

Assessment of Snow Crab in West Greenland 2008

by

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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, Ummannaq-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).

Summary

- 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.
- The recommendations presented here are not expected to result in increased stock biomass in the short term, but only stop the current decline. If a rebuilding of the stock to achieve a higher exploitable biomass and better catch rates is the objective then the recommended catches should be further reduced to allow the stock to grow.
- The catch level in Disko Bay should be reduced to 1,500 tons, divided on 300 tons in the southern part of Disko Bay, 300 tons in the Northern part of the bay and 900 tons in Vaigat.
- Data from research survey suggest the resource has show signs of recovery, except for recruitment which is on a low level. The offshore area of Sisimiut had been closed for the past 2.5 year, but re-opened in mid August 2007. The commercial catch amounted to 173 tons in the closed period and an additional level of 350 tons was allocated to this area, when it re-opened. The effect of the greatly increased catch in 2007 on the exploitable biomass for 2008 is unknown. Owing to the low level of recruitment, it is therefore recommended that the area remain closed to commercial exploitation.
- The recruitment was fully harvested in most of the management areas. Disko Bay inshore area 2 and offshore Sisimiut areas are characterized by decreasing abundance of pre-recruits.

- There is evidence for improvement of the stock in the traditional fishery area, inshore Sisimiut. However, caution must be taken, as the improvement is associated with no fishery in the fjords for the past two years. Despite increasing trends in CPUE, mean carapace width and recruitment, a high exploitation rate inshore can reverse this positive trend.
- The Fishery in the Sisimiut area has in recent years concentrated effort in smaller geographical areas in the traditional fishing grounds as well as allocating a considerable amount of effort in new areas. In this regard it is noted that CPUE is only a good indicator of stock biomass when factors such as spatial coverage, effort, season etc. are approximately constant. This is not the case in this area and is probably responsible for fishermen maintaining stable catch rate levels.
- The ratio of new-shelled (recently-molted) crabs to older-shelled crabs is more than 60% in most of the management areas indicating that commercial exploitation is high and that the annual fishery is based on new recruits. The fishery is therefore highly vulnerable to fluctuations in recruitment.
- 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.
- Catch recommendations are given for the inshore and offshore of each management area and are based on analysis of biological surveys and logbooks.

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 2008 are given in Table 1.

Table 1. Summary of catch recommendations for the crab fishery in 2008 from the Greenland Institute of Natural Resources and total catch from 2006 (catch statistics for 2007 are incomplete at this time).

	Recommended catch Inshore 2008	Recommended catch Offshore	Catch in tons 2006 Inshore	Catch in tons 2006 Offshore
Disko Bugt	1,500	130	1,008	126
Sisimiut	350	continued closed	725	201
Maniitsoq	No advice	continued closed	60	12
Nuuk-Paamiut	700	1,600	199	974
Recommended catch in all	2,550	1,930	1,992	1,313

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). The commercial crab fishery is based on catches of males that reach a minimum legal-size ≥ 100 mm carapace width (CW). 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 1 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". Total allowable catch (TAC) restrictions have been imposed since 1995, but have only limited the catch in some areas since 2004. 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. In 2006, the fishery was closed for 2½ months (July 1 to September 15) in all areas except Uumannaq-Disko Bay (closed only 1 month from July 1 – August 3) to protect soft-shelled crabs.

The Greenland Institute of Natural Resources (GINR) gives stock assessment and management 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. The overall annual catch is based on landings because catch statistics from logbooks for both small and large vessels have only been available since 2003 and are not always complete. Landings increased from approx. 1,000 tons (no TAC) in 1995 to a peak of approx. 15,000 tons (TAC 26,800 tons) in 2001 (based on landings from small vessels and catch from logbook data from large vessels >75 GRT). From 2001 to 2006 the total catch has decreased by approx. 77% to 3,305 tons (TAC 5,700 tons) despite the quota was not being reached (Fig. 2).

The distribution of the landings in each management area in Fig. 3 and Fig. 4, show that traditionally, most of the landings have predominately come from the areas Disko Bay-Ummannaq, Sisimiut and Nuuk-Paamiut. Commercial CPUE is derived from catch and effort data from logbooks.

The total fishing effort (trap hauls) has declined by 81% since 2001 (from 3,416 to 665 thousand trap hauls during 2001-2006) (Fig. 5). The decline has been mostly due to a declining number of participants in the fishery. Preliminary and incomplete logbook data for 2007 shows total effort is 240 thousand trap hauls. The ratio of total landings to logbooks landing varies between management areas. The overall distribution of the fishery along the West coast of Greenland from 2003-2007, derived from available logbook data is shown in Figure 4.

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. From 2004 to 2007 the number of active license holders in all management areas decreased by 55%. The reduction was 60% in inshore Disko Bay (I-DIS) and 57% in the offshore area of Nuuk-Paamiut (O-NUP) (Table 2)).

Table 2. Annual development in the number of active fishing vessels with licenses in the management areas from 2004-2007

Year	I-DIS	O-DIS	I-MAN	O-MAN	I-SIS	O-SIS	I-NUP	O-NUP	O-NAQ	Unkonow
2004	43	19	9	4	19	17	25	28	3	28
2005	33	15	9	5	16	11	25	31	4	25
2006	24	14	6	4	14	9	18	29	1	11
2007	17	9	4	4	12	10	10	12	0	9

Trends in the Catch, CPUE and Effort inshore and offshore will be analysed more specifically for each management area in their respective sections.

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 molt. 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 female size distributions are also described to follow the progression of size modes through the populations and determine primiparous/multiparous ratios within the female population.

Inshore surveys in Disko Bay and Sisimiut

In Disko Bay, 43 stations are sampled annually (Fig. 6a) and in Sisimiut, 40 stations are sampled (Fig. 6b), 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. 6b) in June and a total of 30-60 stations are sampled in the Nuuk-Paamiut and Maniitsoq offshore areas in August-September (Fig. 6c). 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 longline of 16 traps, eight large-meshed (70 mm) traps alternating with eight small-meshed (21mm) traps at approx. 40 m intervals and baited with squid.

Summary of the fishery and survey data in each 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 3. Data for 2007 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 1,134 tons (88% inshore) in 2006, approximately 27% of the 2001 catch.

Inshore - Disko Bay

Fishery

From 2000-2001 catches inshore increased from 2,940-3,950 tons as effort more than doubled (613-1274 thousand trap hauls, Table 3). CPUE, however, decreased from 4.8 to 3.1 (data derived from available logbook data). Catches and effort have steadily decreased since 2001 by approximately 74% to 1,008 tons and 219 thousand trap hauls, respectively, in 2006. CPUE remained low, between 3.1-3.7 kg/trap during 2001-2004, before increasing to 4.6 kg/trap in 2006. Preliminary data for 2007 representing approx. 23% of the allowable quota indicate CPUE in Disko Bay is 4.0 kg/trap (Table 3). The ratio of total landings to total catch obtain by logbooks is 1:1.

The distribution of the fishery in Disko Bay from 2003 to 2007, according to available logbook data is shown in Figure. 7. In 2003, the fishing effort was distributed all along the eastern part of Disko Bay from the northern Vaigat area to the southern part of Disko Island, as well as the southern part of Disko Bay. In 2004, much of the fishing effort shifted from northeast Disko Bay to area 2 off the southeast coast of Disko Island. There was, however, still some effort in Vaigat and in the most-southern part of the Bay. The distribution of the fishery in 2005 indicated that effort was primarily in the southeastern area off Disko Island with the fishery also continuing in Vaigat and in the southern-most part of Disko Bay. The geographic distribution of the fishery in 2006 was similar to that in 2005, except for reduced effort in Vaigat.

The fishery in Disko Bay typically starts in April, peaks during the summer months (June-July) and steadily declines towards the end of the year, except in 2006 when the fishery peaked in September, mainly due to a closure during July and August. Monthly trends in the fishery CPUE in 2006 were stable from September to December at approx. 5 kg /trap, whereas the CPUE steadily decreased at the end of the year in the previous years (Fig. 8). Early season catch rates (Mar-May generally decreased over time (2004-2007), perhaps because early season focused on traditional areas. Late season CPUE increased from 2004-2006, reflecting allocation of effort to new areas as the season progressed. Data from logbooks suggesting that there has been no resource recovery since 2004, but rather the fishery is progressively harvesting all available crabs.

Research Surveys

Inshore (Areas 1 and 2)

Trap surveys have been conducted in 2 inshore areas of Disko Bay since 1997 (See Fig. 6a for maps). CPUE of legal-size males (≥ 100 mm CW) in Area 1 and Area 2 peaked in 2001 and 2000 respectively and have declined steadily by more than 50% to 2004; from 4.2-1.7 kg/trap in Area 1 and 7.5-2.3 kg/trap in Area 2 (Fig. 9). The 2004 CPUE was the lowest observed in the time series. In 2005 and 2006 CPUE in Area 1 was still considerably below the reference mean of 3.7, but increased to 4 kg/trap, marginally above the reference mean, in 2007. In Area 2, CPUE increased from 2.3 to 6.4 kg/trap and has reached the reference mean in 2006. In 2007 Area 2 CPUE decreased to 4.4 kg/trap. Reference means are based on the average kg/trap from 1999-2002.

The mean carapace width (CW) of legal-size males had continually declined in both survey areas to a minimum in 2004 (Fig. 10). CW subsequently increased in both areas in 2005 and remaining unchanged in Area 1 to 2007 while the mean CW has increased over the past 3 years in Area 2.

The abundance of adolescent males (ADO-1), measured as number per trap (NPUE), peaked at 2.2/trap in Area 1 in 2001, and 2.6/trap in Area 2 in 2002 (Fig. 11). The NPUE of ADO-1 has since declined sharply in both areas and was at the lowest levels observed for the time series in 2004 in Area 1. In 2006, the NPUE of ADO-1 males in Area 1 was 0.8/trap and increased in 2007 to 1.8/trap 2007, above the reference mean. NPUE of ADO-1 in Area 2 decreased from 1.7/trap in 2005 to 1/trap, the lowest levels observed in the time series. The NPUE of ADO-1 in Area 2 remains below the reference means for the time series.

Annual trends in size distribution of adolescent and adult males ≥ 100 mm CW are shown in Fig. 12. In Area 1 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 Area 2 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.

Increasing proportion of legal-size soft and new-shelled males (shell condition 1 and 2) have been observed from 2001-2007 (Fig. 13) and have peaked at around 70% in 2006 in both Area 1 and Area 2. The continuously high proportion of soft and new-shelled males suggests a continuous removal of the older shelled males by the fishery, which is becoming increasingly dependent upon recruitment.

The ratio of primiparous and multiparous females, used to support trends in recruitment, decreased sharply in Area 1 from 2000 to 2003, remained low in 2004 and has increased until 2006 and decreased again from 2006 to 2007 (Fig. 14). The increase in Area 1 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 Area 2 the ratio of primiparous and multiparous female has re-

mained constant at a level of 0.45 from 2004 to 2006, but decreased to 0.26 in 2007, suggesting a decreasing recruitment of mature females to the stock.

Outlook - Disko Bay Inshore

Available fishery and survey data indicate that the crab resource in Disko Bay has been declining over the period from 2000 to 2004 despite a decrease in total catch and effort by approximately 50% since 2001. The commercial catch rates remain low and at present are around 3- 4.0 kg/trap. Survey CPUE in Area 1 has increased since 2004, and the CPUE was at the lowest observed level at 1.2 kg/trap in 2004 and increased to 4 kg/trap in 2007. Recruitment has increased since 2004 in Area 1 and both CPUE and recruitment are in 2007 at the mean reference point for the time series. Survey CPUE in Area 2 decreased from 6.4 kg/trap in 2006 to 4.4 in 2007 and is now below reference means for the time series. Caution must be taken, because recruitment of ADO-1 has decreased to historically low levels once again. This suggests that there is only limited improvement in the resource as a whole and recruitment prospects in the coming years are considered poor. Commercial CPUE at the present level of recruitment indicate that there has been no increase in crab biomass despite declining fishery removals especially in the area covering the southern shore of Disko Island (survey area 2). Recruitment indices for a long-term prognosis are uncertain. The percentages of new shelled adult (60-70 %) and adolescent (75-90 %) males in both survey areas indicate that the fishery in Disko Bay is being sustained by new recruits.

Recommendations for the 2008 fishery - Disko Bay Inshore

Survey data from 2007 indicate the resource has stabilised at a low level despite the improvement in survey Area 1, but there are still no clear signs of improvement to the exploitable biomass and prospects for an increase in the future are still uncertain as recruitment is poor for survey Area 2. It is therefore recommended to set the catch level at 1,500 tons divided on 300 tons in the southern part of Disko Bay, 300 tons in the Northern part of Disko Bay and 900 tons in Vaigat.

Special comment: The total catch in 2006 was the lowest since 2000. Over the last 5 years the proportion of soft and new shelled crabs have been high and is now around 70% which indicates that the fishery is largely dependent on new shelled recruits. These characteristics together with the knowledge that the quota was not reached in 2006 are worrying signs as the crab resource is highly vulnerable to fluctuations in recruitment in the short term and there are negative consequences to reproduction in the long term associated with low number of older shelled adult males.

Offshore - Disko Bay

Fishery

Catches in offshore Disko Bay have increased from 112 tons in 2000 to 252-349 tons between 2001-2003 (Table 3).. Meanwhile, effort increased about 500% from 20 to approx. 100 (97-116) thousand trap hauls. Concurrently, CPUE steadily declined from 5.5 to a low of 2.6

kg/trap in 2003. Catches in 2005 and 2006 were 98 tons and 126 tons, respectively and the CPUE has been increased from 4.0- 6.7 kg/trap in the same period. Preliminary logbook data from 2007 show CPUE is 5.1 kg/trap at a preliminary and incomplete catch of 126 tons.

In 2006 and 2007 the offshore fishery has almost exclusively concentrated effort around the southwestern part of Disko Island with some sporadic fishing in the southern part of the management area (Fig. 7).

Outlook - Disko Bay Offshore

Catches have been between 135-350 tons since 2001. CPUE during the same period has varied between 2.6 and 6.7 kg/trap. The fishery data in 2006 indicate signs of improvement. The fishery in recent years has almost exclusively concentrated effort around the southwestern 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 2008 fishery - Disko Bay Offshore

CPUE from the fishery indicates increasing biomass of since 2004 and there are signs of stock improvement. A catch level of 130 tons is recommended, which is the same recommendation as in 2007.

Sisimiut

The historical catch, CPUE and effort data of the fishery in Sisimiut in the inshore and offshore areas are summarized in Table 3. Data for 2007 is only preliminary and incomplete.

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. Overall catches were between 2,543-2,724 tons (>82% from the offshore area) from 2000-2002, but have decreased markedly since, as a result of decreasing catches offshore. The catch in 2006 was approx. 926 tons of which 725 tons were taken inshore while 210 tons were taken offshore where 2 boats received dispensation to fish in the area that has been closed since 2005, but reopened during 15 August to 31 October 2006. The distribution of the fishery over the last few years shows fishing effort has moved outside the fjords in the traditional fishing grounds near Sisimiut. Furthermore two fjords (Ndr. Stoemfjord and Ndr. Isortoq) north from Sisimiut has been exploited since 2004.).

Inshore Sisimiut

Fishery

From 2000-2004 catches steadily increased from 327 to 1,111 tons. Meanwhile, CPUE increased from about 2.8 kg/trap in 2000-2001 to a higher level, ranging 3.7-4.6 kg/trap during 2002-2004 (Table 3).. Effort decreased from 2000 to 2002, but more than doubled in 2003 and declined by more than a factor of 3 to 2006. Since effort has been decreasing to a histori-

cal low level of 87 thousand trap hauls in 2006. From 2005 catches decreased, while CPUE has increased to 8.3 kg/trap in 2006. The distribution of the fishery changed from 2004 to cover new fishing areas in fjords in the northern part of the area (Fig. 15), which have comparatively high CPUE. Thus, these new areas are largely responsible for the increase in the overall commercial CPUE since 2005.

Monthly trends in catches, CPUE and effort from 2004-2006 and preliminary data for 2007 are shown in Fig. 16. The temporal pattern of catches and CPUE in 2006 show CPUE peaked in May and decreased as the season progressed and total catch for the area increased. An exception was the second peak in September for 2006, mainly caused by closure of the fishery from mid July to primo September 2006. A similar pattern is seen in the preliminary and incomplete data for 2007.

Research Surveys

The survey CPUE inshore increased steadily from 2.8-6.5 kg/trap from 1997 to 2001, and was followed by a decline by a factor of 3 to a record low level of 2.2 kg/trap in 2004. During 2004-2006 survey CPUE has been stable at a comparatively low level and below the reference mean of 5.8 kg/trap (1999-2003) for the time series (Fig.17). In 2007 CPUE increased to 4.6 kg/trap, and is close to the reference mean. The mean CW of legal-size males inshore decreased from 2004 to 2006 (Fig. 18) while survey catch rate remained unchanged, but a minor increase was observed in 2007. The 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. 19). Since 2002, the abundance of ADO-1 males has declined sharply to approx. 1 ADO-1 per trap in 2004. The abundance of ADO-1 has remained low but stable from 2004 to 2006. It increased to 1.5 ADO-1 per trap in 2007. Annual size distributions of adolescent and adult males in Sisimiut inshore (Fig. 20) show little evidence of recruitment progressing through to the legal size range (≥ 100 mm CW). Legal-size males of shell condition 2 (new shelled males) comprised 58% of survey catches (Fig. 21). This, together with increasing mean CW, increasing CPUE, as well as number of ADO-1, suggesting some positive recruitment to the stock.

The ratio between primiparous: all mature females declined sharply from 2000-2002 (Fig. 22), and has remained low up to the present with the exception of a slight increase in 2005. Despite this observation, other survey trends suggesting fair recruitment with some prospect for increase in the exploitable biomass in the near future.

The 2007 inshore trap survey included (for the first time) an area in the Northern fjord – Ndr. Strømfjord. In that area CPUE was 8.9 kg/trap and average mean CW was 116mm. The proportion of new shell males comprised 58% and intermediate males (SC3) 42% of the adult males exceeding the minimum legal size of 100 mm CW. The abundance of ADO-1 was at a low level of 0.17 per trap, compared to the other inshore areas of Sisimiut. This area was not included in any other summaries or analyses.

Outlook - Sisimiut Inshore

The survey data shows some improvement in the stock from 2006 to 2007. In the same period fishery removals decreased from 725 tons in 2006 to 344 tons (ultimo August) 2007. Biomass may be recovering slowly, but remains far lower than during the previous peak, 2001-2002 (Fig. 20). Recent high catch rates are not due to high biomass or strong recruitment, but due to reduced effort and catches. Effort has been reduced down to a level that may be sustainable at existing biomass and recruitment levels. Furthermore distribution of effort in the inshore fishery has changed since 2004. Prospects for improved recruitment, in the traditionally fishery areas, in the near future appear positive.

Recommendations for the 2008 fishery - Inshore Sisimiut

An aggregated distribution of effort from the commercial fishery is assumed to be inappropriate for the stock. However, increasing survey and fishery CPUE in comparison with increasing recruitment indicate slowly recovering of the inshore stock in the near future. Although the fishery has redistributed a great deal of effort and catch to fishing grounds in 2 fjords in the northern part of the area, the biological information these fjords are poor and the sustainability of a fishery in these areas is unknown. It is therefore recommended that the inshore catch for 2007 not exceed a level of 350 tons in the traditional area.

Offshore Sisimiut Fishery

From 2000-2002 the most important offshore fishing area was Sisimiut with commercial catches between 2,043-2,275 tons (Table 3), which was approximately 52-55% of the total offshore catch during that time. In 2000 CPUE was 6.4 kg/trap but quickly declined to 3.5 kg/trap in 2002, indicating that the high catches were sustained by an increase in effort (from 319 to 643 thousand trap hauls). In the following years catches continued to decrease and by 2004 catches were reduced by 85% to 375 tons in comparison to 2001 and 2002 levels. CPUE decreased despite a reduction in effort. In 2004 CPUE increased only due to decreasing catch and an approx. 80% reduction in effort. Owing to the large decline in catches and effort, it was recommended to close the area to the fishery in an attempt to promote the recovery of the resource. The distribution of the offshore fishery had also shifted considerably in the years just prior to closure in 2005. In 2003, fishing effort was distributed over much of the offshore area within Holsteinsborg Dyb and sporadically along the edge of the outer shelf, whereas in 2004 were effort only was 20% of the 2003 level, was more concentrated in a small area around the 3-mile basis line and sporadically within the inner section of Holsteinsborg Dyb (Fig. 15).

Monthly trends in catches, CPUE and effort from 2004-2005 and preliminary data for 2007 are shown in Figure 16. The temporal pattern of CPUE show highest values during spring and decreased as the season progressed and total catch for the area increased. An exception was the second peak in 2004 where CPUE increased from September to November. In 2006, fishery Vas closed from mid July to primo September 2006. From 2007 preliminary, the pattern seems to follow the main pattern with high CPUE in spring and decline during season.

In 2005, where 2 large boats obtained dispensation to fish in the offshore area and some small vessels fished offshore just outside the 3-mile basis line, the fishery showed effort extending out from the fjords and distributed close to the inshore/offshore “basis line” as well as considerably offshore outside the 12-mile basis line in the southern part of the area. Catches amounted to approx. 200 tons in both 2005 and 2006. In 2007 catches amounted to 173 tons until 1 August.

The area had been closed since January 2005 and re-opened during 15 August to 31 October in 2007. Although re-opening criteria were not reached, a political decision was made to spread the fishery to be more sustainable in the Sisimiut management area. The quota for the re-opened area was increased to 350 tons.

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*

Research Surveys

A steady increase in the survey CPUE has been observed over the past 3 years to 5.6 kg/trap in 2007. This value is still low and considerably below the reference mean of 10.0 kg/trap (derived from the mean in the years 2000-2003) for the time series and lower than the 6 kg/trap as prescribed for the re-opening criteria. The mean CW of legal-size males (≥ 100 mm CW) offshore decreased considerably from 119 to 112 mm from 2003-2005, but has increased to 114 mm CW in 2007 (Fig. 18). There is no apparent trend corresponding to progression of length distributions in the most recent years except for a minor trend in 2007 (see Fig. 20). The abundance of ADO-1 in Sisimiut offshore declined markedly from 2000 to a record low level below 0.5 ADO-1/trap in 2004 (Fig. 19). From 2005 the abundance of ADO-1 rose to approx. 1.5 per trap in 2006. This trend suggests an increase in recruitment of legal-sized males may be forthcoming in the near future, but in 2007 abundance of ADO-1 was declining to the 2005 level of 1.2 per trap. Annual size distributions of ADO-1 (82.2-100mm CW) showed some evidence of these adolescents progressing through to legal-size from 2001 to 2003 (Fig. 20) but overall progression was not particularly obvious, possibly disguised by the large drop in the overall biomass of legal-size males since 2002

The percentages of new-shelled crabs within the legal size range decreased from almost 90% in 2004 to about 50% in 2007 (Fig. 21). This sharp decrease in percent of new-shelled crabs in the spring survey in 2005 is likely due primarily to the large reduction in commercial catches in 2004 (Table 3), also reflected in an increase in fishery and survey CPUE. The subsequent decrease in percent new-shelled males to 2007, however, may have been due to increasing recruitment into the stock, as ADO-1 had increased in 2005 and 2006. However, it is unclear to what extent the changes in shell condition ratios and CPUE are due to reduced

catch versus increased recruitment. In general the increased percentage of old-shelled males and increasing CPUE are both positive signs for the stock indicating an increased abundance of older shelled males that are available to participate in reproduction. The ratio of primiparous:total mature females declined sharply from 2000-2002, then increased from 2003 to 2005 (Fig. 22). A significant drop in this ratio occurred in 2006 and continued in 2007, indicating poor recruitment may be forthcoming in the future.

Outlook - Offshore Sisimiut

Survey and fishery data indicate that after the biomass declined substantially from 2000-2004 that there are now signs of recovery from the survey and fishery data. However, the increase in biomass is largely attributable to greatly reduced removals due to the large reductions in commercial catches, up to 2006. The exploitable biomass is still at a low level and according to the survey data is still considerably below the mean for the entire time series. Recruitment indices for the offshore area indicate moderate recruitment prospects in the short term. However, progression of the males into the legal size has been limited and the increase in stock biomass has not yet been substantial. The total catch for the offshore area is expected to reach 600 tons in 2007, almost double the quota (350 t), and triple the fishery removals in each of the previous two years (Table 3). Caution must be exercised as the effect of this increased level of removals by the re-opened fishery in 2007 is unknown

Recommendations for the 2008 fishery - Offshore Sisimiut

There are some positive signs of stock recovery. Mean CW of the legal sized crabs has increased for the past 2 years as well as the survey CPUE. The results from the survey have almost reached the re-opening criteria, except for the abundance of pre-recruits. All these indices suggest signs of recovery to allow a guarded exploitation. Caution must be taken, because the survey occurs in June, and most of the fishery removals in 2007 occurred after the survey. The effect of the greatly increased catch in 2007 on the exploitable biomass for 2008 is unknown. All these indices suggest the resource has yet to show significant signs of recovery to allow exploitation. It is therefore recommended that the area remain closed to commercial exploitation.

Maniitsoq-Kangaamiut

The historical catch, CPUE and effort data of the fishery in Maniitsoq-Kangaamiut inshore and offshore areas are summarized in Table 3.

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 115 tons in 2004 as the CPUE both inshore and offshore decreased to the lowest levels observed in the fishery (2.4 and 2.1 kg/trap in offshore and inshore areas). Since 2003 the inshore fishery has been less than 100 tons and from 2005 the offshore fishery has been closed.

Inshore Maniitsoq-Kangaamiut

Fishery

Catches in Maniitsoq-Kangaamiut inshore peaked in 2001 and 2002 at approx. 1,000 tons both years. During this time the CPUE from the fishery was stable and low at approx. 3.5 kg/trap. In 2003 catches decreased substantially to only 40 tons. CPUE remained at around 3.7-3.9 kg/trap despite the large decrease in catches and effort. In 2004, catches almost doubled to 78 tons as effort increased, but CPUE decreased to 2.4 kg/trap. Logbook data from the fishery in 2006 suggest that the biomass had increased as CPUE was 4.3 kg/trap at a catch of 60 tons. The distribution of the fishery in 2004 to 2006 was, however, limited to in and around a fjord in the northern part of the area (Fig. 23) and is not representative of the resource biomass in the area as a whole.

Outlook - Inshore Maniitsoq-Kangaamiut

There are indications that CPUE has slightly increased over the last year, but a decrease from 2006 to 2007. Improvement is, however, small considering the low commercial catch and effort. It is difficult to determine the biomass of the resource in the area as a whole as logbook data from the fishery are limited to a small inshore area in the northern part of Maniitsoq-Kangaamiut. There is no survey in the inshore area so comparative biomass and recruitment prospects are unknown.

Recommendations for the 2007 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 increased from 381 to 826 and 743 tons from 2000 to 2001 and 2002, respectively as effort increased from 50 to 275 thousand trap hauls. CPUE during the same period was originally 7.6 kg/trap in 2000 but decreased substantially to 2.7 kg/trap in 2002 suggesting the resource biomass was negatively affected by the increase in the fishery. In 2003 the catches declined by 41% (445 tons) as effort decreased by 44%. Despite these reductions the CPUE remained low at 2.8 kg/trap. Distribution of the fishing effort and catches in 2003 indicated the majority of the catches in the Maniitsoq-Kangaamiut area were taken primarily in the northern parts of the area where effort extended offshore considerably (Fig. 23). In 2004 CPUE decreased further to 2.1 kg/trap despite a further 76% drop in catches indicating the resource was still in a state of decline. Fishing effort was distributed not far offshore near the basis-line and was only 13% that in 2003. The continued poor state of the resource biomass and confirming 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. Some fishery has, however, taken place and shows CPUE was 4.3 kg/trap at a catch of 12 tons in 2006. The management area has been closed

in 2005 and 2006, but was reopened with a quota on 200 tons in August 2007. Preliminary catches from 2007 show a catch level of 143 tons.

Research Surveys

Due to technical problems with the hydraulic system on the research ship Adolf Jensen, the survey has been cancelled in 2007. No new survey data is available for the stock assessment and advice.

In 2003, 2005 and 2006, surveys were conducted at 17, 12 and 17 locations offshore in the Maniitsoq-Kangaamiut area. In 2003 and 2005, the survey CPUE of legal-size males (≥ 100 mm CW) was very low at 1.2 kg/trap and 0.8 kg/trap, respectively (Fig. 24). In 2006, the survey CPUE increased to 4.2 kg/trap. In the 2006 survey the more northerly areas were sampled for the first time since 2003 and the increase in the survey CPUE was largely due the higher biomass in these areas. The abundance (NPUE) of adolescent males between 82.2-100 mm (ADO-1) also increased from lows in 2003 and 2005 (0.3 and 0.2 crabs/trap, respectively) to 2.0 crabs/trap (Fig. 25). This increase was also mainly attributable to a higher prevalence of ADO-1 in the northern areas. In 2005, a high percentage of new-shelled males SC2 (Fig. 26) and a decrease in the mean CW (Fig. 27) in a period with no increase in the survey CPUE during low exploitations suggest a large loss of older shelled males and only little recruitment insufficient to make up for losses. In 2006, the moderate increase in the percentage of SC3 crabs and the increase in CPUE suggest the low exploitation has allowed a number of new-shelled males to remain in the population and become older shelled exploitable crabs. The length distributions of adolescent and adult males (Fig. 28) suggest an increasing catchability or trap efficiency, but not an increase abundance of recruitment. The ratio of primiparous:multiparous females in 2006 is considerably low (0.25) but has increased slightly from 2003 and 2005 values (Fig. 29).

Outlook - Offshore Maniitsoq-Kangaamiut

According to survey indices the offshore resource appears to be improving in a scenario where there is no exploitation. However, caution is warranted as there is no continuous series of survey data, and 2006 data can only be compared with survey data from 3 years earlier because of the reduced number of stations in 2005. Furthermore, fishery data in 2006 are incomplete and very sparse and those available suggest no increase in CPUE despite a large reduction in catch. Thus the apparent increase in offshore biomass at present is highly uncertain.

Recommendations for the 2008 fishery - Offshore Maniitsoq-Kangaamiut

No new data are available for 2007. It is suggested that the Maniitsoq-Kangaamiut area remain closed to the fishery in 2008 to evaluate whether the resource is actually recovering and to allow further improvements to the resource biomass.

It is also recommended to establish a management plan that will identify stock criteria for reopening the area and a commercial fishery practice that will promote a sustainable fishery.

Nuuk-Paamiut

The historical catch, CPUE and effort data of the fishery in Nuuk-Paamiut inshore and offshore areas are summarized in Table 3.

The Nuuk-Paamiut area is another important fishing area where total catches peaked at more than 5,000 tons in 2001. However, catches the following year were approximately 50% lower (2,531 tons) despite only a 10% decrease in effort. This led to the fishery CPUE inshore and offshore decreasing from 5.3 and 3.8 kg/trap respectively in 2001 to 2.8 kg/trap in 2002 in both areas,. Total catches including inshore and offshore have been somewhat stable around 2,300 tons during 2002-2005, partly as a result of low overall effort and more recently due to quota restrictions. Total catches decreased by half to 1,173 tons in 2006 (974 tons offshore and 199 tons inshore).

Inshore - Nuuk-Paamiut

Fishery

Catches peaked at 4,157 tons in 2001 and then declined by more than 95% to 199 tons in 2006 (Table 3), while fishing effort declined by 96%. Catches have been steadily declining concurrent with a reduction in effort, which has been moving offshore in recent years. This is reflected in the logbook data showing the majority of catches from the small vessels (inshore fishery) are taken offshore and is supported by the general distribution of inshore fishing effort being somewhat continuous with the offshore fishery, near the boundary (Fig. 30). CPUE has gradually increased during this period from a low of 2.8 kg/trap in 2002 to 8.4 kg/trap in 2005, but decreased to 6.9 in 2006, despite a 37% reduction in effort (Table 3). Preliminary commercial data in 2007 shows a CPUE of 7.3 kg/trap at a catch of 66 tons. The distribution the fishery in 2004 and 2006 has been concentrated near the middle of the management area in sub-areas Fiskenæs-Danasdyb and Frederikshåb-Ravnsdyb. There is, however some fishery in the northern part of the area - Godthåb. Preliminary data from the fishery in 2007 show a similar distribution to 2006.

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 increased to 2006 as total catch and effort decreased but some concern regarding sustainability of the resource at higher catch levels, due to the lack of biological data. Preliminary data from 2007 show a decrease in CPUE.

Recommendations for the 2008 fishery - Inshore Nuuk-Paamiut

There had been indications of improvement to the resource biomass over the last several years in a scenario of decreasing fishing exploitation. It is however, difficult to determine the

extent of the improvement due to the lack of other stock indices. It is therefore recommended that the catch level of 700 tons for 2008.

Offshore - Nuuk-Paamiut

Fishery

From 2000-2002, catches in Nuuk-Paamiut offshore declined from 1,339 to 761 tons. Concurrently, CPUE also declined by approximately 50% (5.4-2.8). Catch more than doubled to 1,611 tons in 2003 and further increased to 1,980 tons as effort decreased to 244 thousand trap hauls in 2005. The commercial CPUE increased from 4.2 kg/trap in 2003 to 8.1 kg/trap in 2005. In 2006 the catch decreased to 974 tons, which was not limited by the quota of 1,800 tons. Effort decreased by 43% in comparison to the year before and the commercial CPUE decreased to 6.9 kg/trap. Preliminary data for 2007 show a CPUE of 7.2 kg/trap at a catch of 358 tons. There have been no landings of crab from ultimo June to mid October 2007 to the main industry component (Royal Greenland) in Paamiut. The fishery starts in January and has the highest catch rates from February to May, approx 9 – 11 kg/trap in 2004 and 2005 and 7 –8 kg/trap in 2006 and 2007. CPUE steadily declines during remainder of the season (Fig. 31). The Feb-May data indicate that early-season CPUE in 2007 was comparable to that in 2006, at a lower level than during 2004-2005.

The distribution in the offshore fishery has changed slightly in recent years 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 the middle of the Nuuk-Paamiut (sub-areas Fiskenæs-Danasdyb and Frederikshåb-Ravnsdyb) in 2004 and 2005 (Fig. 30). Furthermore, for the first time, effort has been allocated to a fishery along the outer edges of the banks (Fyllas bank) in the northern part of Nuuk-Paamiut area in 2005. Monthly trends in commercial data generally show substantial declines in both catches and CPUE during the year, suggesting the resource is being depleted considerably as the fishing season progresses.

Research Surveys

Due to technical problems with the hydraulic system on the research ship Adolf Jensen, the survey in 2007 has been cancelled. No new data is available for the stock assessment and advice.

After a period of very low survey CPUE of legal-size males from 2001-2004 the CPUE has increased over the last 2 years from 1.4 to 3.4 kg/trap in 2006 (Fig. 32a). Trends in CPUE within 3 sub-areas from south to north (Frederikshåb-Ravnsdyb - Fiskenæs-Danasdyb - Godthåbsdyb) indicate that the increase, although small, is throughout the area with the greatest increase being observed in the sub-area Fiskenæs-Danasdyb in the middle of the Nuuk-Paamiut area (Fig. 32b). The average CW of legal-size males declined from approx. 120mm CW in 2003 to approx. 113mm in 2005 (Fig. 33). In 2006 the average CW was slightly higher primarily due to an increase in CW in the northern area (Godthåbsdyb), whereas the average CW of legal-size males in the southern sub-areas Fiskenæs-Danasdyb and Frederik-

shåb-Ravnsdyb has been stable in recent years. The overall abundance (NPUE) of adolescent males (ADO-1) 1 year from attaining legal size has increased to 0.7 crabs/trap in 2006 after a period of decreasing values over several years (Fig. 34). The increase is, however, almost exclusively due to a greater abundance of ADO-1 in the sub-area Fiskenæs-Danasdyb and thus indications of improved recruitment in the near future overall appears to be spatially limited as the abundance of adolescents is still low in the northern and southern sub-areas. 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 modal width of adults has extended beyond the legal-size ($\geq 100\text{mm}$ CW) and become broader since 2002 and 2003 (Fig. 35). This progression appears to be on a small scale particularly in the sub-areas Godthåb and Frederikshåb-Ravnsdyb where a mode at 85mm has fully recruited by 2006. 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 (62% SC1+2) in comparison to 2005 when new shelled adult males exceeding 100mm CW comprised 80% (Fig. 36). This was observed in all sub-areas and together with the high CPUE is likely a result of a recruitment pulse reaching maximum size as old-shelled adults predominantly in 2 of the 3 sub-areas. The ratio of primiparous:multiparous females overall and in all sub-areas of Nuuk-Paamiut (Fig. 37), suggests that recruitment will decline in the future.

Outlook - Offshore Nuuk-Paamiut

The increase in commercial CPUE from 4.2 to 8.1 kg/trap in 2005 at a catch of 1,798 tons seems to have come to a halt in 2006 as the CPUE decreased to 6.9 kg/trap at a catch of 974 tons. Trends in the survey CPUE indicate an increase in the biomass since 2004 but the overall survey CPUE is still comparatively low at 3.4 kg/trap and does not reflect the fishery data directly. Survey data from 2006 also indicate there may be an increase in recruitment in the short term as indicated by an increase in ADO-1 albeit mainly in the central part of the area (Fiskenæs-Danasdyb). Recruitment prospects for the near future appear to poor in the northern and southern part of the area but more promising in the middle. The ratio of primiparous:multiparous females further suggests a decline in recruitment in the longer term. The distribution of the fishery in 2004 and 2006 indicates the fishery has mainly targeted areas of moderately high commercial CPUE, largely concentrated in Fiskenæs-Danasdyb in the middle of the offshore area on the inner banks with effort increasing in the northern area of Godthåbsdyb. The decline in the commercial CPUE from 2005 to 2006 may indicate that although some survey indices suggest an improved biomass and forthcoming recruitment in the short term, the area may not be able to sustain the current fishery of 2,000 tons., especially as resources in the fishing areas targeted are depleted and recruitment is only strong in a few localized areas.

Recommendations for the 2008 fishery - Offshore Nuuk-Paamiut

No new biological data are available for 2007. In 2006 data show after 2 years of increasing commercial biomass the CPUE in 2006 decreased slightly from 8.0 to 6.9 kg/trap after a decrease in catch by more than half from the previous year to 974 tons. Survey CPUE has increased slightly from 2004-2006 but is still poor at 3.4 kg/trap. Short-term recruitment indic-

es suggest a moderate increase but this appears temporally and spatially limited to one main area. Longer-term recruitment prospects are highly uncertain because trends in ADO1 males and primiparous females do not agree.

To take into consideration recruitment uncertainties and the decreasing resource biomass observed in 2006, it is recommended that the catch level for 2008 does not exceed 1600 tons, identical with the quota for 2007.

Special comments

Owing to the cancelled survey in 2007, there is no fishery-independent data, to validate the apparent decrease in the exploitable biomass in this area.

Other areas with a limited fishery

Upernavik

The historical catch, CPUE and effort data of the fishery in Upernavik is shown in Table 3. The last fishery catch data for the Upernavik area is 65 tons from 2004. No catch or landings data is available for 2005 to 2007.

The quota was set at 100 tons but no logbook data was received to determine catch statistics. It is most likely that the commercial fishery is either very low or not undertaken anymore. In 2007 no quota was given to this area.

Outlook - Upernavik

A reliable outlook for Upernavik is not possible as there are no biological surveys undertaken in this area and CPUE and fishery distribution derived from logbook data is not available.

Recommendations for the 2008 fishery - Upernavik

Due to insufficient fishery data and no biological surveys no recommendations for this management area are given.

Narsaq-Qaqortoq

The historical catch, CPUE and effort data of the fishery in Narsaq-Qaqortoq inshore and offshore areas are summarized in Table 3.

Narsaq-Qaqortoq Inshore and Offshore

Overall catches in Narsaq-Qaqortoq have decreased 6-fold from 822-133 tons from 2001-2003. A fishery of 541 tons from landing data has been reported for 2004 but only 34 tons of this was represented in logbooks, thus giving little information on the fishery. There has been no reported fishery since 2005.

Outlook - Inshore Narsaq-Qaqortoq

No new data is available for this management area.

Recommendations for the 2008 fishery - Narsaq-Qaqortoq

There are no surveys in this area and substantial fishery data are not available, therefore no advice is given.

Tables

Table 3. Catches, catch rates (CPUE) and effort in management inshore and offshore areas from 2000-2007.

*2007 data is preliminary and incomplete.

catch offshore)

Management Area	Year	Total catch (tons)	Quota	Inshore catch (tons)	Inshore CPUE (kg/trap)	Inshore effort ('000)	Offshore catch (tons)	Offshore CPUE (kg/trap)	Offshore effort ('000)
Upernavik	2000	--	--	--	--	--	--	--	--
	2001	--	--	--	--	--	--	--	--
	2002	--	--	--	--	--	--	--	--
	2003	--	--	--	--	--	--	--	--
	2004	65	--	--	--	--	--	--	--
	2005	--	100	--	--	--	--	--	--
	2006	0	0	--	--	--	--	--	--
	2007*	--	0	--	--	--	--	--	--
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	--	2,482	3.7	679	257	2.6	97
	2004	2,341	--	2,174	3.4	632	167	3.7	45
	2005	1,499	1718	1,402	3.8	365	98	4.0	24
	2006	1,134	1600	1,008	4.6	219	126	6.7	19
	2007*	473	1530	348	4.0	88	126	5.1	25
Sisimiut	2000	2,534	--	491	2.8	175	2,043	6.4	319
	2001	2,606	--	327	2.9	113	2,275	4.6	495
	2002	2,724	--	473	4.6	103	2,251	3.5	643
	2003	1,633	--	692	3.7	187	941	3.1	304
	2004	1,432	--	1,111	3.9	286	321	4.9	65
	2005	1,125	900	914	6.5	141	211	6.3	34
	2006	926	700	725	8.3	87	201	11.1	18
	2007*	517	850	344	8.8	39	173	13.0	13
Maniitsoq-Kangaamiut	2000	944	--	563	4.3	131	381	7.6	50
	2001	1,835	--	1,009	3.7	273	826	5.0	165
	2002	1,775	--	1,032	3.8	272	743	2.7	275
	2003	486	--	40	3.5	12	445	2.8	160
	2004	115	--	78	2.4	33	38	2.1	18
	2005	73	200 (inshore)	62	4.3	15	11	3.8	3
	2006	72	100 (inshore)	60	4.3	14	12	4.3	3
	2007*	154	300	11	2.9	4	143	10.3	14
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	--	704	3.4	207	1,611	4.2	385
	2004	1,795	--	180	4.5	40	1,615	8.0	203
	2005	2,295	--	316	8.4	38	1,980	8.1	244
	2006	1,173	1,800	199	6.9	29	974	6.9	140
	2007*	423	1,600	66	7.3	9	358	7.2	50
Narsaq-Qaqortoq	2000	2	--	0	--	--	2	--	--
	2001	822	--	822	--	--	0	--	--
	2002	643	--	642	--	--	1	--	--
	2003	133	--	123	--	--	10	--	--
	2004	541	--	32	3.9	8	2	1.0	2
	2005	76	--	76	8.3	9	--	--	--
	2006	0	--	--	--	--	--	--	--
	2007*	0	--	--	--	--	--	--	--

Summary of annual catches in tons, CPUE (kg/trap) and effort (thousands) as well as quotas since 2004 of the crab fishery inshore and offshore in 6 management areas (Upernavik, Uummannaq-Disko Bugt, Sisimiut, Maniitsoq-Kangaamiut, Nuuk-Paamiut and Narsaq-Qaqortoq). Catch data was derived from landings and logbook data. CPUE (kg/trap) and Effort was derived from logbook data and weighted up to the highest totals (logbook data or landings) if necessary. ** Catch data for Inshore and Offshore Sisimiut in 2004 is based on landings by small vessels (818 tons, i.e. the maximum catch inshore as small vessels fish both inshore and offshore) and large vessels (614 tons i.e. minimum

Figures

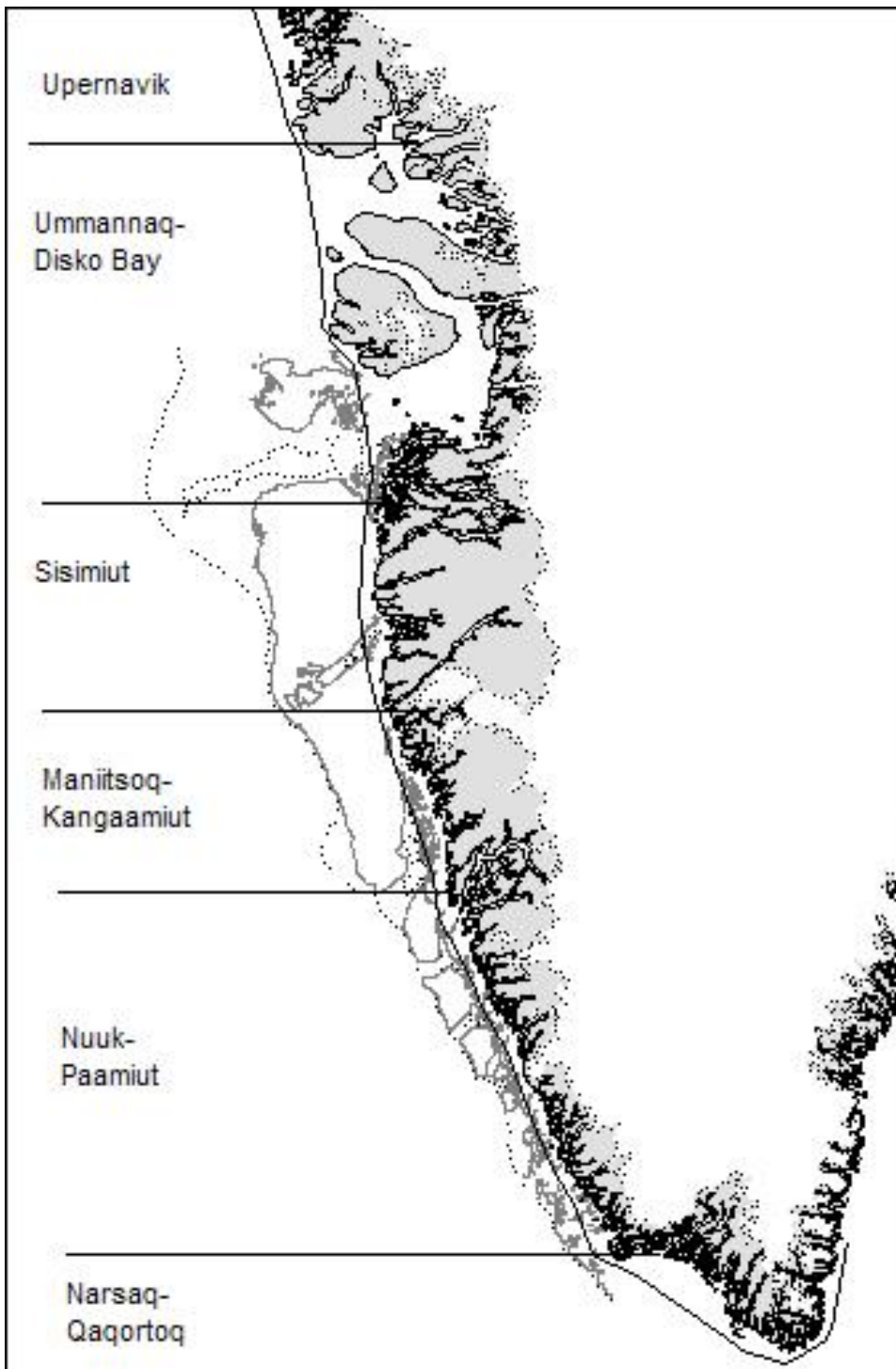


Fig. 1. Map of West Greenland outlining the 6 management areas as of 2004 for the snow crab fishery.

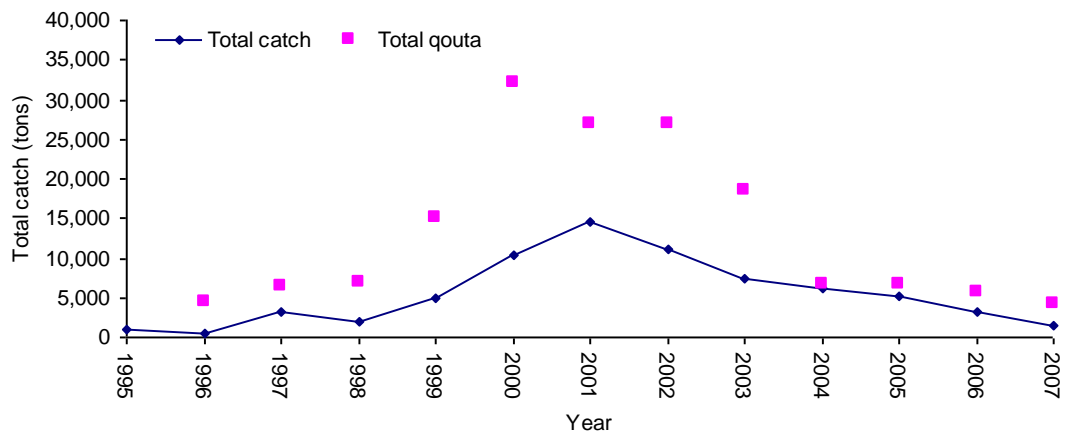


Figure 2. Total catch and quota size from 1995-2007. Data from 2007 is only preliminary.

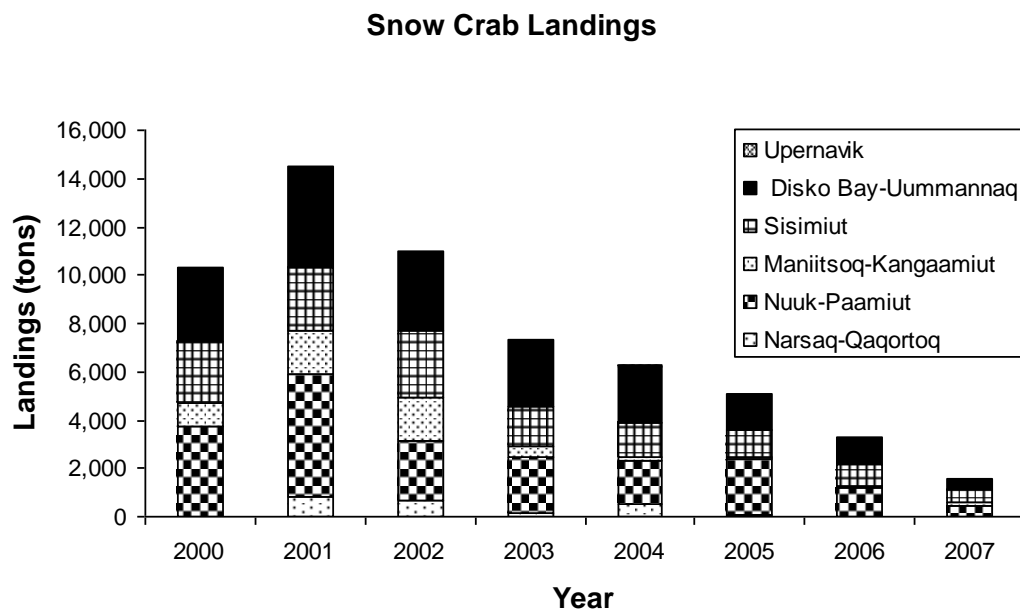


Fig. 3. Snow crab landings in the 6 management areas of West Greenland 2000-2006. Data for 2006 are preliminary and incomplete.

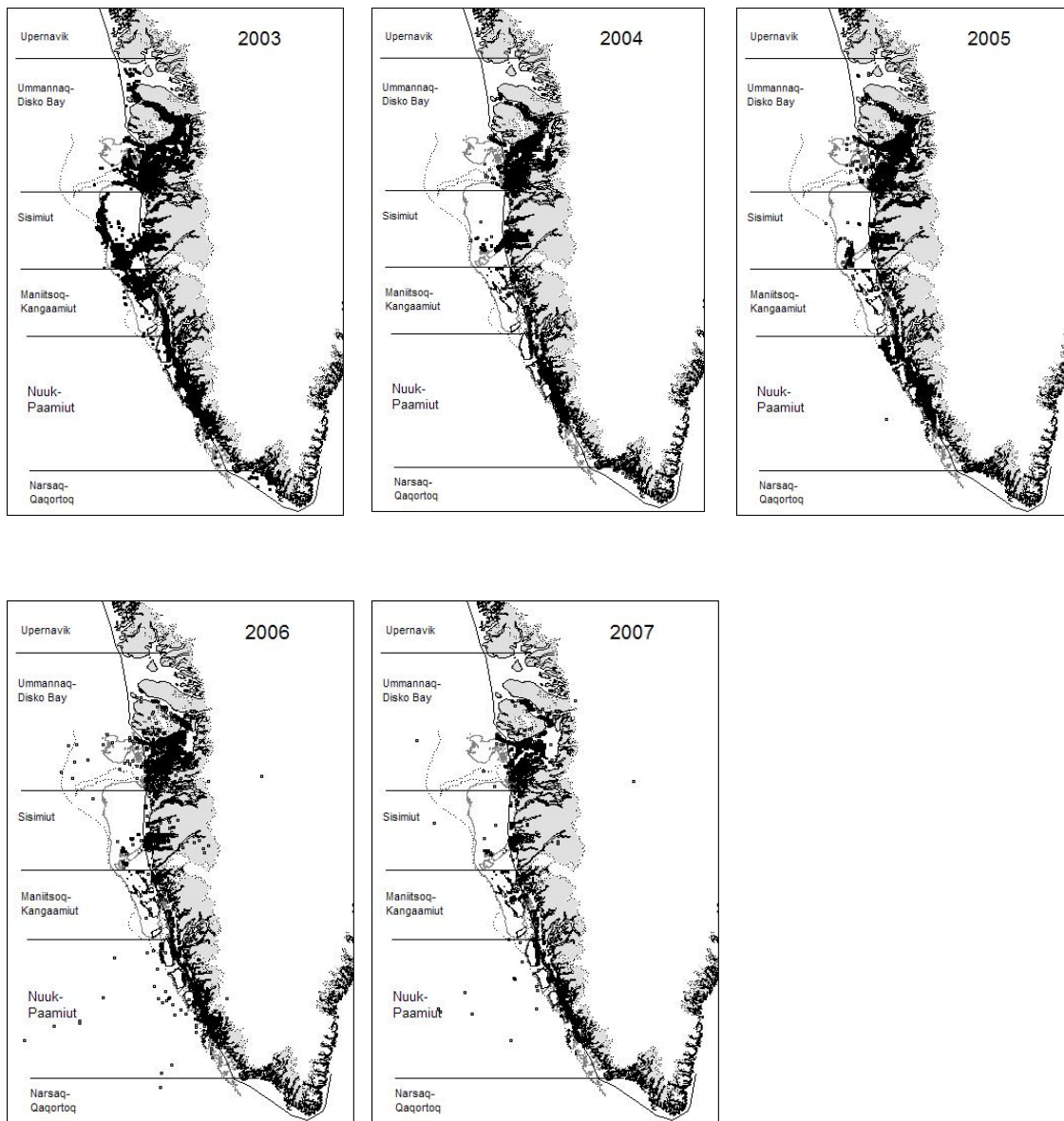


Fig. 4. Distribution of the crab fishery off West Greenland within each management area from 2003 - 2007, derived from logbook data. Lines are used to separate management areas. Inshore and offshore areas are separated by a basis-line.

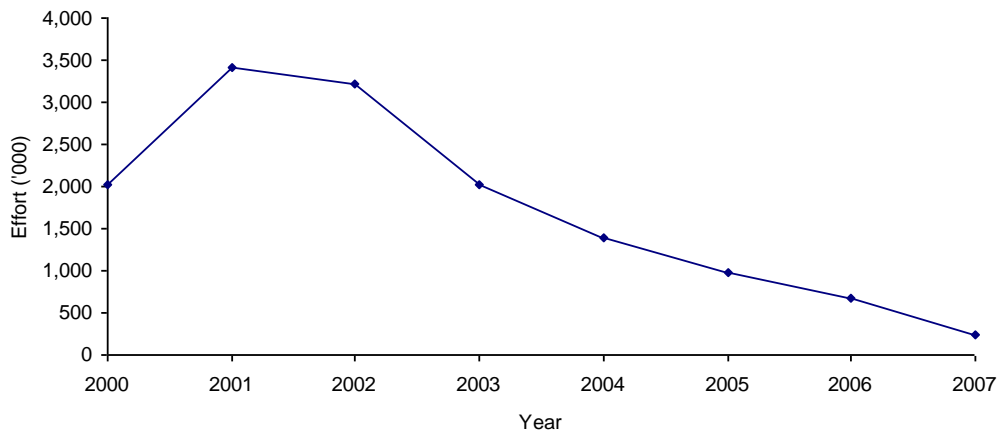


Figure 5. Total number of effort in all management areas from 2000 to 2007. Data from 2007 is preliminary.

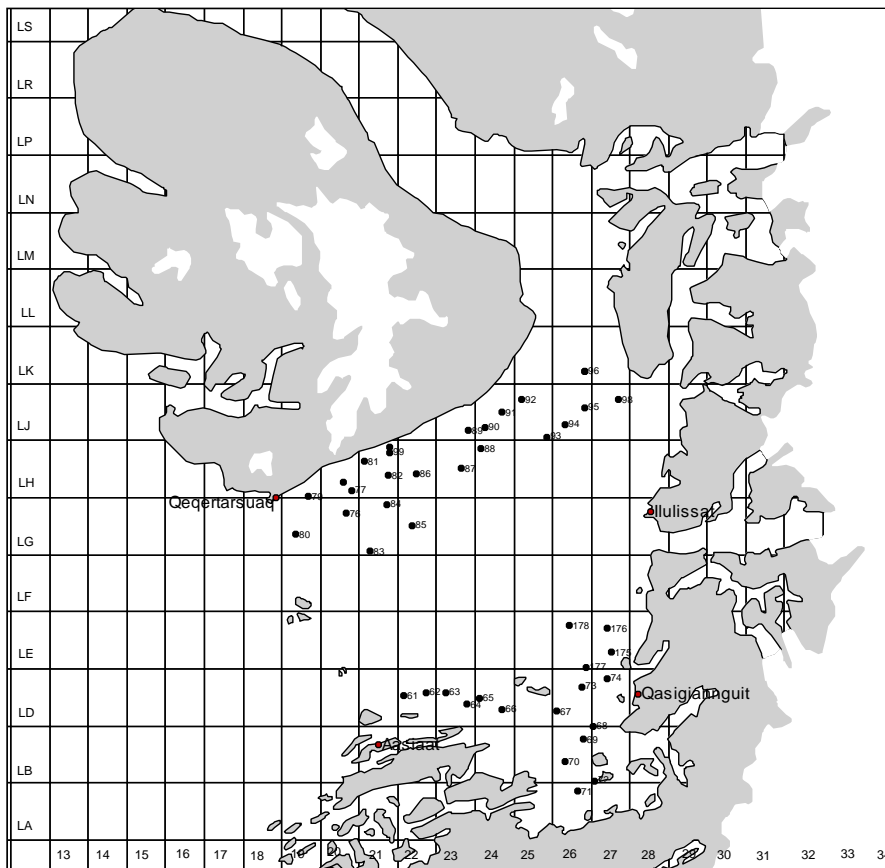


Fig. 6a. Map showing the location of survey stations in Disko Bay, Area 1 (North) and Area 2 (South).

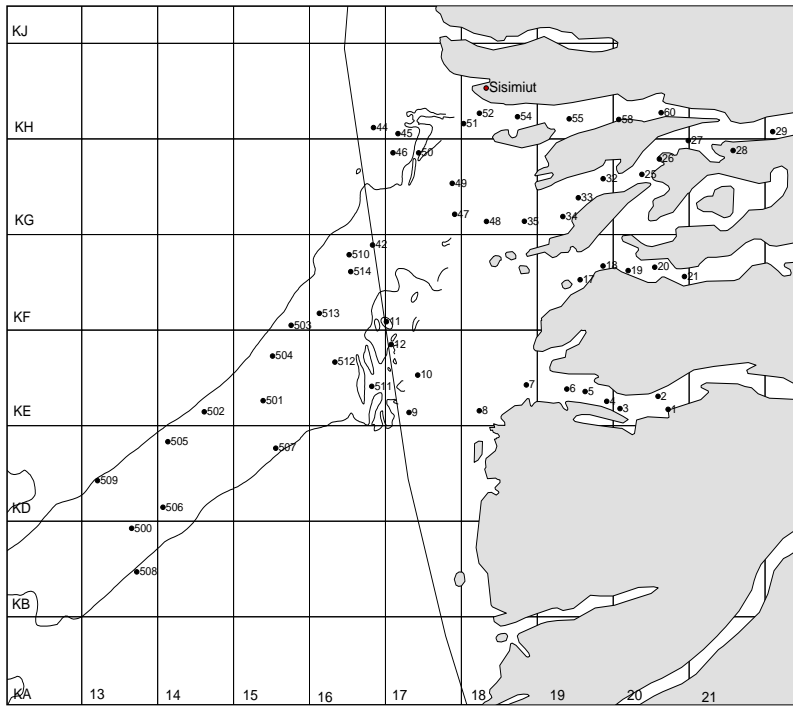


Fig. 6b. Map showing the location of inshore and offshore survey stations in Sisimiut.

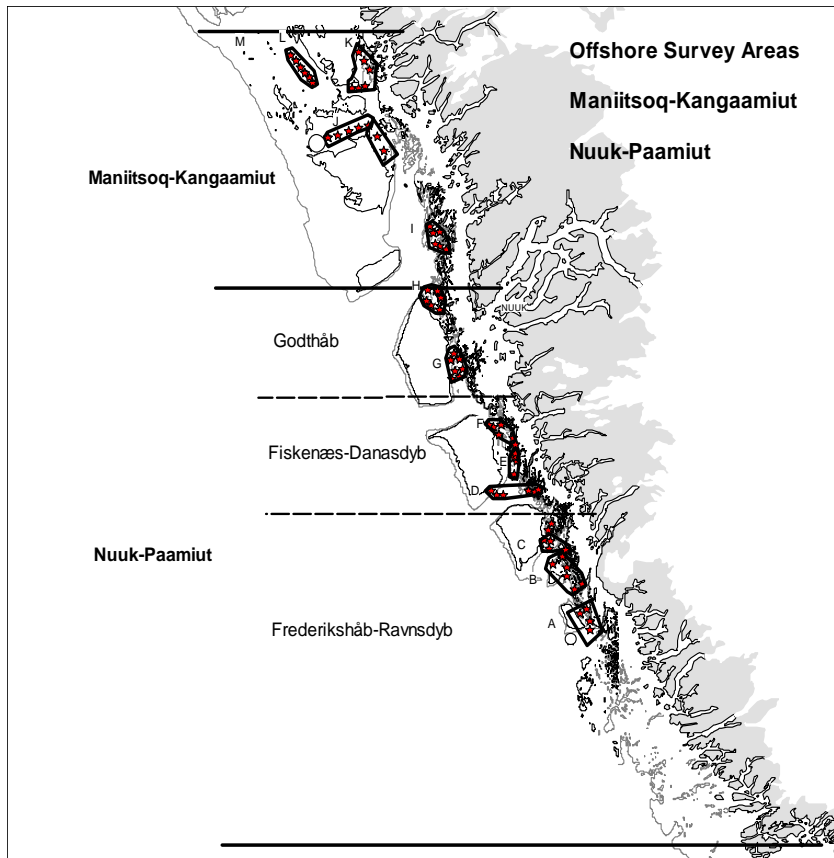


Fig. 6c. Map showing the location of survey stations from Maniitsoq-Kangaamiut and Nuuk-Paamiut (and sub-areas).

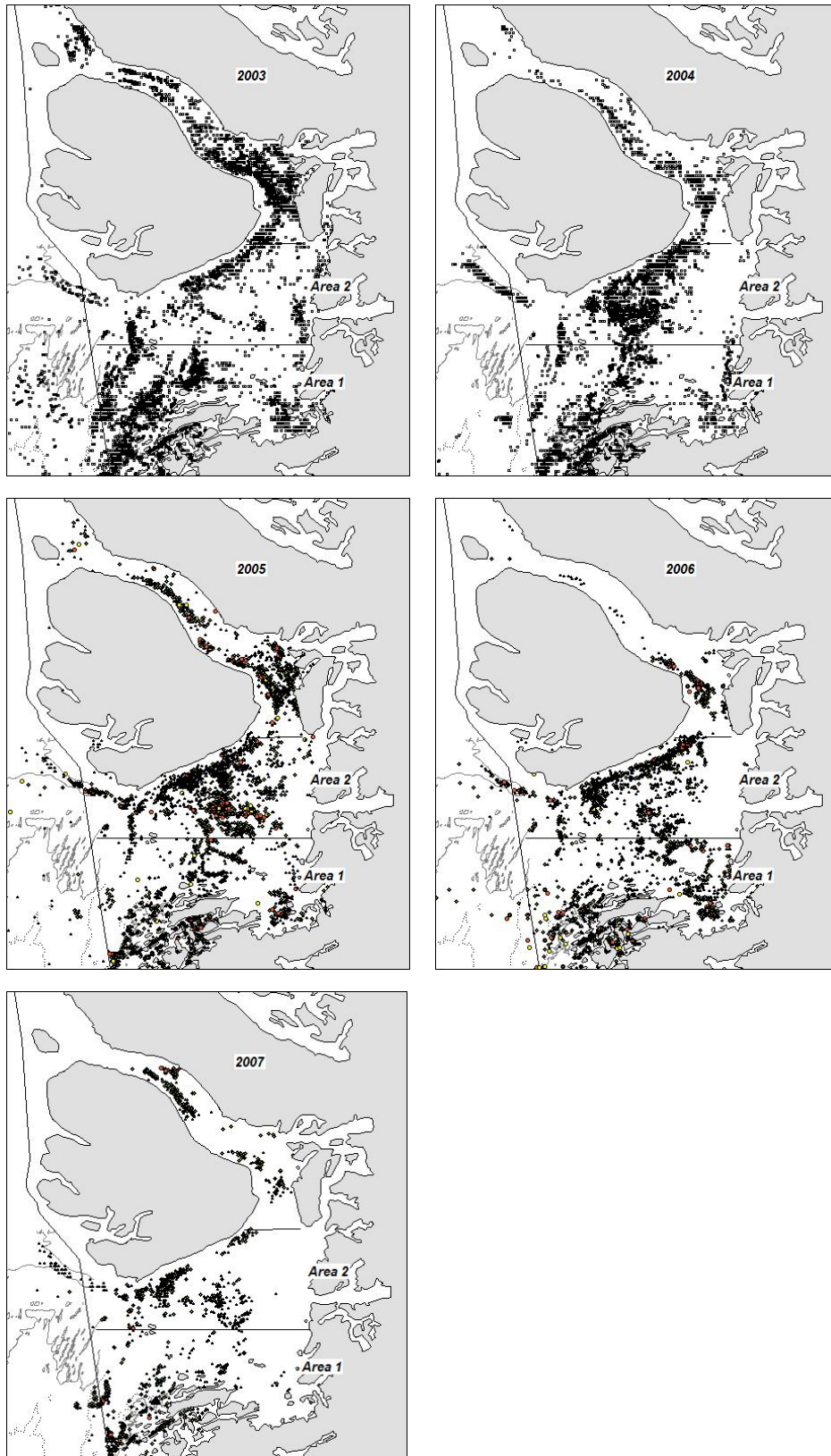


Fig. 7. Annual distribution of fishing effort in Uummannaq-Disko Bay from 2003-2007. Data for 2007 is preliminary and incomplete.

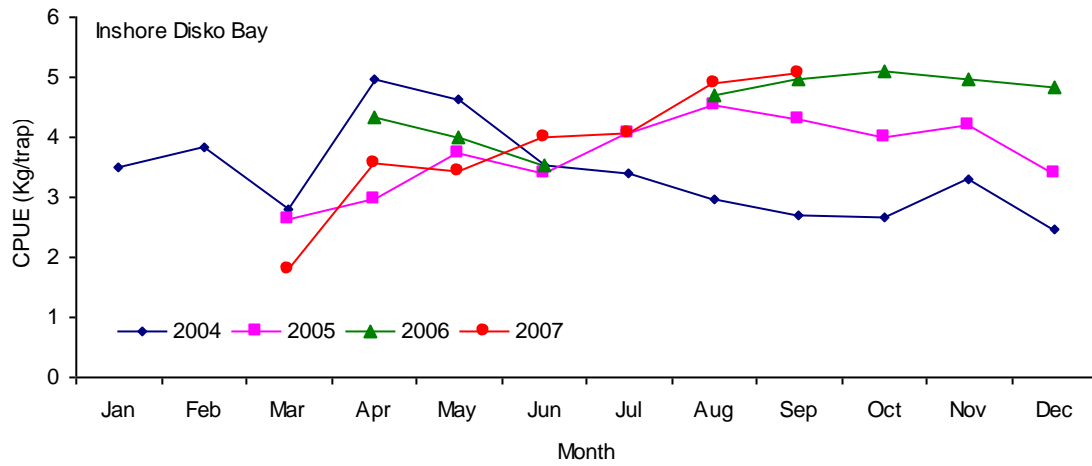


Fig. 8. Monthly trends CPUE (kg/trap) in Uummanaq-Disko Bay Area from 2003-2007. Data for 2007 is incomplete.

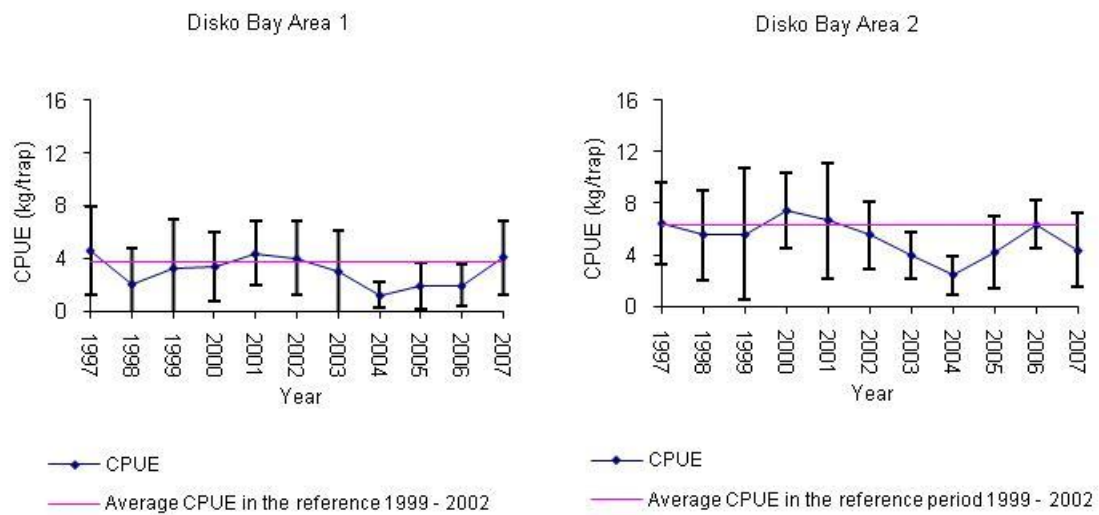


Fig. 9. Annual trends in CPUE (kg/trap) of legal-size males (≥ 100 mm CW) from trap surveys in Disko Bay Survey Area 1 and Area 2 (1997-2007). The mean CPUE for the reference period (1999-2002) is indicated with a line.

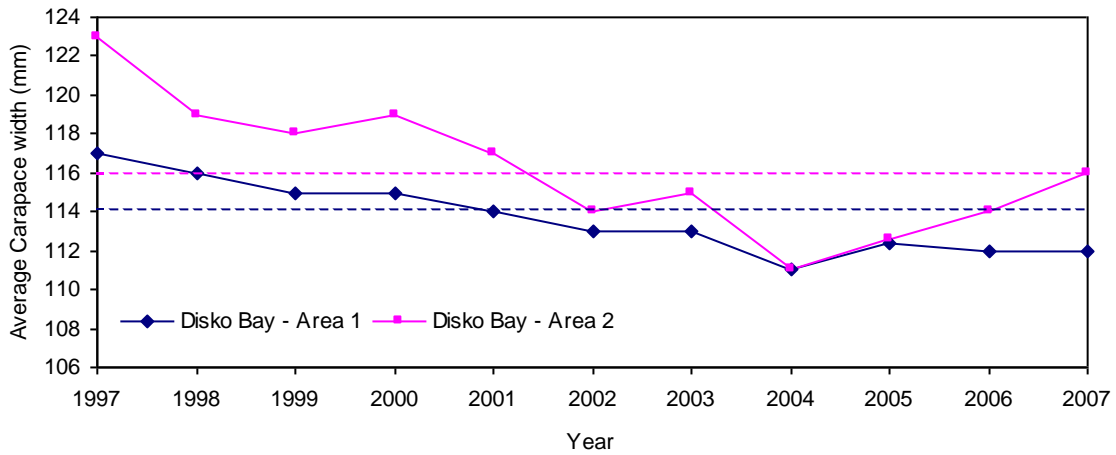


Fig. 10. Annual trends in the mean carapace width (CW) of legal-size males (≥ 100 mm CW) from trap surveys in Area 1 and Area 2 of Disko Bay. The dashed lines represent the mean CW for the time series in Area 1 and Area 2, respectively.

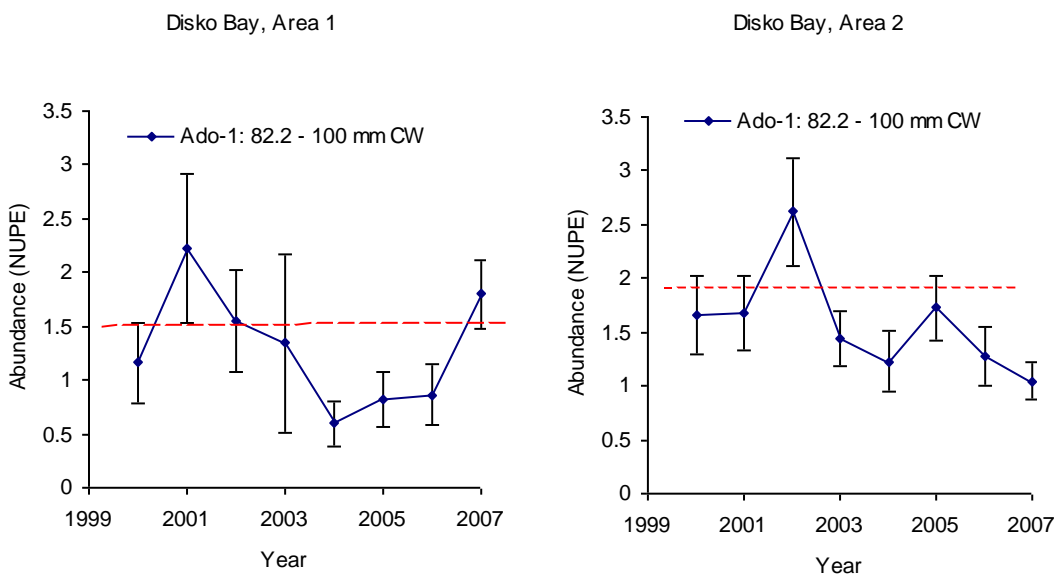


Fig. 11. Annual trends in NPUE (No. of crabs per trap) \pm S.D. of adolescent males (ADO-1: 82.2-100mm CW) in Area 1 and Area 2 of Disko Bay expected to recruit to the fishery the following year. The dashed line is the mean NPUE of ADO-1 in Area 1 and Area 2 during the reference period 1999 to 2002.

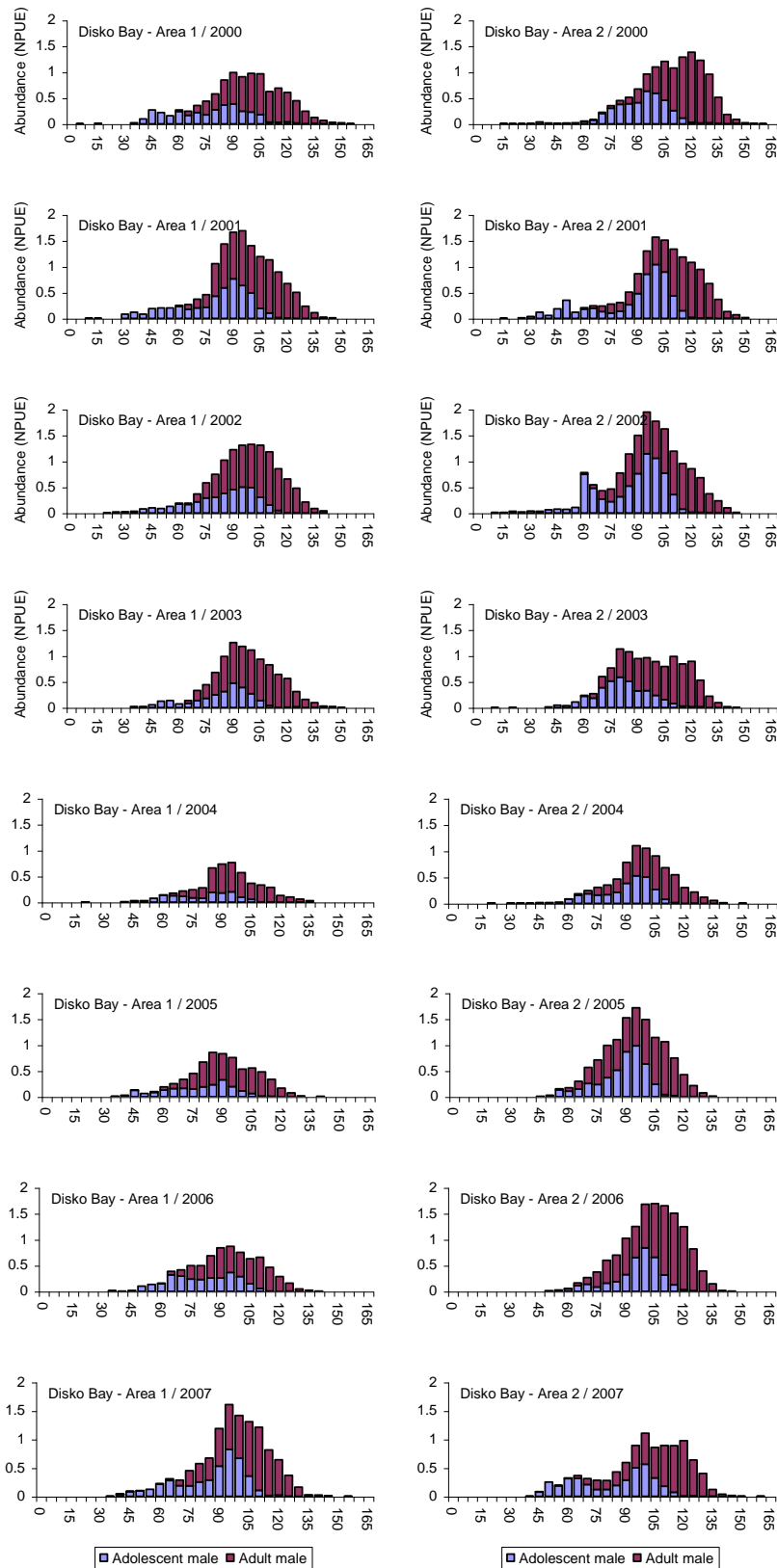


Fig. 12. Size distribution of adolescent and adult males from survey Area 1 and Area 2 in Disko Bay from 2000-2007.

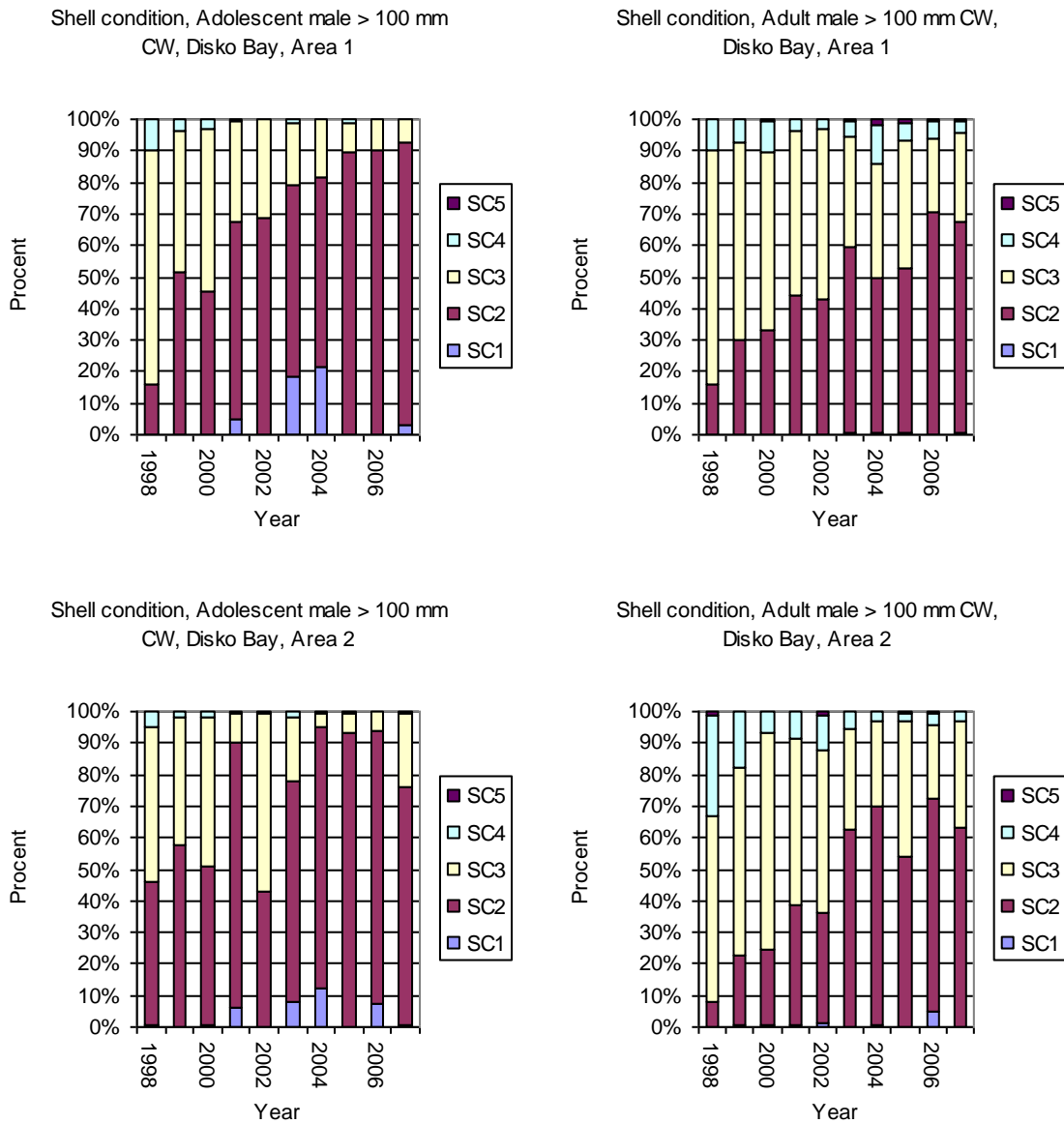


Fig. 13. The percentage of shell conditions (1-5) of adolescent and adult legal-sized male crabs (≥ 100 mm CW) sampled in Area 1 and Area 2, Disko Bay 1998 to 2007.

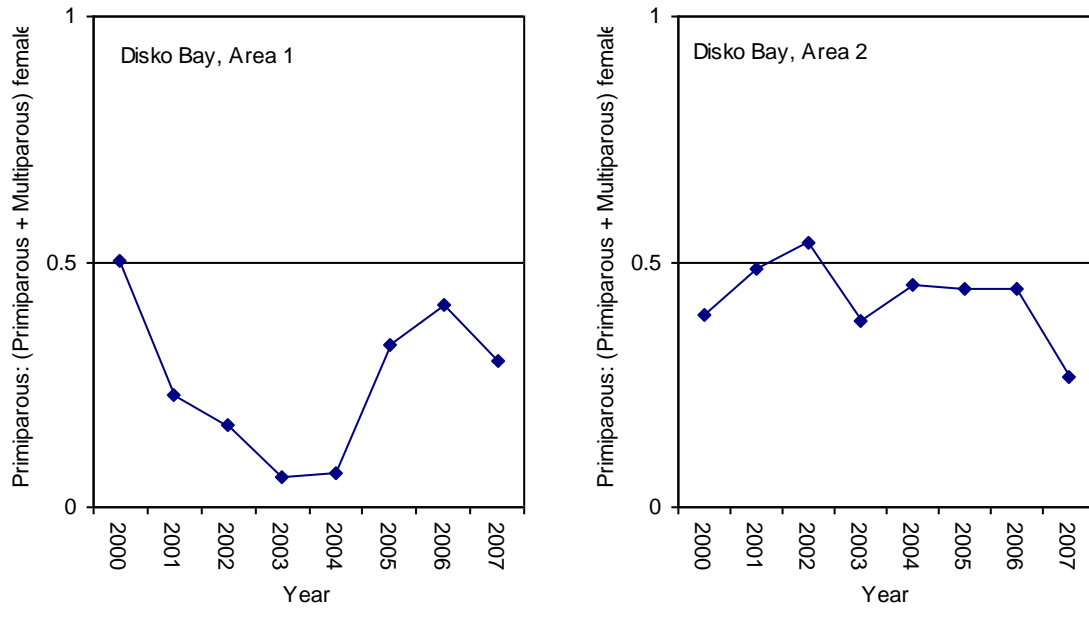


Fig. 14. Annual trends in the ratio between primiparous and multiparous in Area 1 and Area 2, Disko Bay 2000-2007.

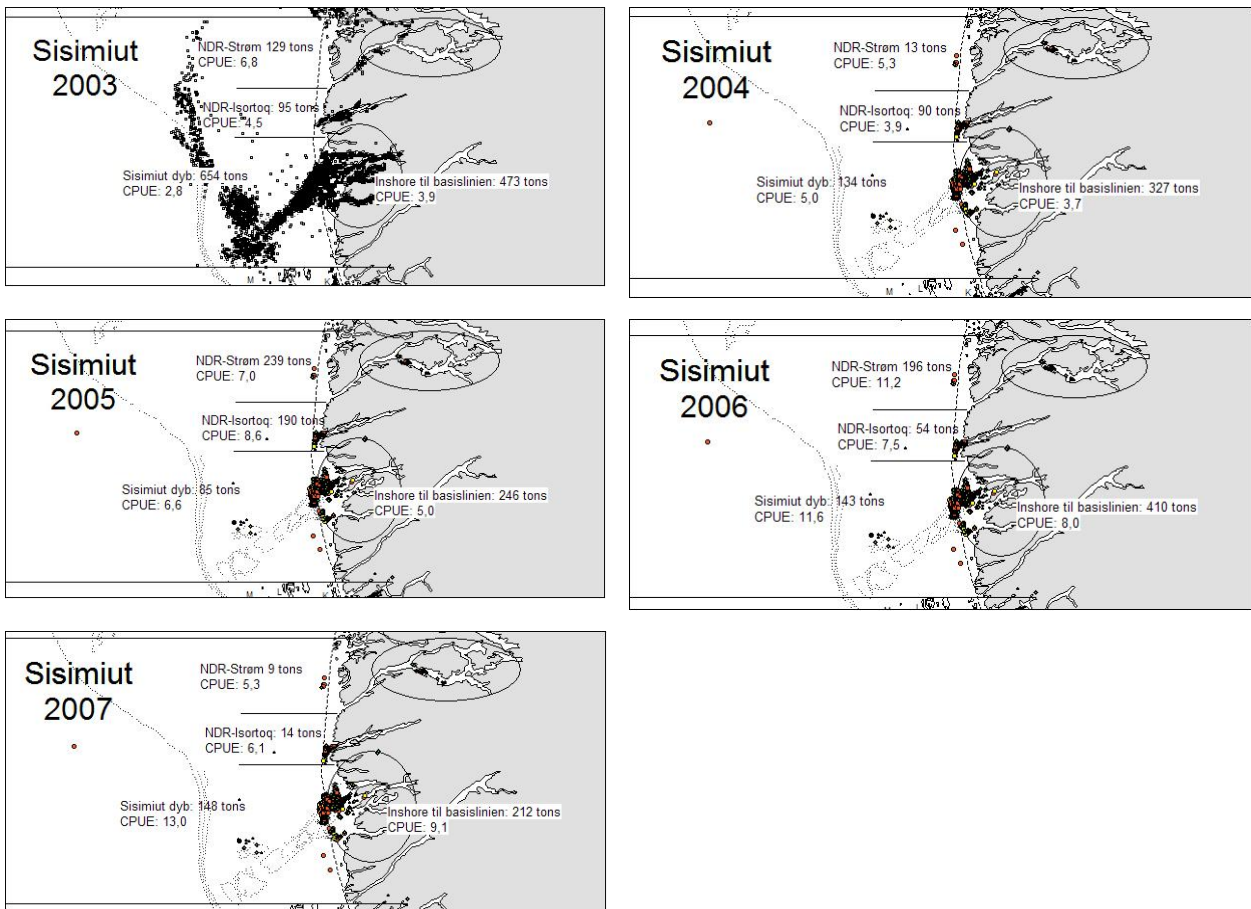


Fig. 15. The distribution and crab fishery in Sisimiut inshore and offshore in 2003 -2007 the circles indicate new and increasing areas of effort and catch in comparison to previous years. The coastal line indicates the basis- line separating the offshore from the inshore.

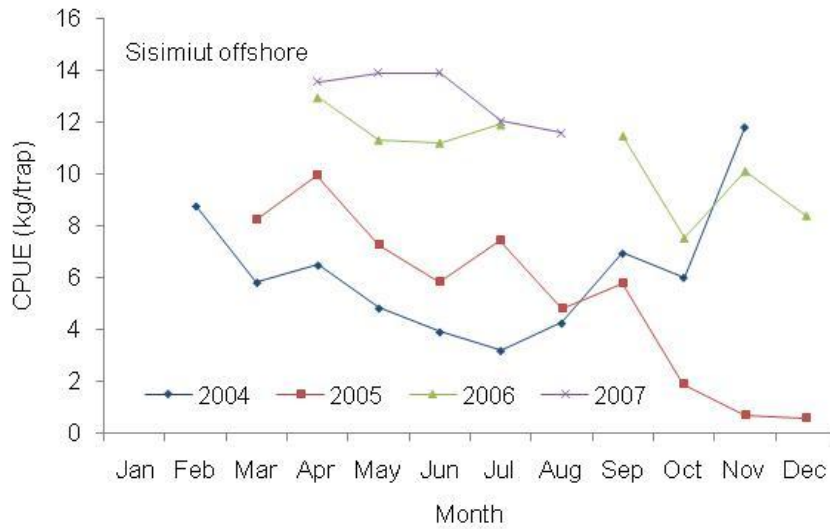
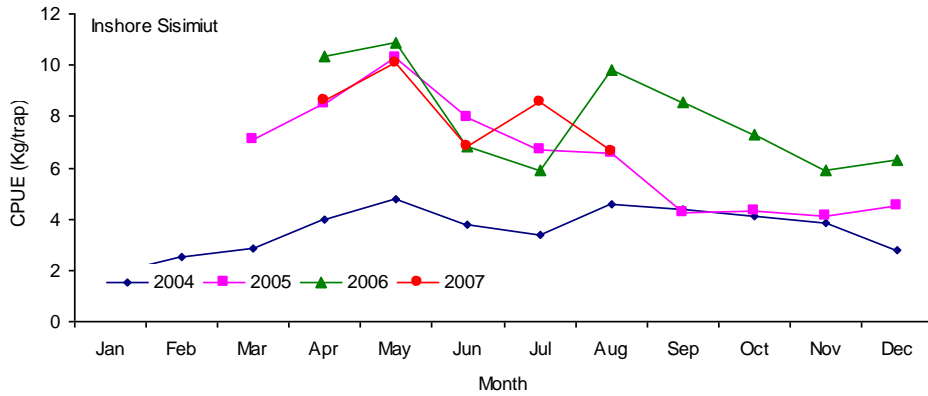


Fig. 16. Monthly trends in CPUE (kg per trap) from the fishery in Sisimiut inshore and offshore from 2004 to 2007. Data for 2007 is incomplete.

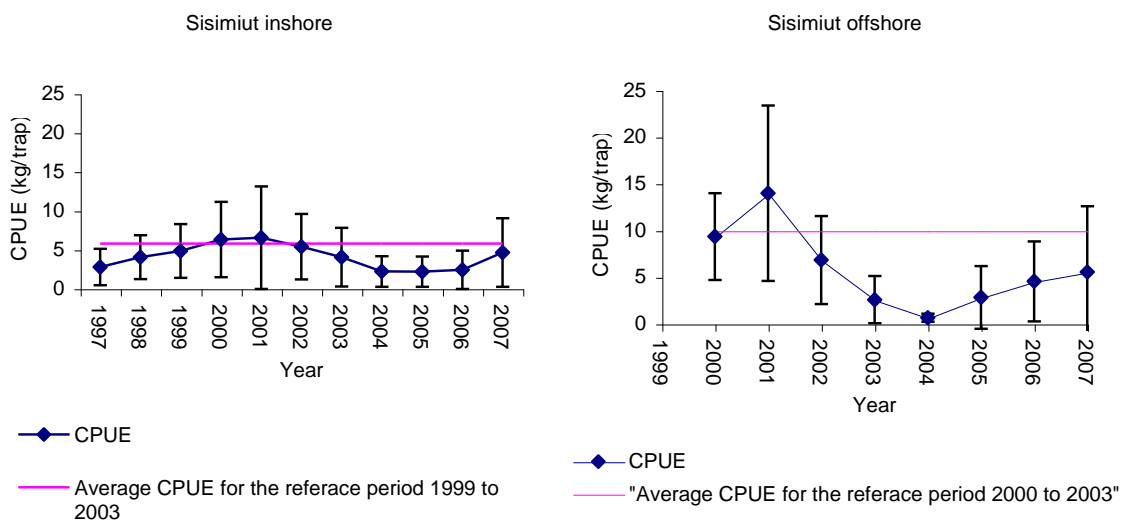


Fig. 17. Annual trends in CPUE (kg/trap \pm S.D.) of legal-size males (≥ 100 mm CW) from trap surveys in Sisimiut inshore from 1997 to 2007 and Sisimiut offshore 2000-2007. The mean CPUE for the reference period (1999-2003) in Sisimiut inshore is indicated with a line and 2000 to 2003 for the offshore area.

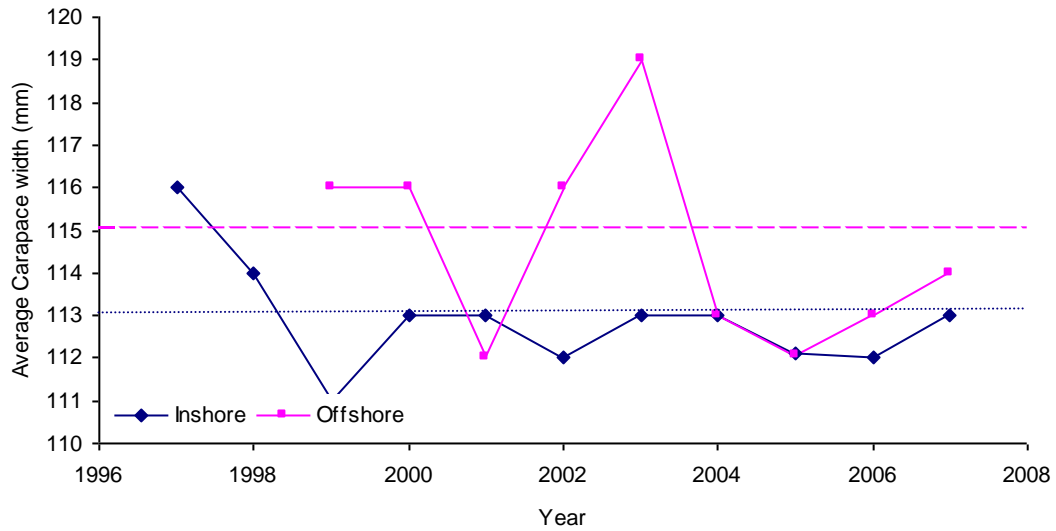


Fig. 18. Annual trends in the mean carapace width (CW) for legal-size males (≥ 100 mm CW) from trap surveys in Sisimiut inshore (1997-2007) and Sisimiut offshore (1999-2007).

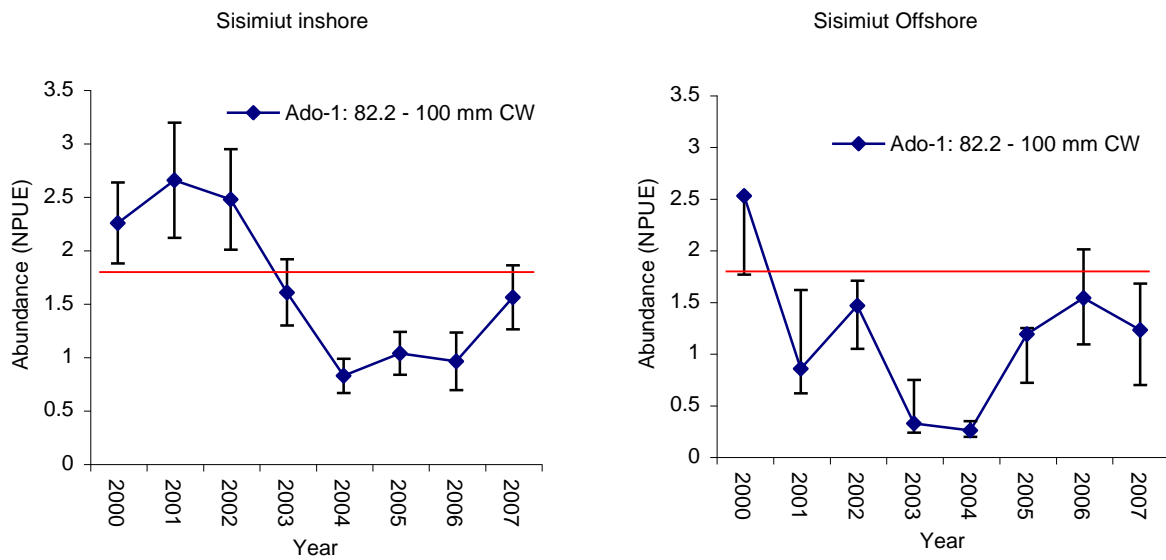


Fig. 19. Annual trends in the abundance NPUE (No. crabs per trap \pm S.D) of adolescent males (ADO-1: 82.2-100mm CW) expected to recruit to the fishery the following year in Sisimiut inshore and offshore areas from 2000 to 2007.

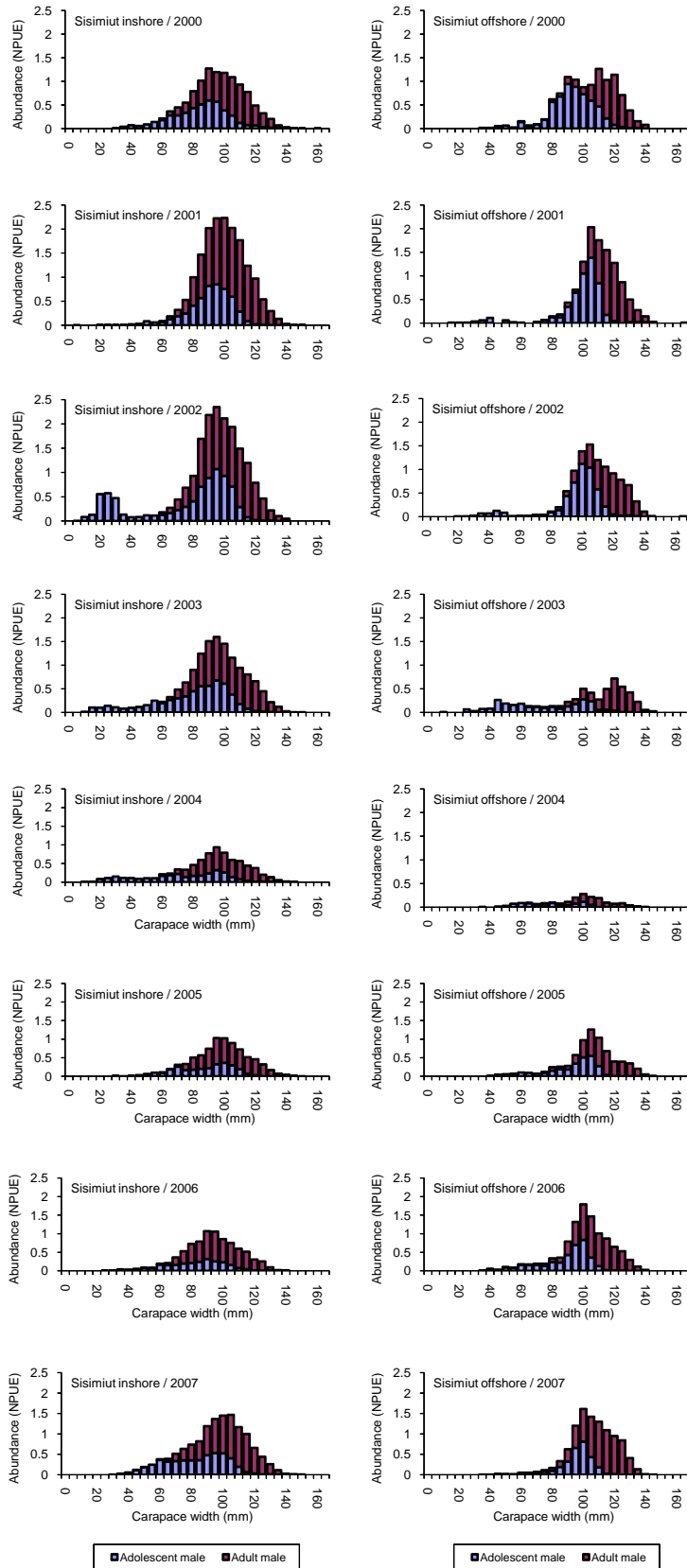


Fig. 20. Size distribution of adolescent and adult males from surveys in Sisimiut inshore and offshore from 2000 to 2007.

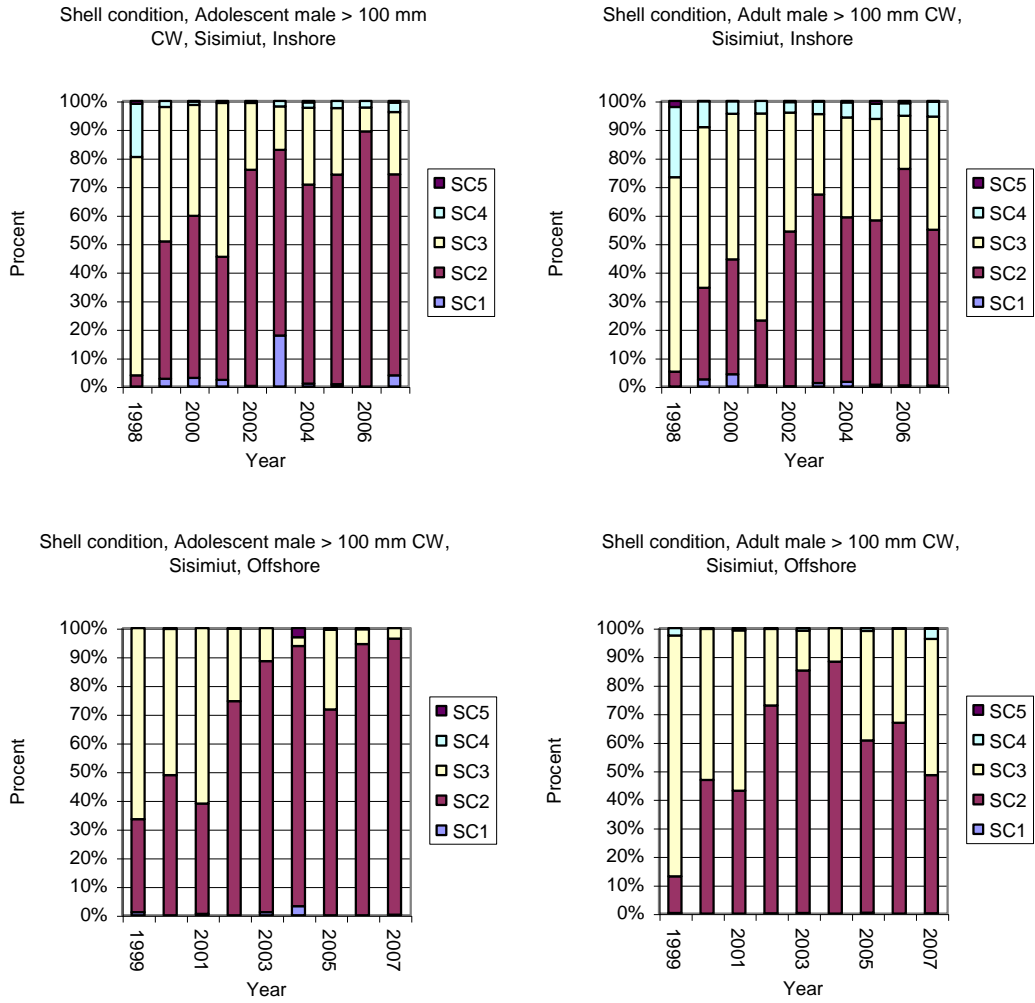


Fig. 21. The percentage of shell conditions (1-5) of legal-size adolescent and adult males ($\geq 100\text{mm}$ CW) sampled in trap surveys in Sisimiut inshore and offshore from 2000 to 2007.

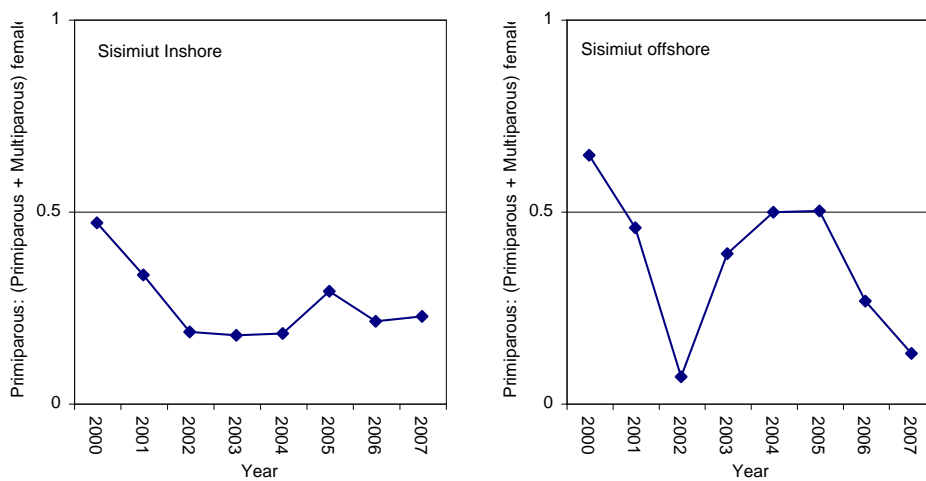


Fig. 22. Annual trends in the ratio between primiparous and multiparous females in Sisimiut inshore and offshore from 2000 to 2007.

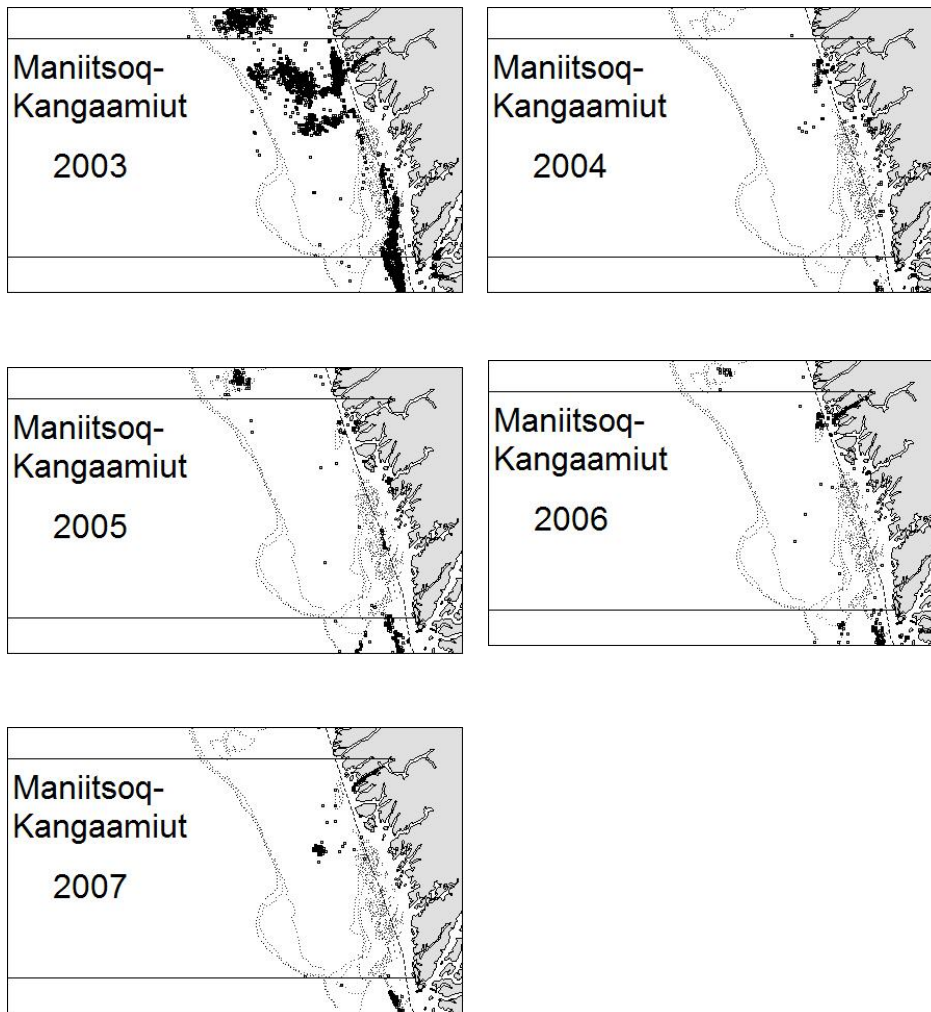


Fig. 23. Annual distribution of the fishing effort in Maniitsoq-Kangaamiut Area from 2003 to 2007. Data for 2007 is preliminary and incomplete.

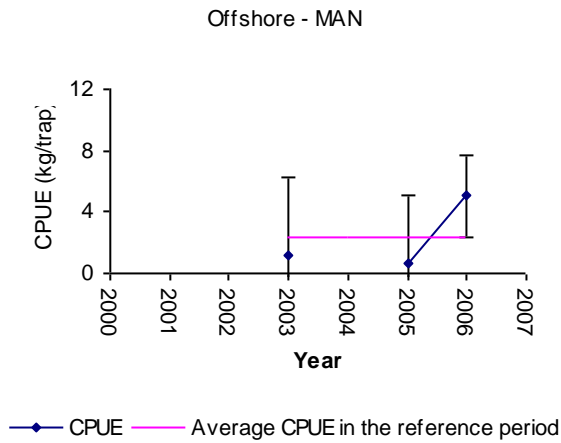


Fig. 24. The CPUE (kg/trap \pm S.D.) from trap surveys in Maniitsoq-Kangaamiut offshore in 2003 and 2005-2006.

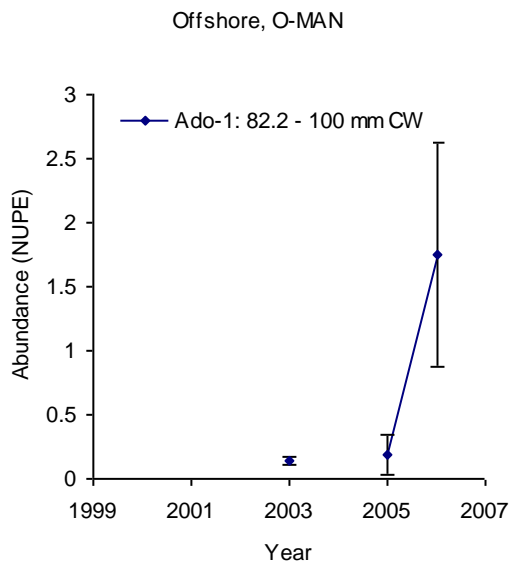


Fig. 25. The abundance (No. of crabs per trap \pm S.D.) of adolescent male crabs, ADO-1 (82.2-100mm CW), ADO-2 (67.2-82.2mm CW) and ADO-3 (53.2-67.3mm CW) expected to recruit to the fishery in 1, 2 and 3 years from Maniitsoq-Kangaamiut offshore survey in 2003 and 2005-2006.

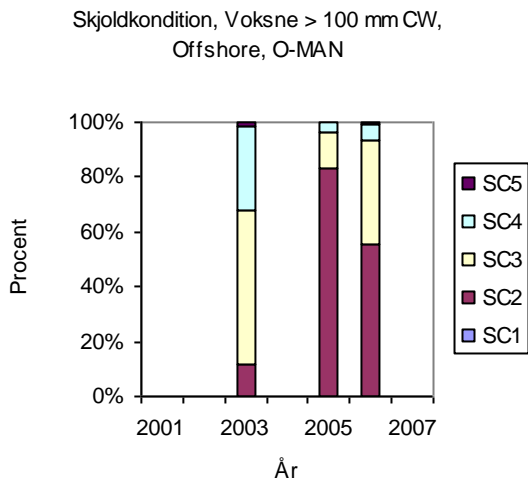


Fig. 26. The frequency (%) of shell condition (1-5) in legal-size males (>100mm CW) from the Maniitsoq-Kangaamiut offshore area in 2003 and 2005-2006.

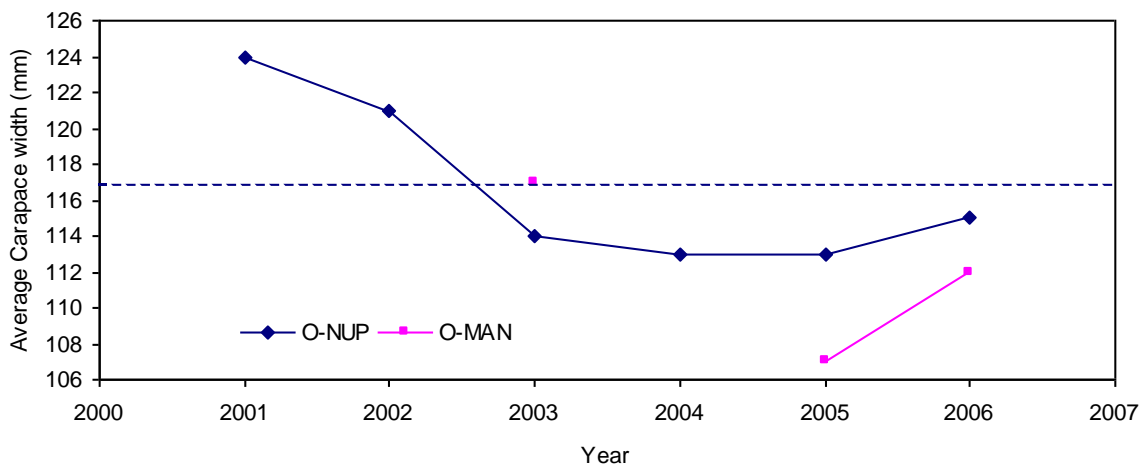


Fig. 27. The average carapace width (CW) of legal-size males (≥ 100 mm CW \pm S.D.) from trap surveys in Maniitsoq-Kangaamiut offshore in 2003 and 2005-2006.

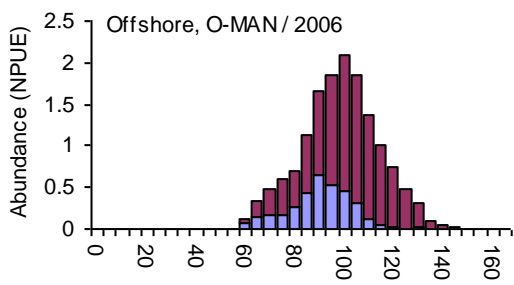
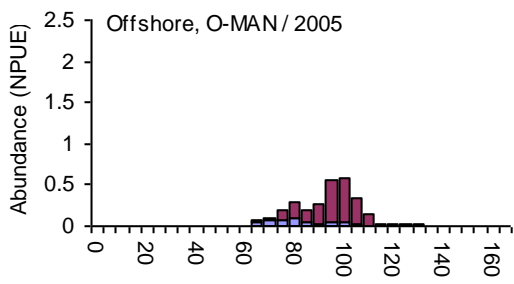
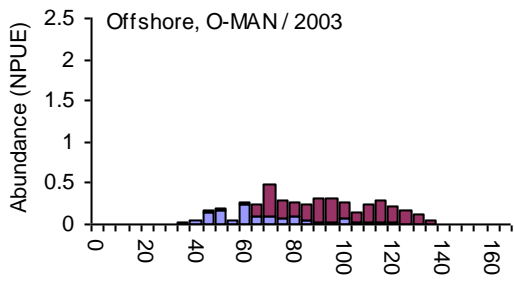


Fig. 28. Size distribution of adolescent and adult male snow crabs from trap surveys in the Maniitsoq-Kangaamiut offshore area in 2003 and 2005-2006.

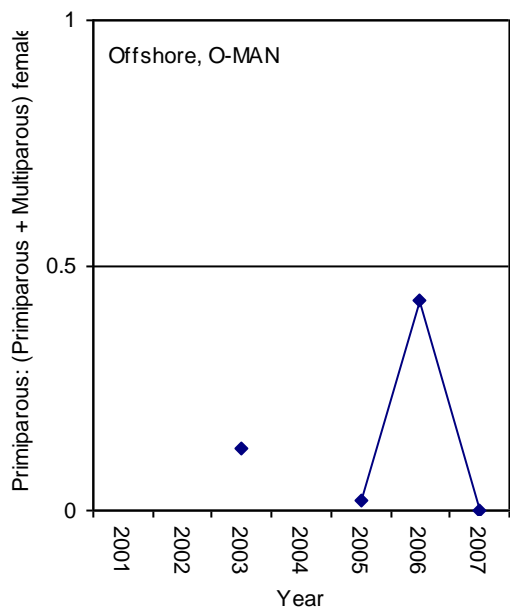


Fig. 29. The ratio between primiparous and multiparous females from offshore trap surveys in Maniitsoq (2003 and 2005 -2006).

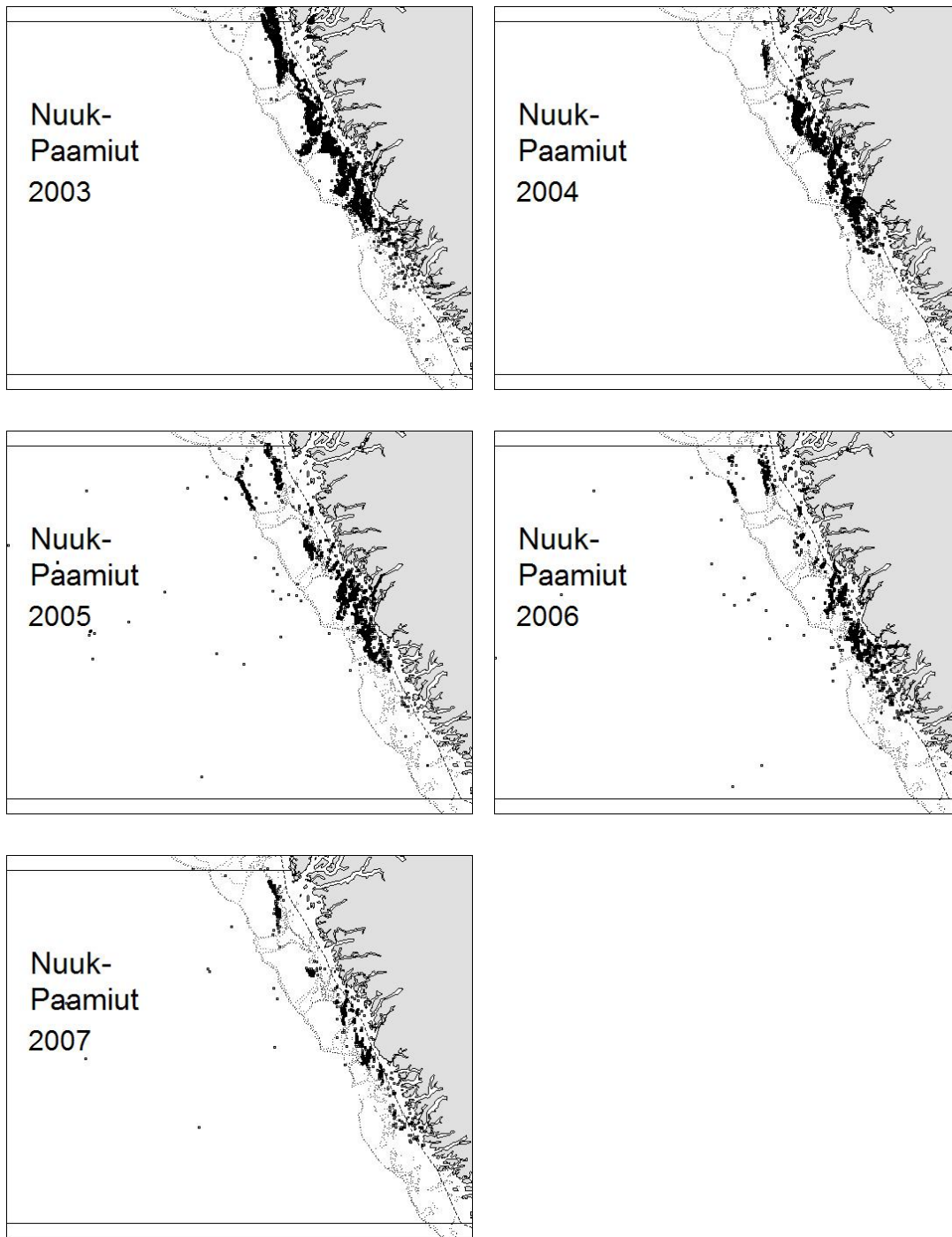


Fig. 30. Annual distribution of fishing effort in Nuuk-Paamiut Area 2003-2007. Data for 2007 is incomplete.

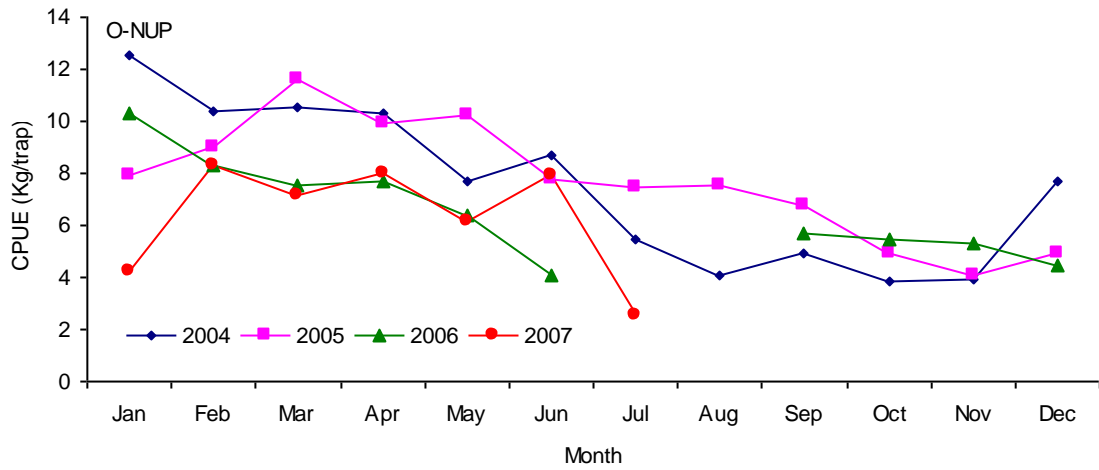


Fig. 31. Monthly trends in CPUE (kg/trap) in Nuuk-Paamiut Area 2003-2006.

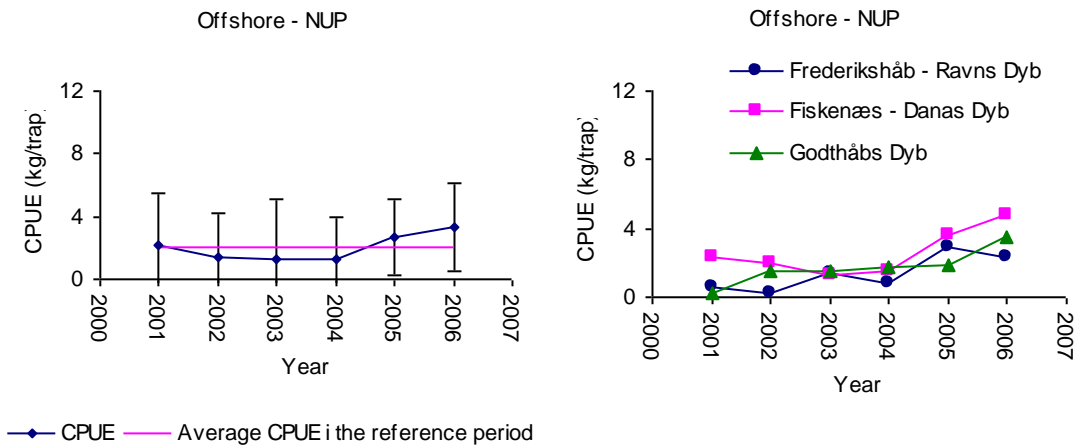


Fig. 32. Annual trends in the CPUE (kg/trap \pm SD) of legal-size males (≥ 100 mm CW) from the offshore trap surveys in Nuuk-Paamiut (a) and its sub-areas (b) (2002-2006).

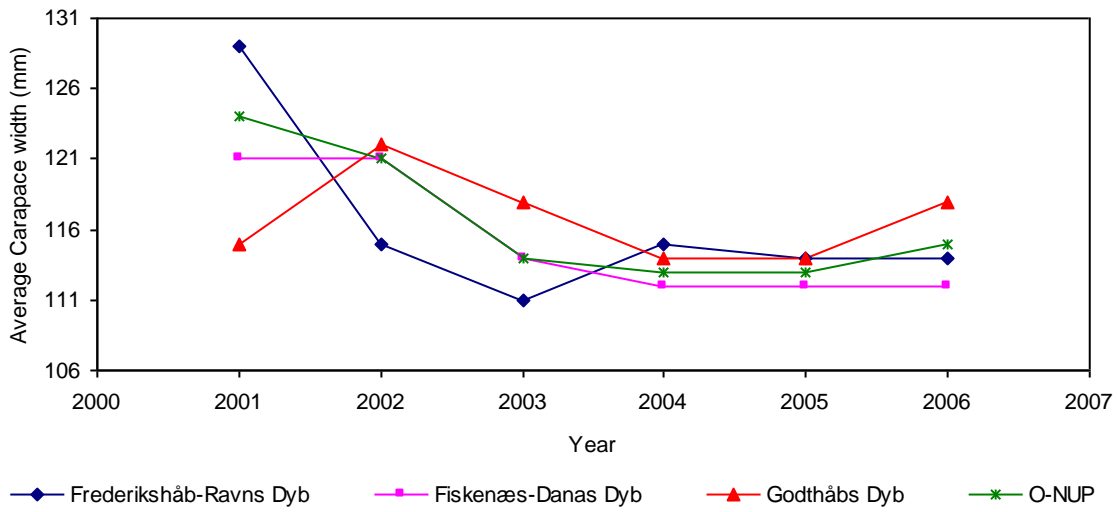


Fig. 33. Annual trends in the mean carapace width (CW \pm S.D.) of legal-size males (≥ 100 mm CW) from offshore trap surveys in Nuuk-Paamiut 2002-2006.

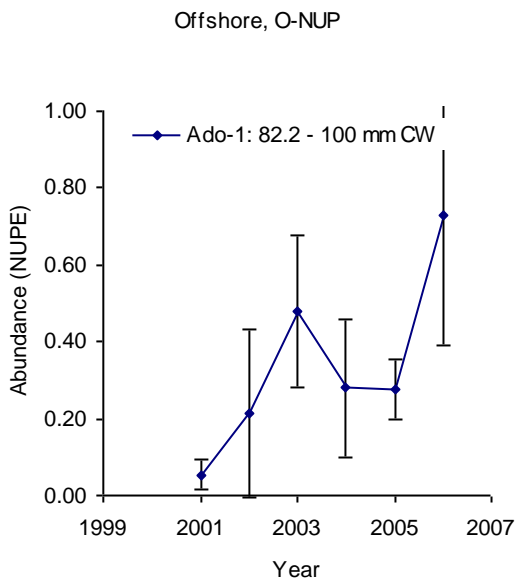


Fig. 34. Annual trends in the NPUE (No. of crabs per trap \pm S.D.) of adolescent males (ADO-1 (82.2-100mm CW) expected to recruit to the fishery in 1 years in Nuuk-Paamiut from 2002-2006.

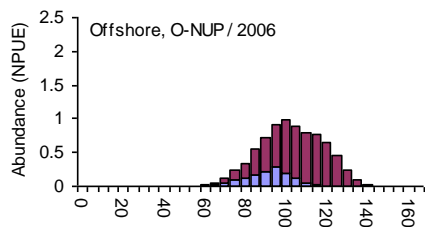
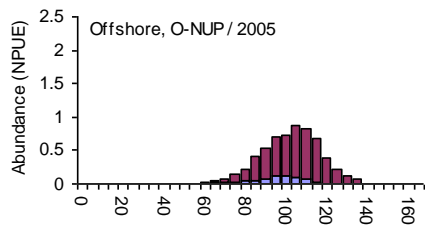
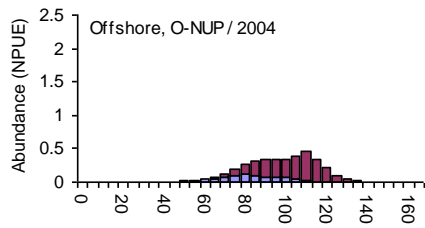
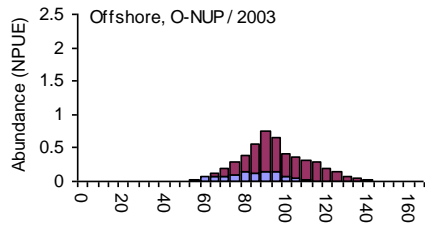
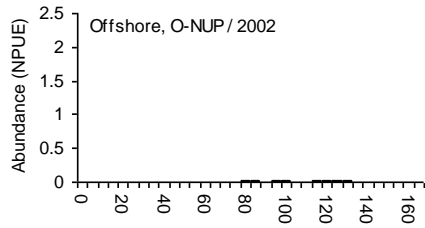
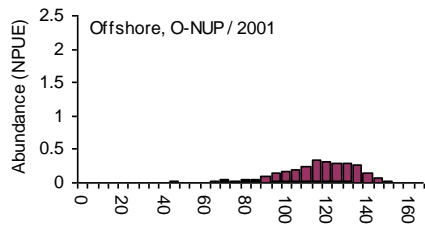


Fig. 35. Size distribution of adolescent and adult male snow crabs from 2002-2006 derived from survey data from the Nuuk-Paamiut management area.

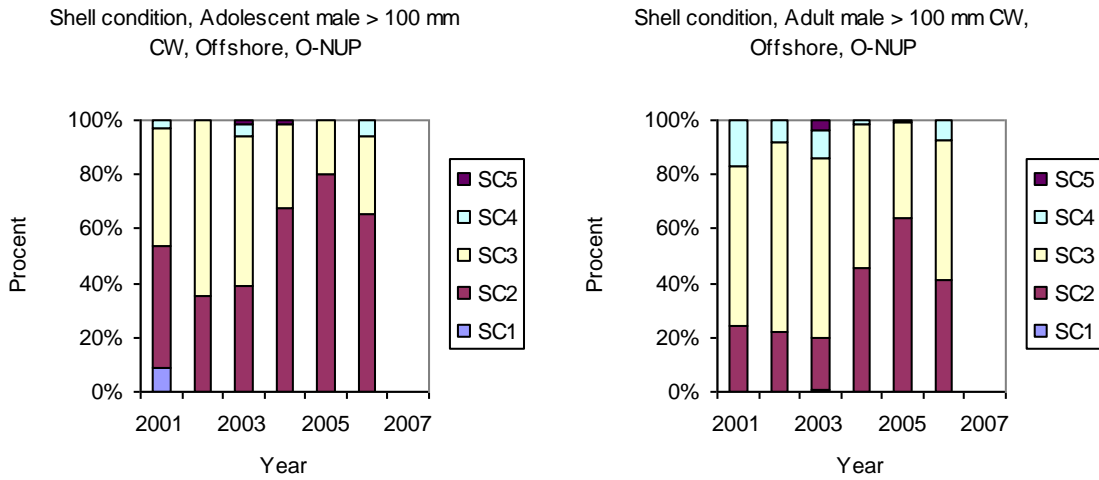


Fig. 36. The frequency (%) of shell condition (1-5) of legal-size adult males ($\geq 100\text{mm CW}$) from 2002-2006 in Nuuk-Paamiut offshore.

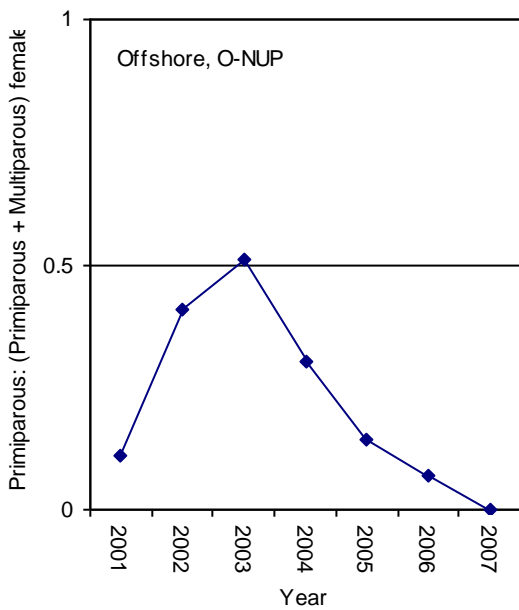


Fig. 37. The ratio between primiparous and multiparous females from offshore trap surveys in O-NUP (2001 -2006).