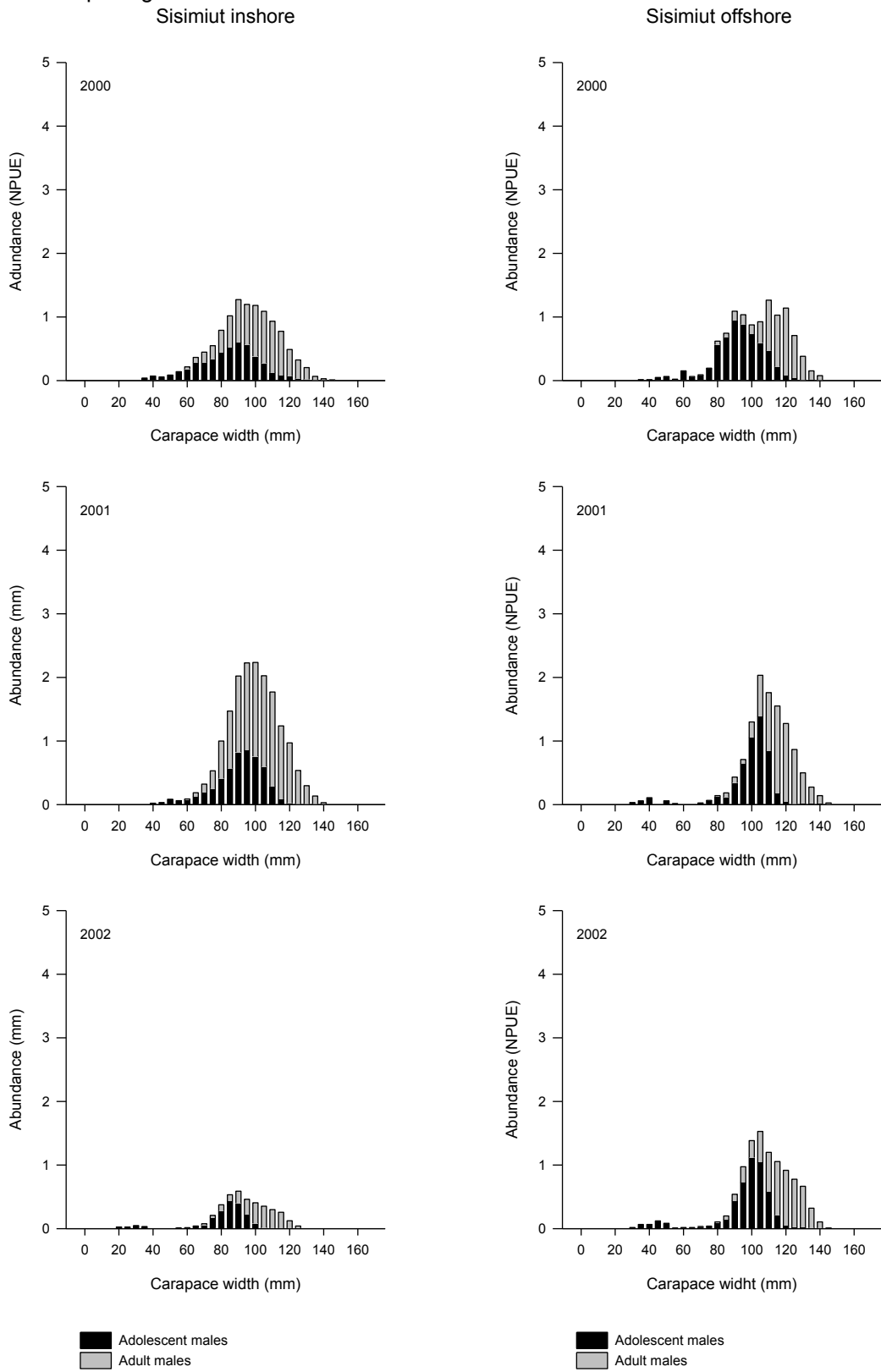
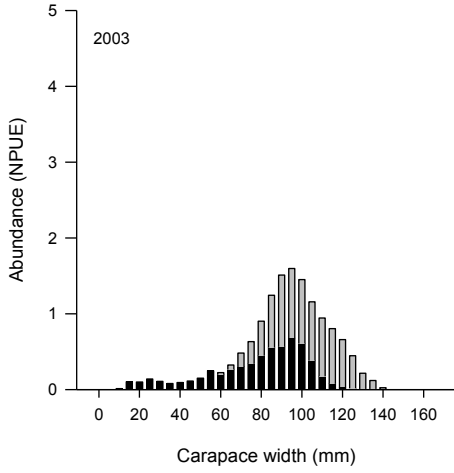


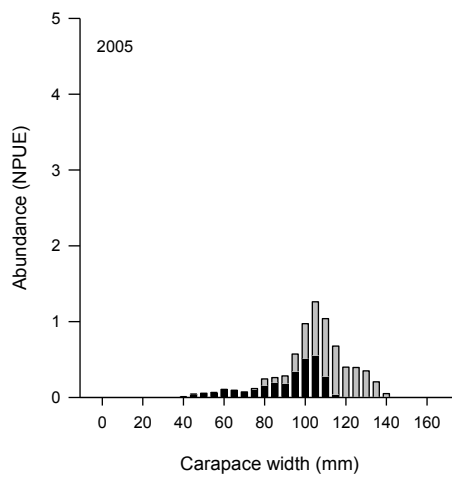
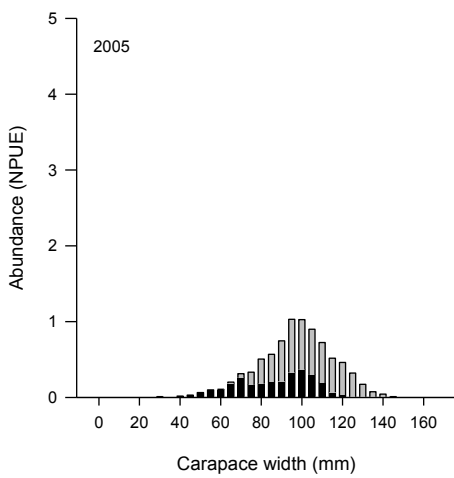
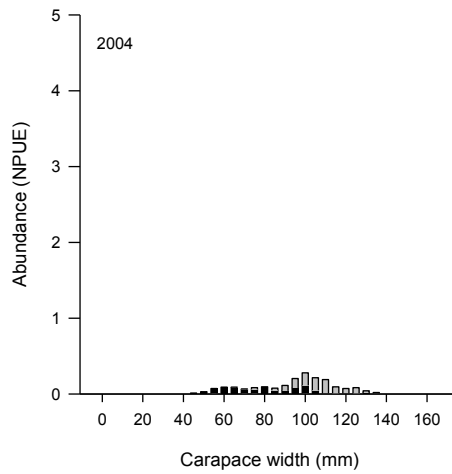
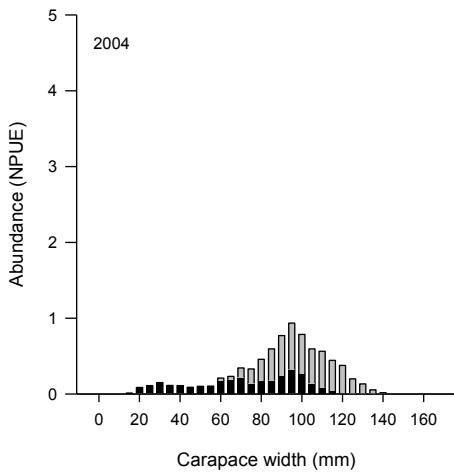
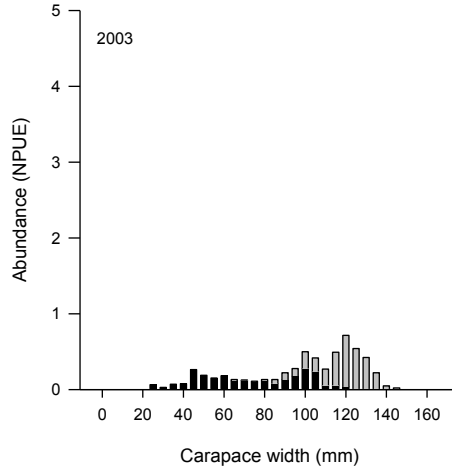
Fig. 22. Annual trends in the abundance NPUE (No. crabs per trap \pm S.E) of adolescent males (ADO-1: 82.2-100mm CW) expected to recruit to the fishery the following year in Sisimiut inshore areas from 2000 to 2010. The re-opening/closure criteria in Sisimiut inshore are indicated with a line.



Sisimiut inshore



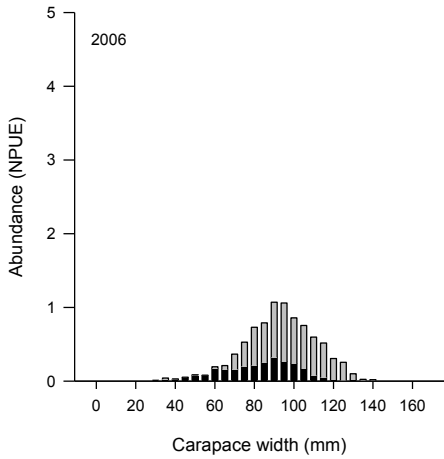
Sisimiut offshore



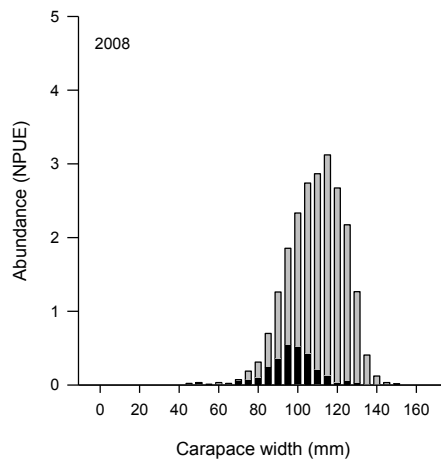
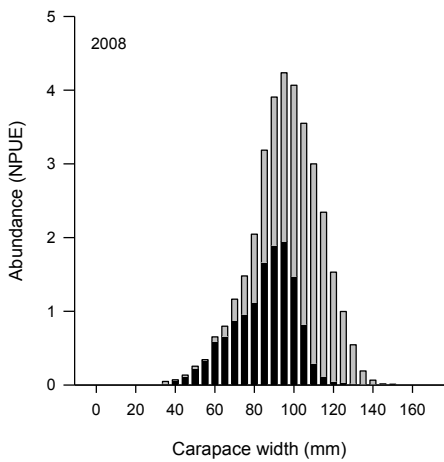
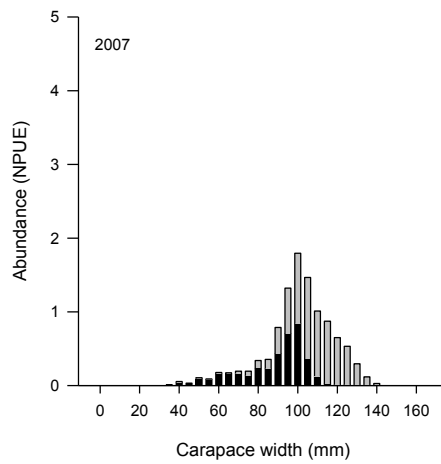
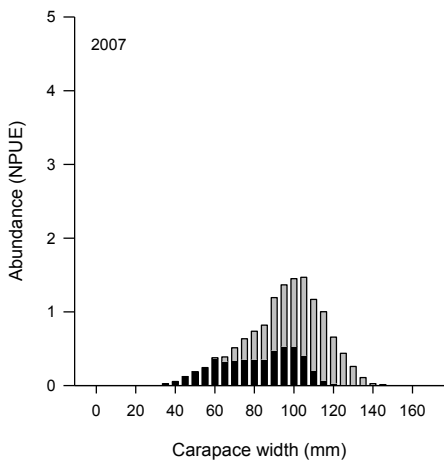
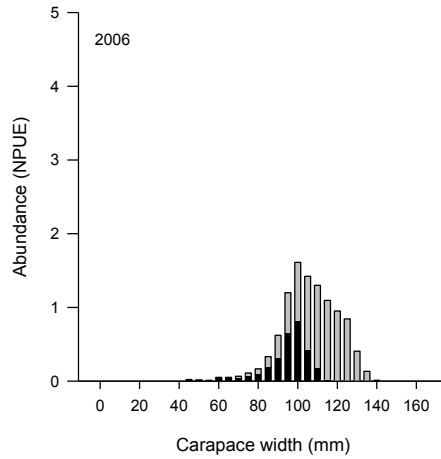
Adolescent males
 Adult males

Adolescent males
 Adult males

Sisimiut inshore



Sisimiut offshore



Adolescent males
 Adult males

Adolescent males
 Adult males

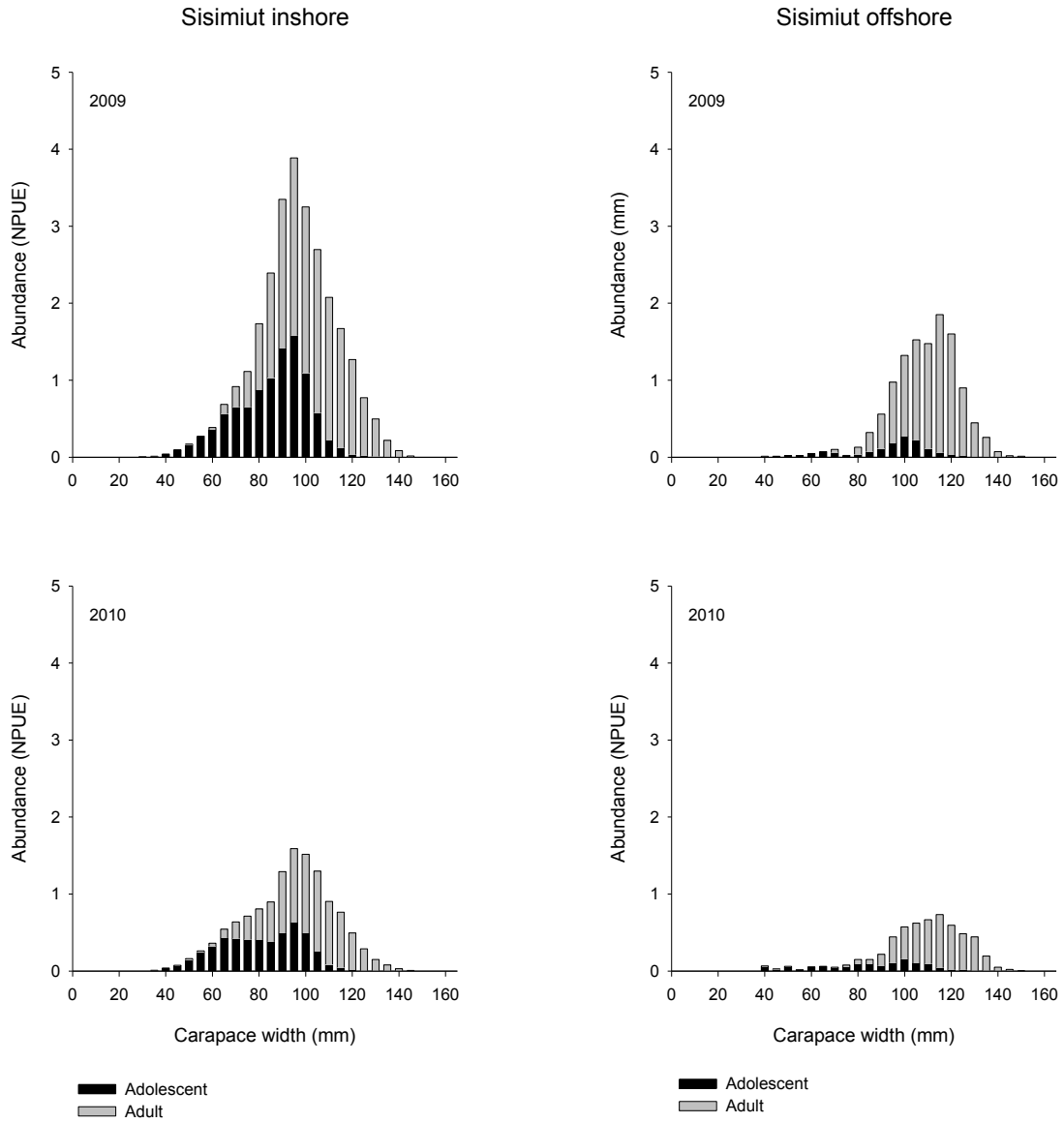


Fig. 23. Size distribution of adolescent and adult males from surveys in Sisimiut inshore and offshore from 2000 to 2010.

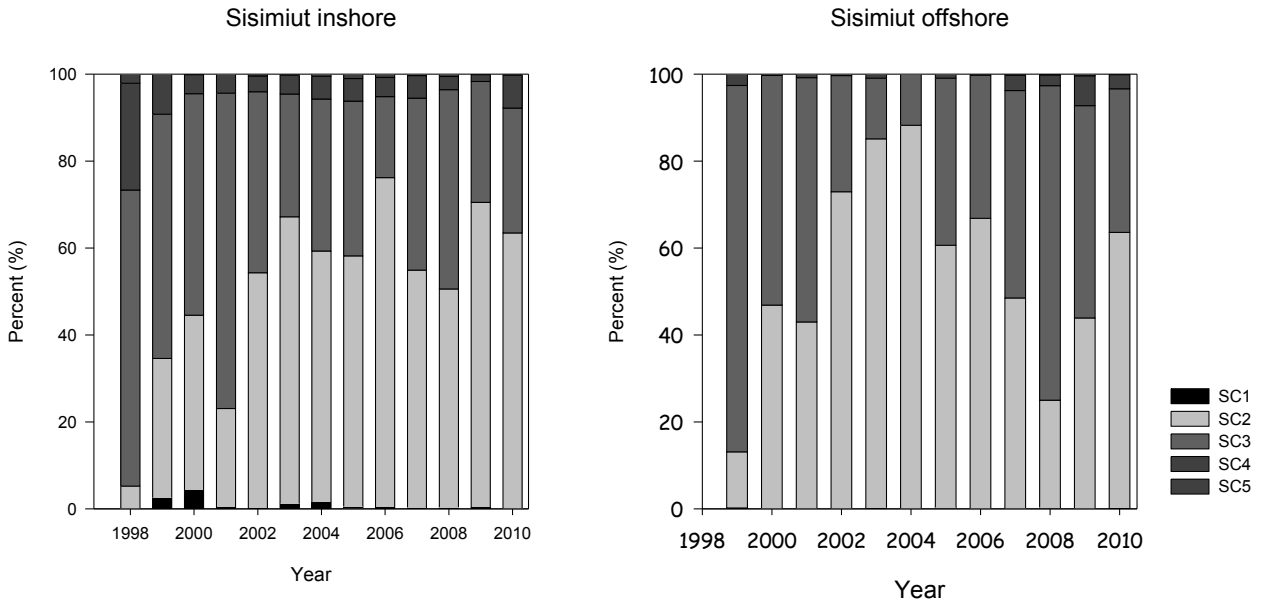


Fig. 24. The percentage of shell conditions (1-5) of legal-size adult males ($\geq 100\text{mm}$ CW) sampled in trap surveys in Sisimiut inshore and offshore from 2000 to 2010.

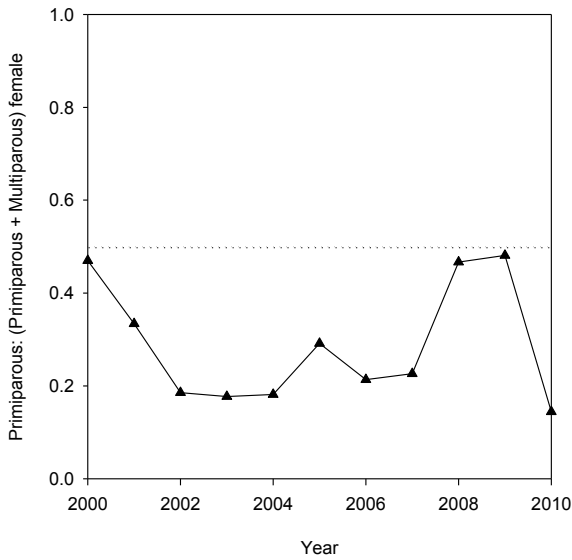


Fig. 25. Annual trends in the ratio between primiparous and multiparous females in Sisimiut inshore from 2000 to 2010.

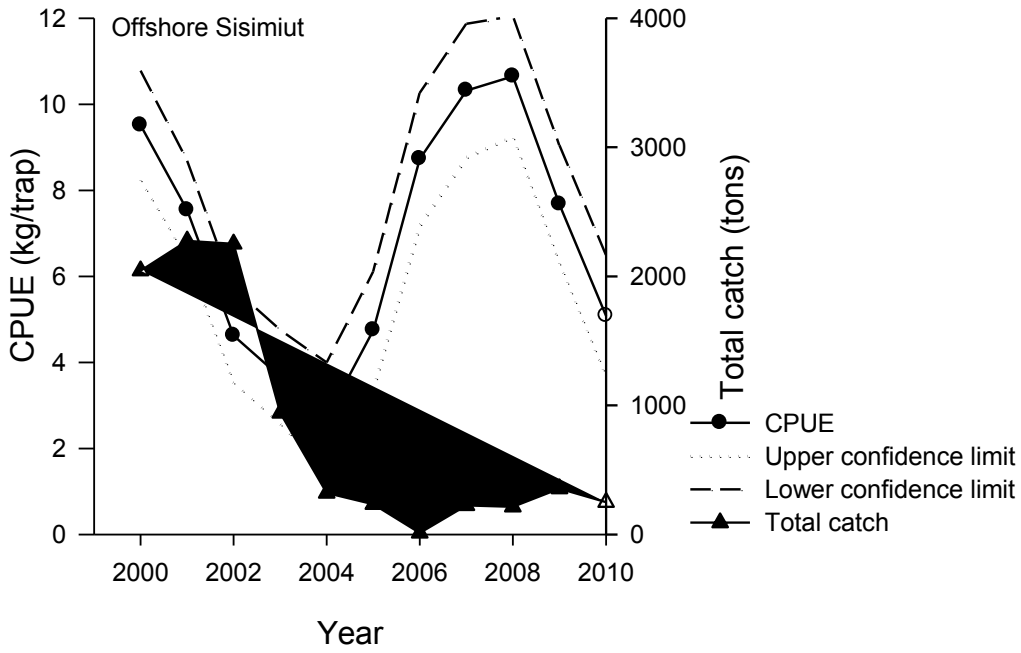


Fig. 26. Standardised CPUE index and total catch based on logbook information offshore Sisimiut from 2000-2010. Data for 2010 is incomplete.

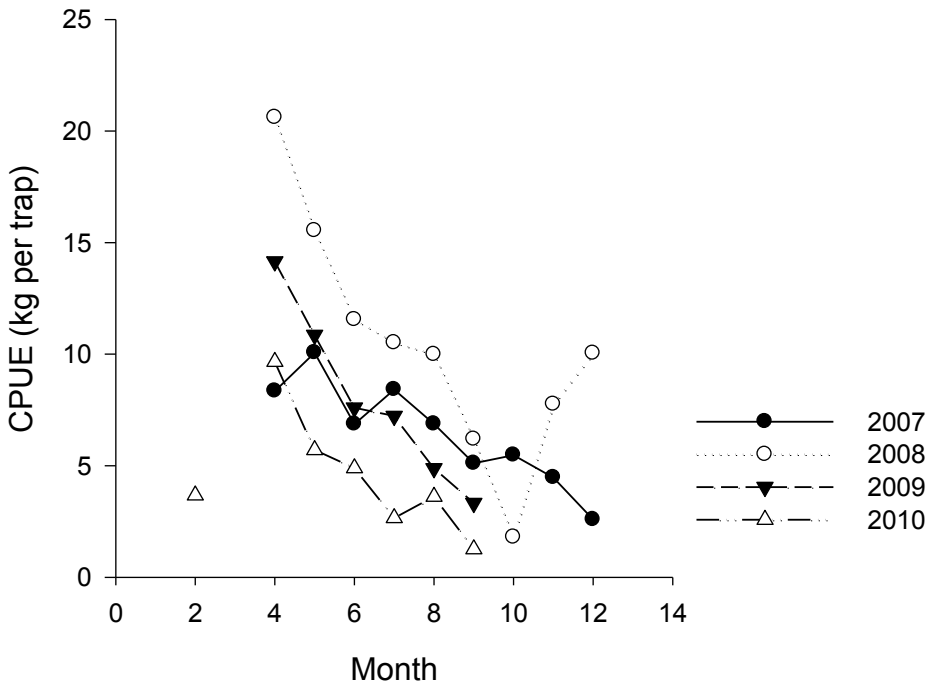


Fig. 27. Monthly trends in CPUE (kg per trap) from the fishery in Sisimiut offshore from 2007 to 2010. Data for 2009 is incomplete.

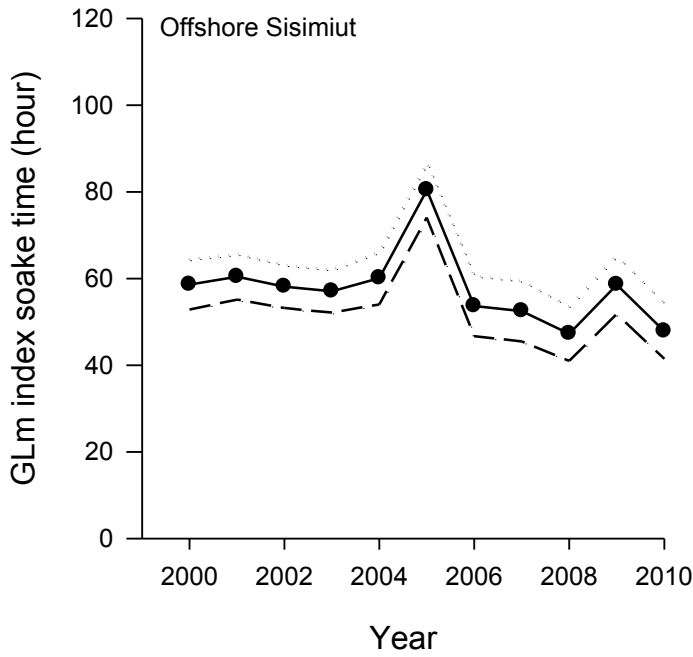


Fig. 28. Standardised soak time index based on logbook information offshore Sisimiut from 2000-2010. Data for 2010 is incomplete.

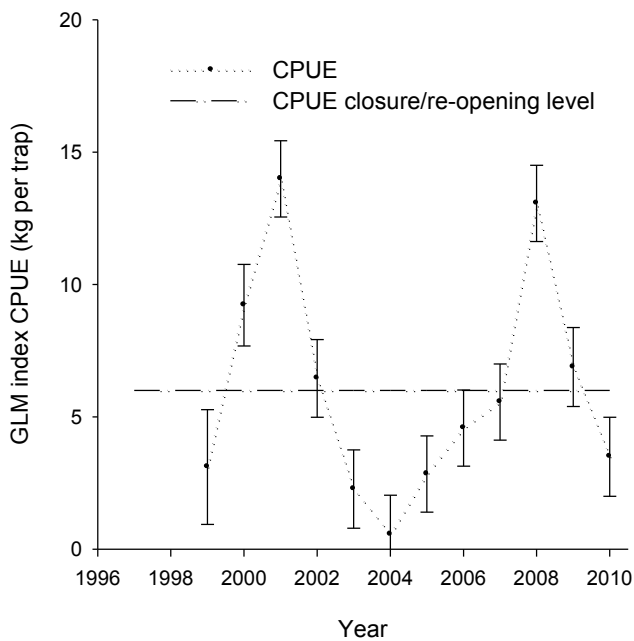


Fig. 29. Annual trends in CPUE (kg/trap \pm S.E.) of legal-size males (≥ 100 mm CW) from trap surveys in Sisimiut offshore from 2000 to 2010 and. The re-opening/closure criteria in Sisimiut offshore are indicated with a line.

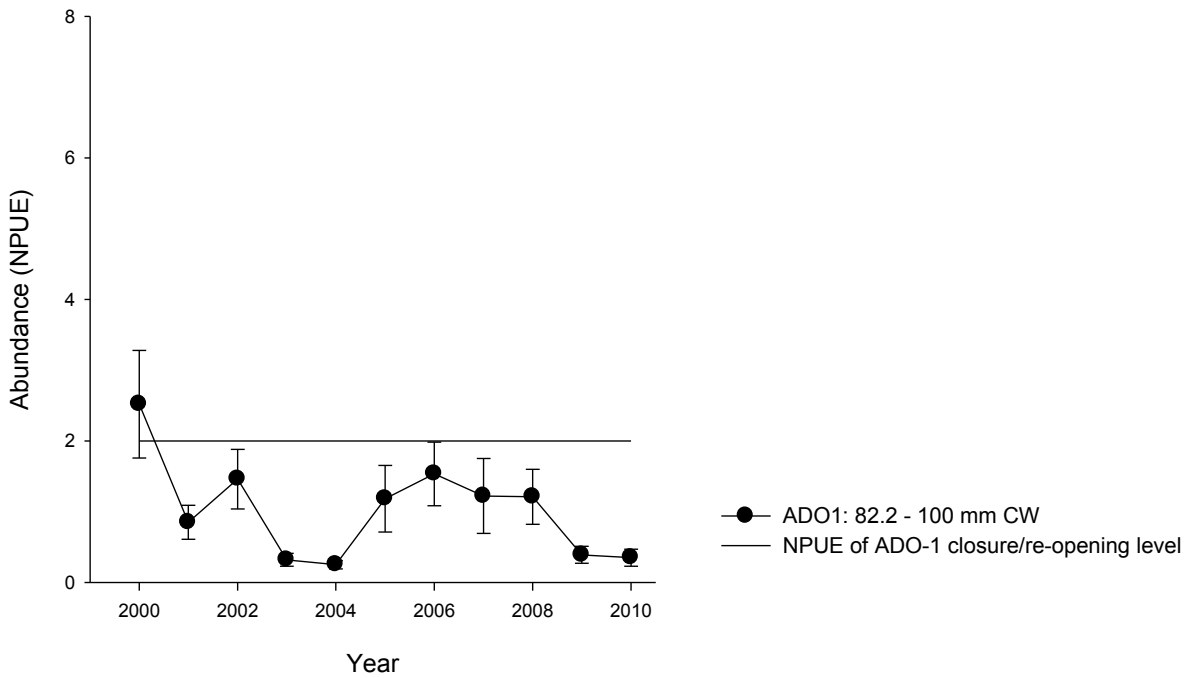


Fig. 30. Annual trends in the abundance NPUE (No. crabs per trap \pm S.E) of adolescent males (ADO-1: 82.2-100mm CW) expected to recruit to the fishery the following year in Sisimiut offshore areas from 2000 to 2010. The re-opening/closure criteria in Sisimiut offshore are indicated with a line.

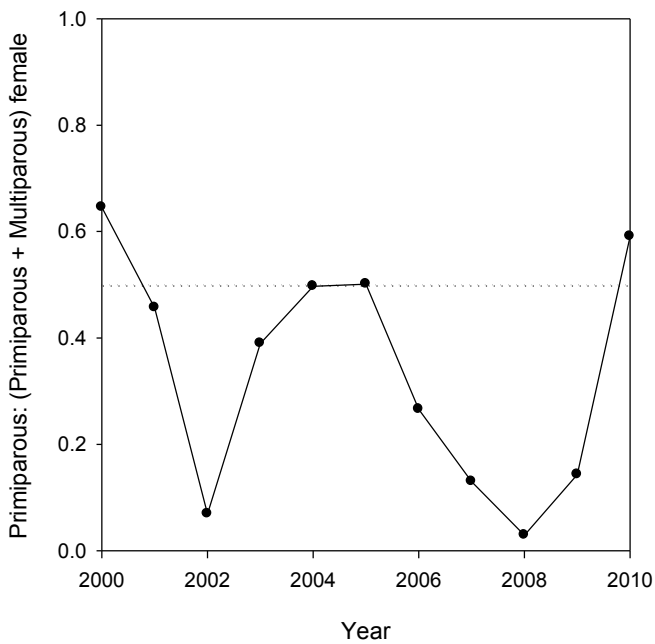


Fig. 31. Annual trends in the ratio between primiparous and multiparous females in Sisimiut offshore from 2000 to 2010.

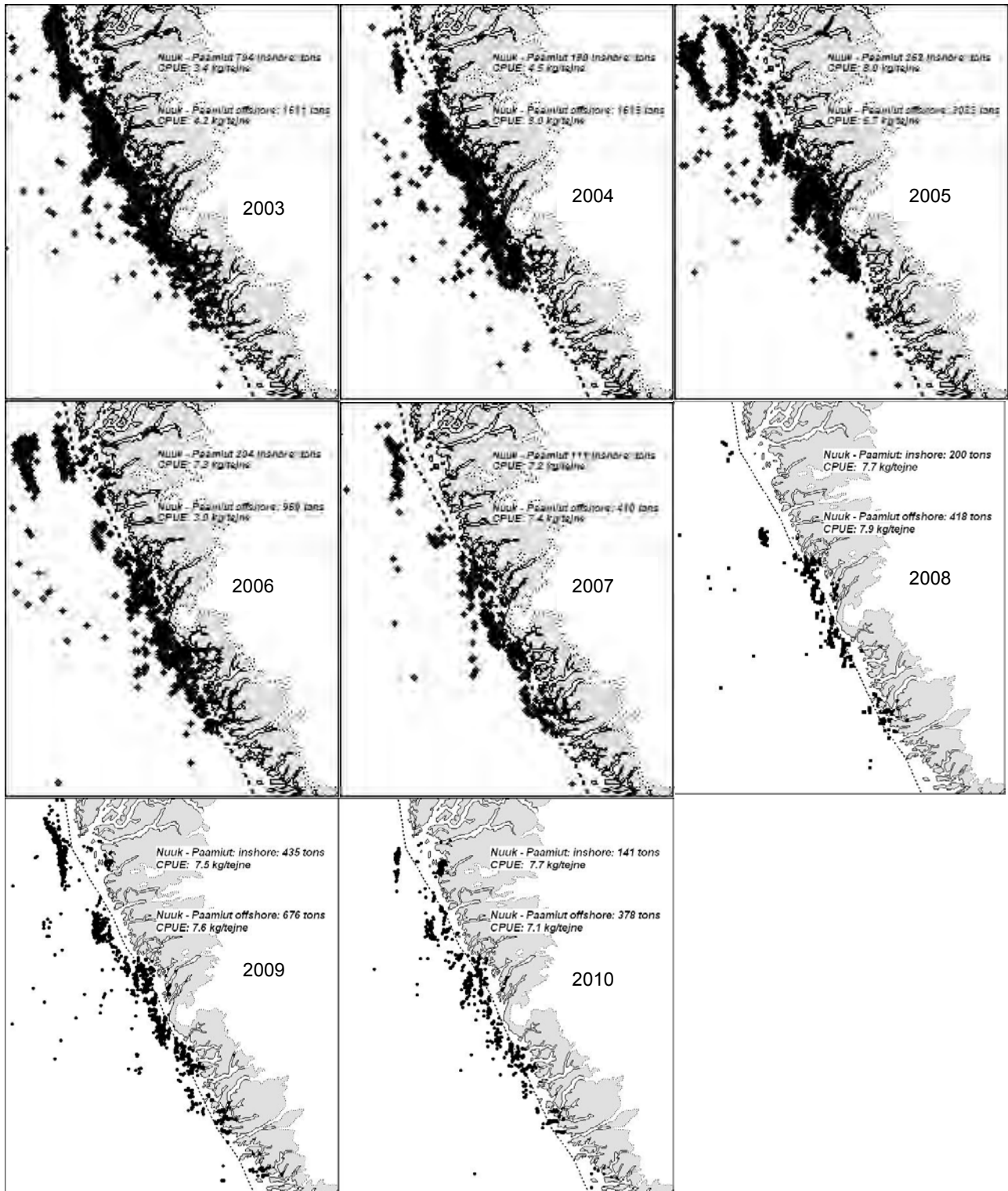


Fig. 32. The distribution and crab fishery in Nuuk - Paamiut inshore and offshore in 2003 - 2010. The coastal line indicates the basis-line separating the offshore from the inshore. Data from 2010 is preliminary and incomplete.

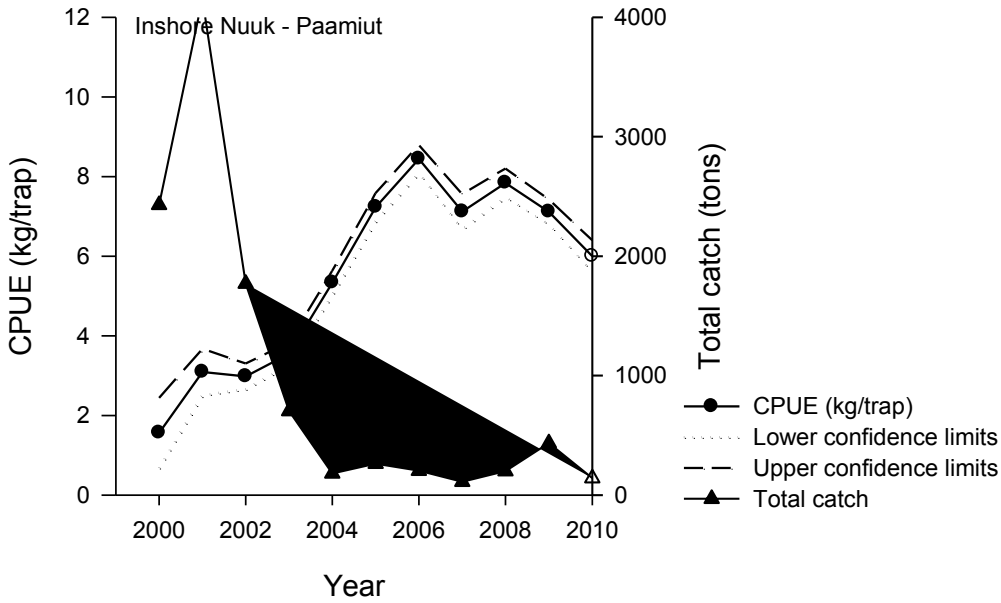


Fig. 33. Standardised CPUE index and total catch based on logbook information inshore Nuuk - Paamiut from 1999-2010. Data for 2010 is incomplete.

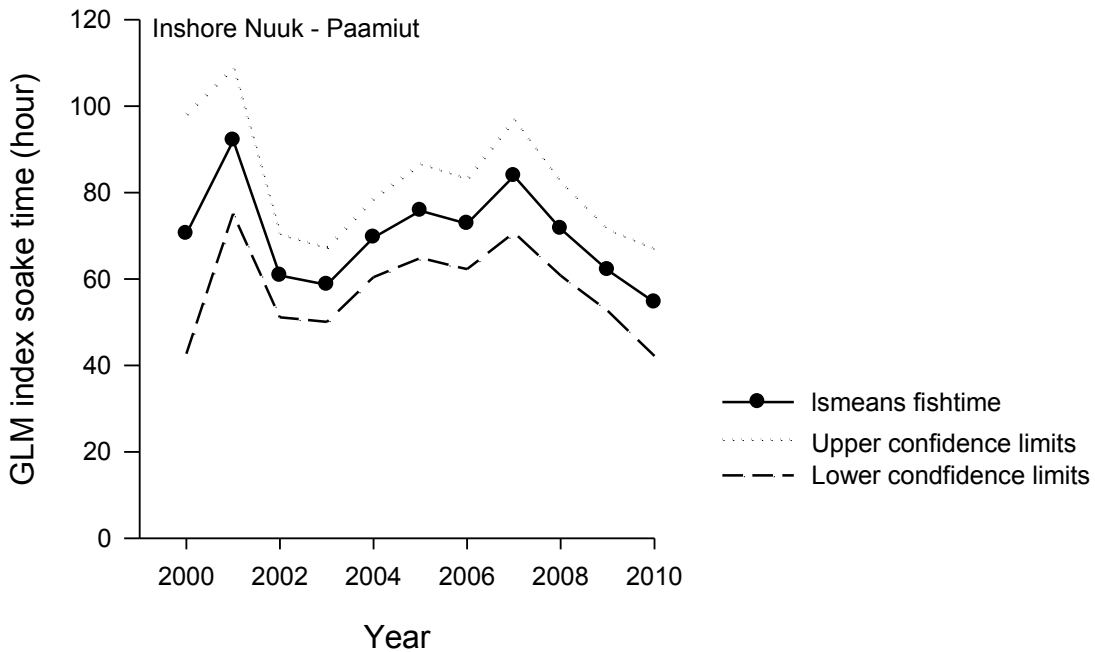


Fig. 34. Standardised soak time index based on logbook information inshore Nuuk - Paamiut from 1999-2010. Data for 2010 is incomplete.

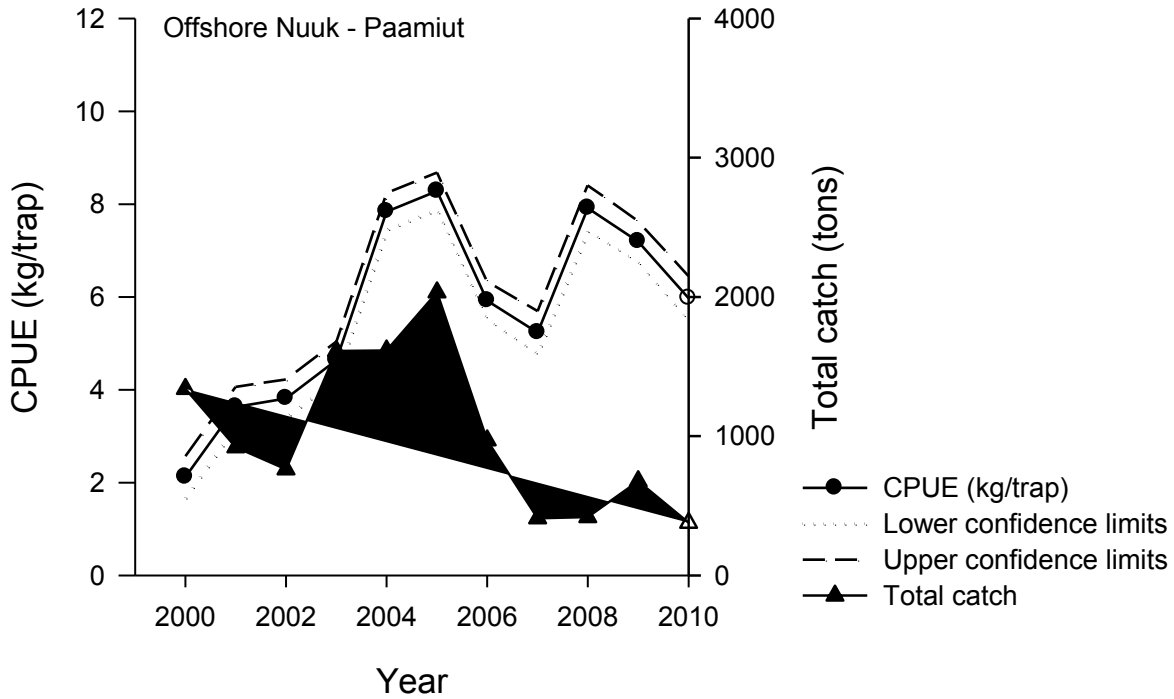


Fig. 35. Standardised CPUE index and total catch based on logbook information offshore Nuuk - Paamiut from 1999-2010. Data for 2010 is incomplete.

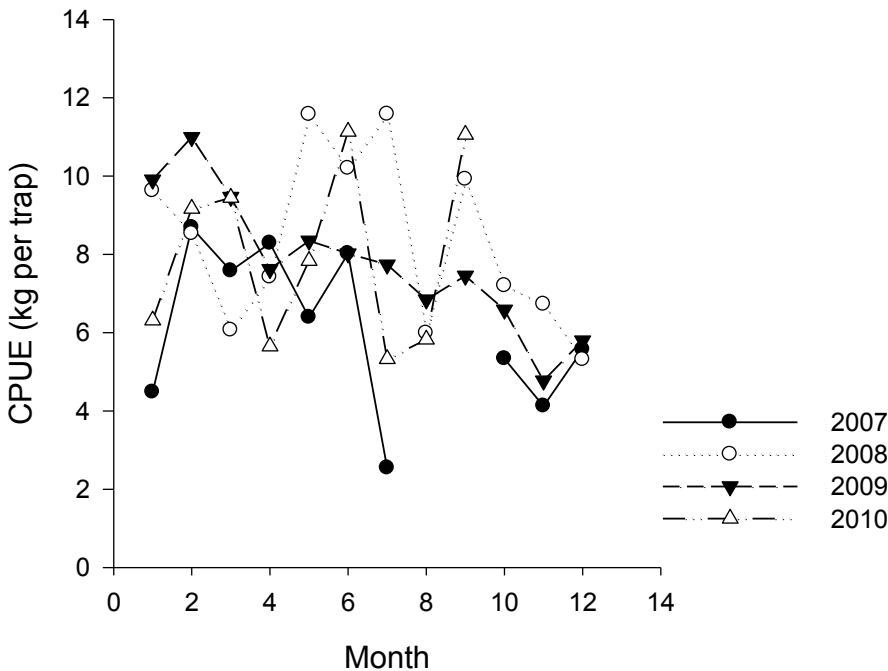


Fig. 36. Monthly trends in CPUE (kg per trap) from the fishery in Nuuk-Paamiut offshore from 2003 to 2010. Data for 2010 is incomplete.

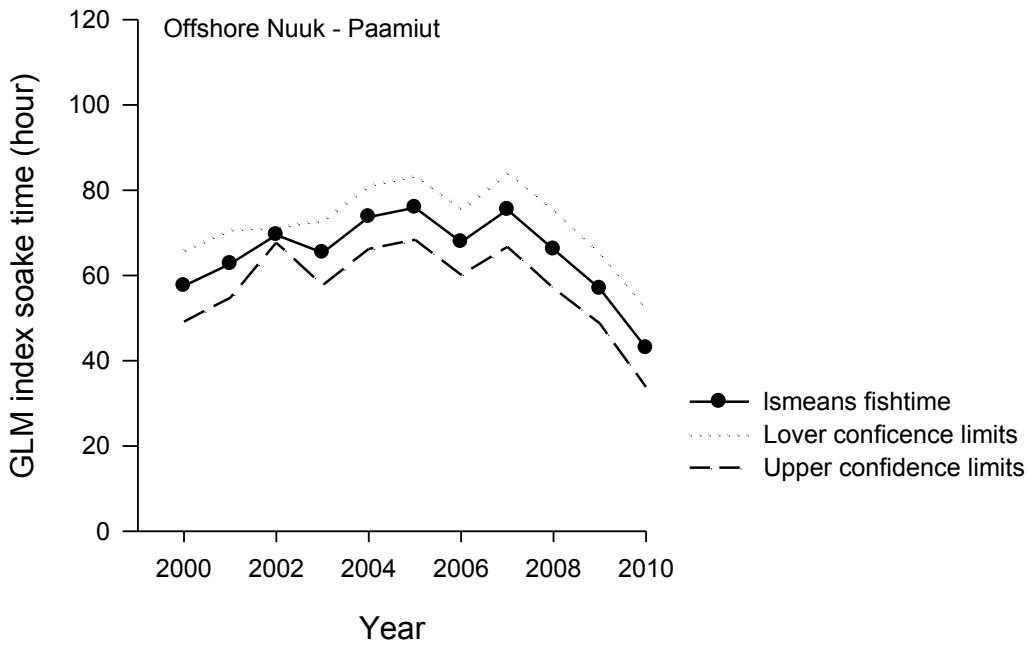


Fig. 37. Standardised soak time index based on logbook information offshore Nuuk - Paamiut from 1999-2010. Data for 2010 is incomplete.

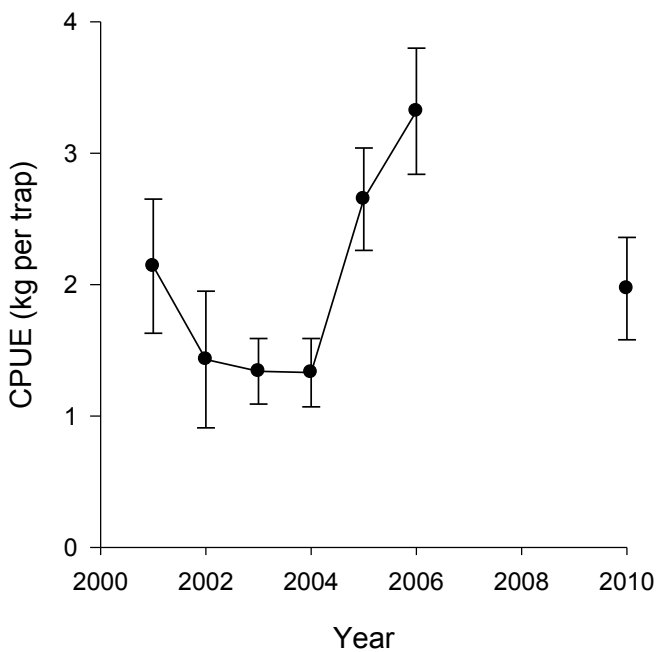


Fig. 38. Annual trends in the CPUE (kg/trap \pm S.E.) of legal-size males (≥ 100 mm CW) from the offshore trap surveys in Nuuk-Paamiut 2002-2010.

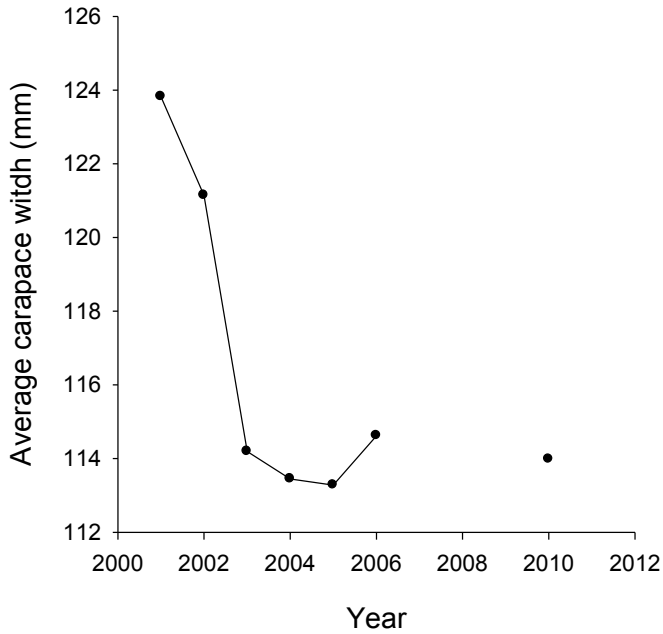


Fig. 39. Annual trends in the mean carapace width (mm.) of legal-size males (≥ 100 mm CW) from offshore trap surveys in Nuuk-Paamiut 2002-2010.

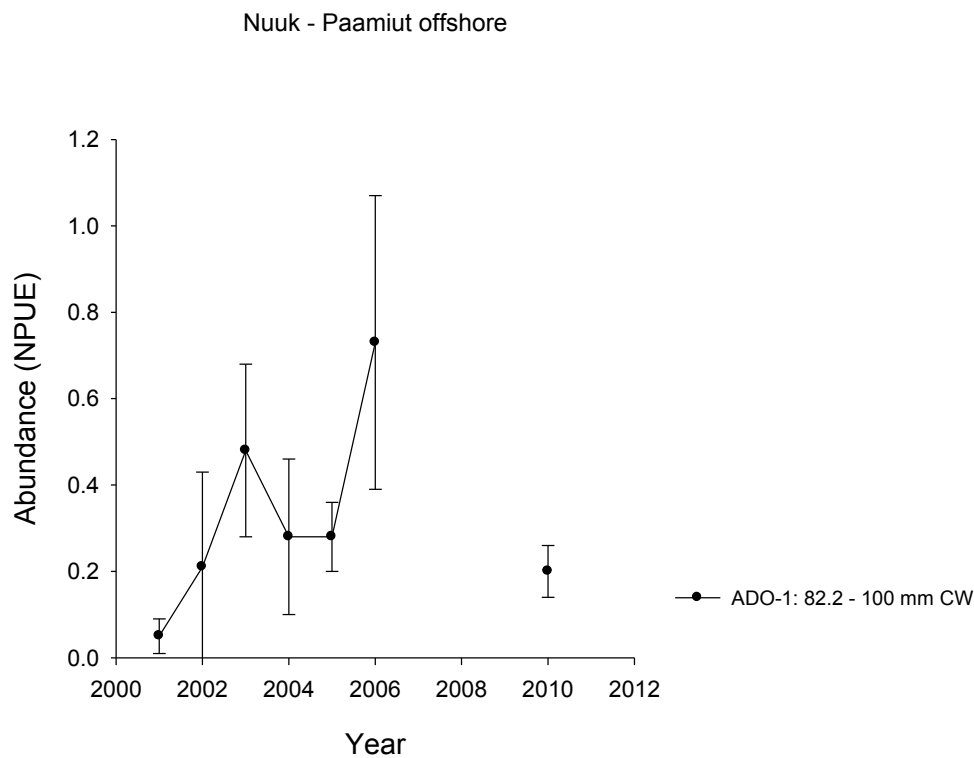
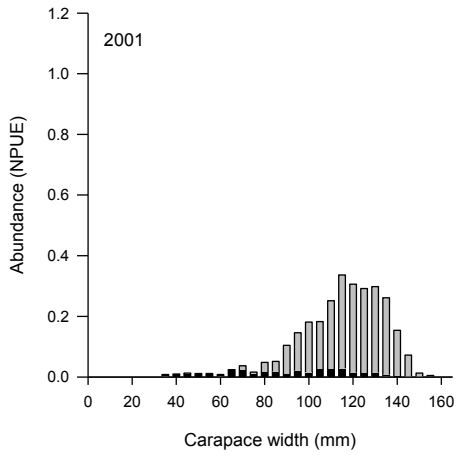
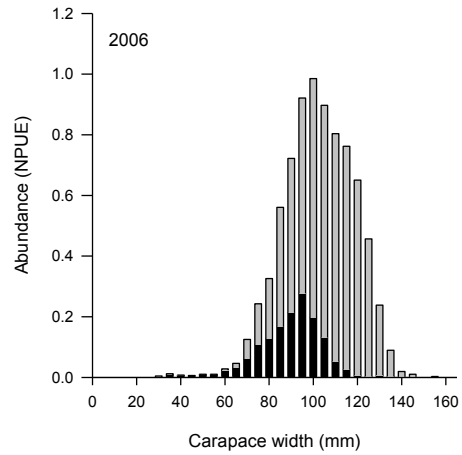
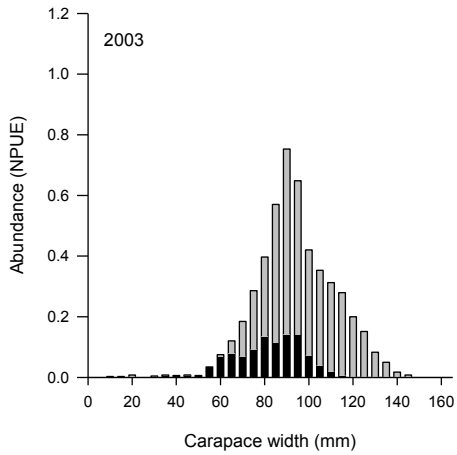
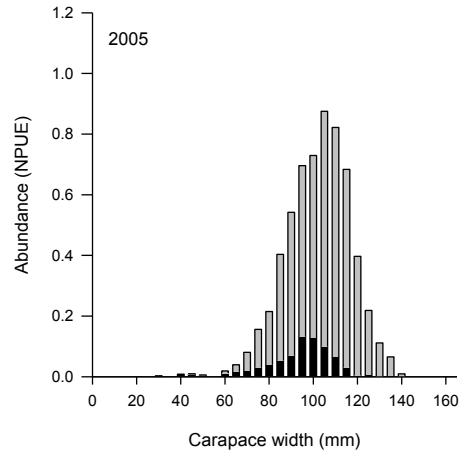
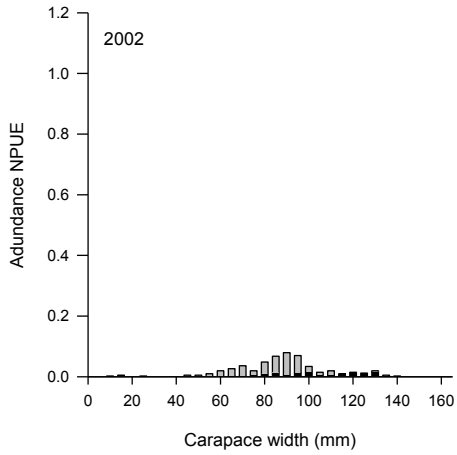
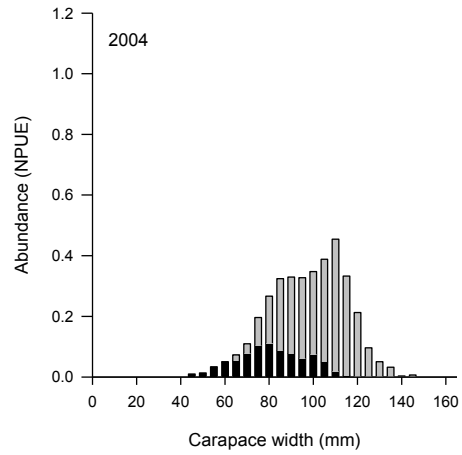


Fig. 40. Annual trends in the NPUE (No. of crabs per trap \pm S.E.) of adolescent males (ADO-1 (82.2-100mm CW) expected to recruit to the fishery in 1 years in Nuuk-Paamiut from 2002-2010.

Nuuk Paamiut offshore



Nuuk Paamiut offshore



Adolescent males
 Adult males

Adolescent males
 Adult males

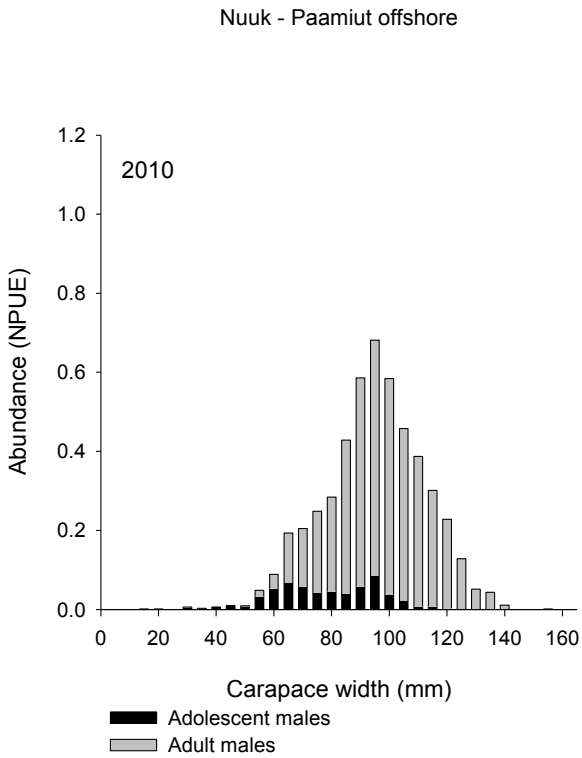


Fig. 41. Size distribution of adolescent and adult male snow crabs from 2002-2006 derived from survey data from the Nuuk-Paamiut management area.

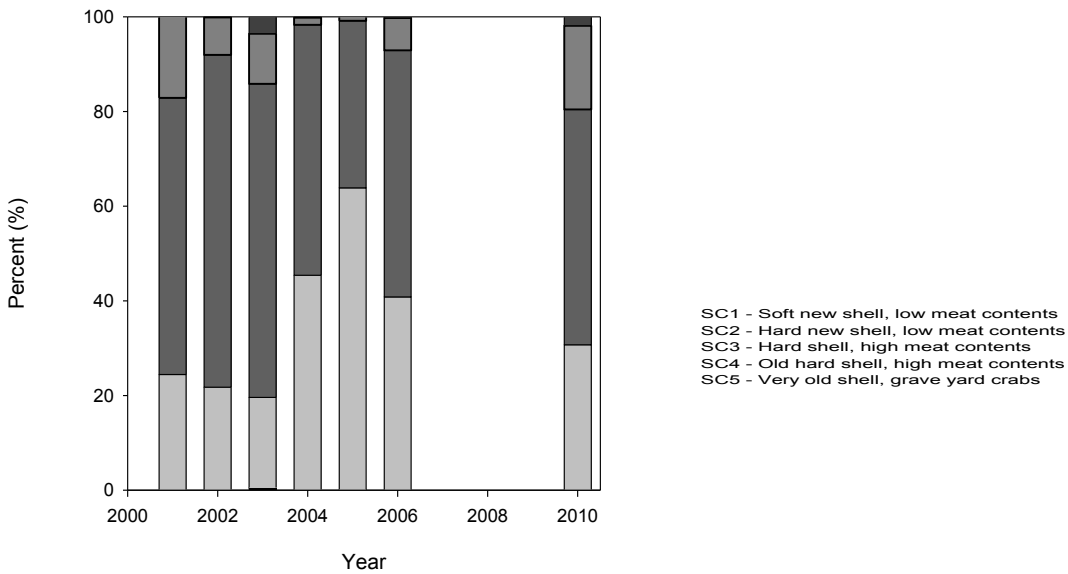


Fig. 42. The frequency (%) of shell condition (1-5) of legal-size adult males (≥ 100 mm CW) from 2002-2010 in Nuuk-Paamiut offshore.

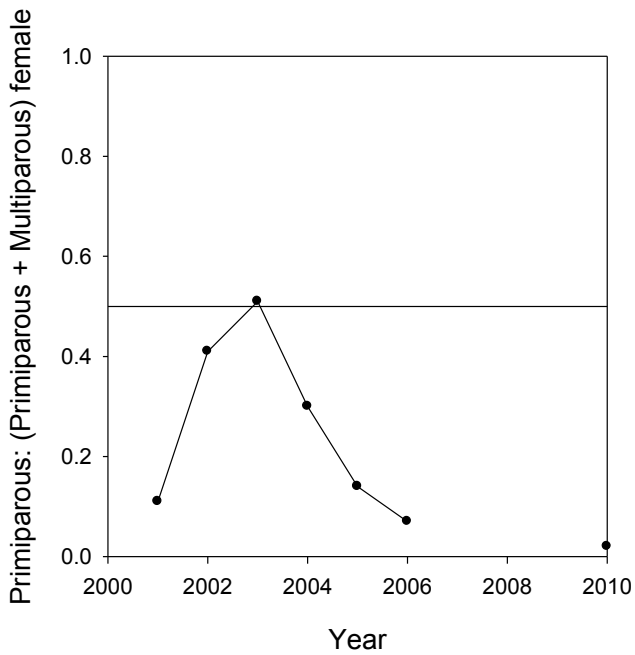


Fig. 43. The ratio between primiparous and multiparous females from offshore trap surveys Nuuk – Paamiut offshore 2001 – 2010.

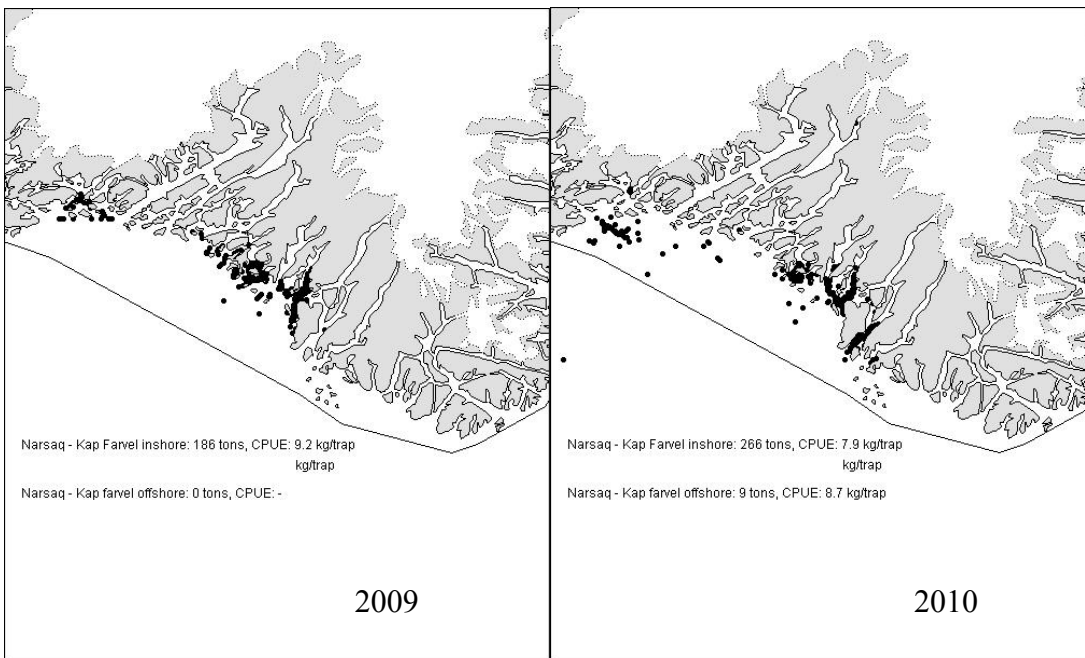


Fig. 44. The distribution and crab fishery in Narsaq – Kap farvel inshore and offshore in 2009 - 2010. The coastal line indicates the basis- line separating the offshore from the inshore. Data from 2010 is preliminary and incomplete.

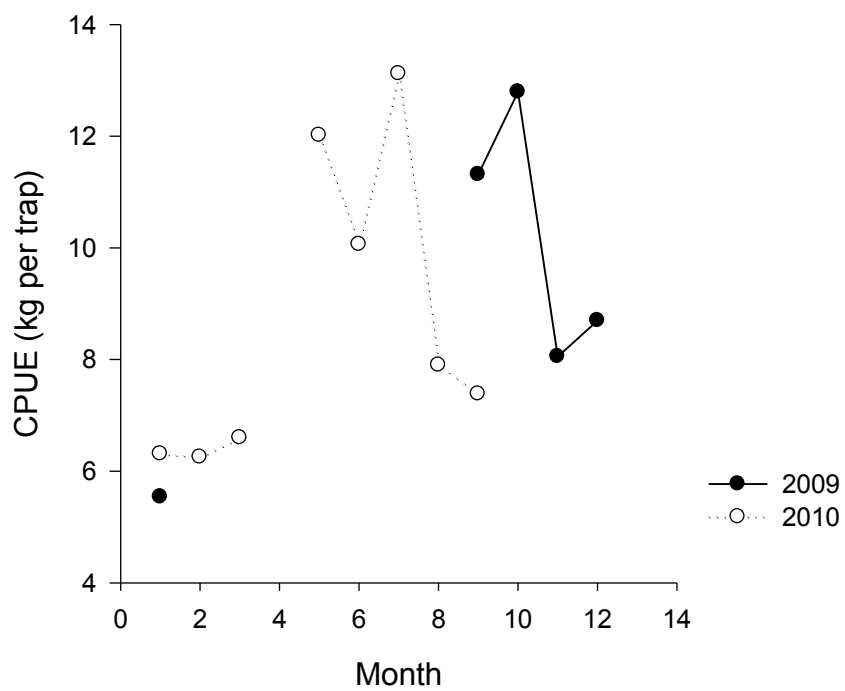


Fig. 45. Monthly trends in CPUE (kg per trap) from the fishery in Narsaq – Kap farvel indhore from 2009 to 2010. Data for 2010 is incomplete.