

SUBMISSION TO THE
NUNAVUT WILDLIFE MANAGEMENT BOARD AND NUNAVIK MARINE
REGION WILDLIFE BOARD

FOR

Information:

Decision:

Recommendation: X

Issue: Northern (*Pandalus borealis*) and Striped (*Pandalus montagui*) Shrimp Total Allowable Catch levels for the 2014/15 season

Background

Two shrimp species (*Pandalus montagui* and *Pandalus borealis*) occur in the Northern shrimp fishery that takes place in the Davis Strait and eastern Hudson Strait which includes parts of the Nunavut Settlement Area and the Nunavik Marine Region. Total Allowable Catch (TAC) for each species is set for two distinct science assessment zones (East and West), then distributed into management units as per defined sharing arrangements.

The TAC levels for each species of shrimp need to be established for the 2014/15 season. The current TAC levels were based on science data from the 2007 to 2009 surveys and not reconsidered while the shrimp management changes were going through the land claims decision making processes from 2010 to 2013.

A science update on the status of the shrimp stocks in the Eastern Assessment Zone (EAZ) and Western Assessment Zone (WAZ) which incorporates the 2013 survey data has been provided to DFO managers. The science update is attached at Annex 1.

DFO Comments

Options are available for consideration in determining TACs for 2014/15 season. Option 1; uses the two year average of the fishable biomass to ensure TAC fluctuations are more uniform; and Option 2 uses the most recent single survey data point. Where the shrimp resources are healthy, a third option would be to maintain current TAC levels.

Western Assessment Zone

Both shrimp species are healthy. During the development of the new shrimp management regime stakeholders agreed that a 10% exploitation rate (ER) was advisable given the newness of the fishery in this area and the limited data available.

Option 1: The two year average fishable biomass, based on the 2013 and 2011 survey data points, is 58,600 t for *P. montagui* and 20,800 t for *P. borealis*. Using the same ER of 10%, the resulting TACs would be 5,860t for *P. montagui* and 2,080t for *P. borealis*.

Option 2: The 2013 fishable biomass was 45,650t *P. montagui* and 22,000 t for *P. borealis*. Using the same ER of 10%, the resulting TACs would be 4,565t for *P. montagui* and 2,200t for *P. borealis*.

Option 3: Maintain current TAC levels (5,000t for *P. montagui* and 1,500t for *P. borealis*) given the newness of the fishery in this area and the limited data available. The potential ER would be approximately 11% for *P. montagui* and 7% for *P. borealis*.

DFO recommends Option 3. Given the preliminary nature of this fishery, it would be advisable to maintain current harvest levels to see how the resource reacts.

Eastern Assessment Zone– *P. borealis*

Survey results indicate that *P. borealis* is healthy. This stock has been managed at an ER of around 15%.

Option 1: The two year average fishable biomass, based on the 2013 and 2012 survey data points, is 55,000t. Using the same 15% exploitation rate, the resulting TAC would be 8,250t for *P. borealis*.

Option 2: The 2013 fishable biomass was 49,637t for *P. borealis*. Using the 15% exploitation rate, the resulting TAC would be 7,445t.

Option 3: Maintain the TAC at the current level of 9000t. The resulting ER would be 18% which would be acceptable given the stock is healthy and a longer time series is available.

DFO recommends Option 3. Since the resource is healthy and the potential ER of 18% is acceptable, there is no firm rationale to reduce the TAC and impact individual quotas.

Eastern Assessment Zone – *P. montagui*

The shrimp management changes in the north were put in place in part to address conservation concerns around *P. montagui* in the EAZ. At the onset of that exercise, the *P. montagui* biomass estimates available were from the 2008/09 surveys which are at the higher end of recent biomass estimates. Since the 2008-09 survey, the *P. montagui* biomass continued to be on a declining trend. However, the TAC was not adjusted despite the decline in resource biomass to allow time for the land claims decision making processes to be completed. The shrimp management changes in the north have been implemented and the TAC can be adjusted based on more recent biomass information.

During the development of the new shrimp management regime both Boards agreed that a 15% ER was acceptable. Given the declining trend for *P. montagui* in the Cautious Zone for a few years, a lower ER would also be advisable.

Option 1: The *P. montagui* biomass increase seen in 2012 is considered to be unreliable in the time series and cannot be used for TAC calculations. Thus the two year average fishable biomass is based on the 2011 and 2013 survey data points and comes to 5,600t. Using the 15% exploitation rate, the resulting TAC would be 840t, a reduction of 1,410t from the current 2,250t TAC. If the existing split between the Davis Strait West and Nunavut/Nunavik East management units is maintained, the share for Inuit will be 429t.

Option 2: The 2013 *P. montagui* fishable biomass estimate is 3,534t. Using the 15% ER, the resulting TAC would be 530t, a reduction of 1,720t from the current 2,250t TAC. If

the existing split between the Davis Strait West and Nunavut/Nunavik East management units is maintained, the share for Inuit will be 271t.

Option 3: Maintaining the current TAC level of 2,250t is not a viable option given the potential ER would be 64% and would present a significant conservation concern.

DFO recommends Option 1. While a TAC reduction is required for conservation reasons, this option represents the least impact to stakeholders and the resulting TAC would be reasonably acceptable.

The science update was provided to Nunavut and Nunavik industry and the Government of Nunavut on January 31, 2014. Views of industry, governments and other key stakeholders on TAC levels for 2014/15 will be obtained at a teleconference planned for March 7, 2014. An update on stakeholder views can be provided at the Board meetings.

The advice of the Boards and stakeholder views will be provided to the Minister for consideration in determining the 2014/15 TAC levels. Once the 2014/15 TACs have been set, the TACs will be distributed into the shrimp management units consistent with the joint Nunavut and Nunavik shrimp management arrangement approved by the Minister in July 2013 for the three year term (2013 to 2016).

Request

Fisheries and Oceans is seeking the advice of the Nunavut Wildlife Management Board and the Nunavik Marine Region Wildlife Board on the TAC levels for *P. montagui* and *P. borealis* in the EAZ and WAZ for 2014/15.

Prepared by: Resource Management, Fisheries and Oceans Canada

Date: February, 2014



UPDATE OF STOCK STATUS INDICATORS FOR NORTHERN SHRIMP, *Pandalus borealis*, AND STRIPED SHRIMP, *Pandalus montagui*, IN THE WESTERN AND EASTERN ASSESSMENT ZONES

Context

Fisheries and Oceans Canada (DFO) Resource Management requested an update of Science advice on the stock status of the two species of shrimp, Northern Shrimp (*Pandalus borealis*) and Striped Shrimp (*P. montagui*), in the Western Assessment Zone (WAZ) and Eastern Assessment Zone (EAZ). The Zonal Advisory Process (ZAP) for the EAZ and Shrimp Fishing Areas (SFA) 4-6 is scheduled for a full assessment of each SFA biennially (odd numbered years) with updates of the key indices of the Precautionary Approach (PA) framework in intervening years. The EAZ has been fully assessed twice as an assessment zone (DFO 2011, 2013) and twice prior as SFA 2 (DFO 2008, 2010). Because of the current biennial ZAP schedule, new survey data are only available on update years. The survey area which became the WAZ was fully assessed in 2010 (DFO 2010) and 2008 (DFO 2008). DFO 2012 updated the resource status in the EAZ and WAZ. Assessments follow the framework developed in 2007 for Northern Shrimp off Labrador and the northeastern coast of Newfoundland (DFO 2007a). A series of fishery-independent surveys and fishery data form the basis of the update (see DFO 2011 for details).

This Science Response Report results from the Science Response Process of January 2014 on the update of stock status indicators for Northern Shrimp and Striped Shrimp in the Western and Eastern Assessment Zones.

Background

The EAZ and WAZ were adopted as the basis for assessing the status of shrimp in SFA 2 and 3 at the 2011 ZAP (DFO 2011). The outline of the EAZ and WAZ combined is equivalent to the combined area of SFA 2 and 3. A new management system for the area of SFA 2 and 3 was approved by the Minister and co-management boards in 2012 and implemented for the 2013/14 fishing season. New management measures include the following:

- three new SFAs, Nunavut, Nunavik and Davis Strait, were established reflecting the three jurisdictions present within the area (Fig. 1),
- these new SFAs were further subdivided into management units which fall entirely within either the EAZ or WAZ (Fig. 1);
- a Total Allowable Catch (TAC) would be set for *P. borealis* and a TAC would be set for *P. montagui* for both the EAZ and WAZ based on results of surveys conducted in each assessment zone thereby eliminating quotas that could be fished in multiple SFAs which existed previously;
- the TAC would be divided by maintaining existing quotas within an area where possible or by a sharing agreement;

- an initial exploitation rate of 10% for both species was agreed to for the WAZ because this is a renewed fishing area and the survey time series is limited; and
- the EAZ would be managed to the previously accepted 15% exploitation rate.

Subsequently it was agreed that Nunavut and Nunavik quota could be fished in either the Nunavut Land Claims Area or Nunavik Marine Region.

As a result of these management changes, the TACs in the WAZ increased from 1,000 t to 5,000 t for *P. montagui* and from the 400 t to 1,500 t for *P. borealis*. In the EAZ, the TAC for *P. borealis* reduced by 150 t to 9,000 t because the borealis by-catch quota was reduced. Eliminating overlapping quotas and taking into account survey results reduced the TAC for *P. montagui* from 6,300 t to 2,250 t. TACs were based on survey data available through 2010 and were maintained until implemented for the 2013/14 season and do not reflect changes in the resource biomass since then. This update is the first review of stock status since the changes were implemented in the fishery.

Two exploitation rates are presented for each assessment zone and species because the TAC generally is not fully taken. Exploitation rate refers to the realized exploitation rate based on reported catch while the potential rate assumes the TAC had been caught.

Resource status was evaluated within a Precautionary Approach (PA) framework (DFO 2006). Reference points (RP) were based on the geometric mean of SSB. The Limit Reference Point (LRP) is 30% of the mean and the Upper Stock Reference (USR) is 80% of the mean. RPs for SFA 2 were developed (DFO 2009) and implemented in the Integrated Fisheries Management Plan (IFMP) (DFO 2007b). These RPs were transferred unchanged to the EAZ. RPs for the Western Assessment Zone were developed using the same method (DFO 2013).

In the EAZ, the first two years of survey data (2006-2007) are not considered comparable with the rest of the series because of poor trawl performance and incomplete sampling coverage in the Resolution Island survey area. These years are not considered when assessing trends in the indices from the EAZ.

Update of Indicators

Eastern Assessment Zone – *P. borealis*

Fishery

The total catch (directed and by-catch) of *P. borealis* in the EAZ as of 3 January 2014 was 6,794 t, 75% of the TAC (Fig. 2). Since the 2013/14 fishery runs until 31 March 2014, catch records may not be complete. However, ice conditions typical in January should have curtailed fishing in the zone and so most of the catch for the season has likely been included. The majority of catch taken in the EAZ comes from SFA DS-W (Fig. 1) southeast of Resolution Island and east of the Nunavut and Nunavik Land Claims borders.

Biomass

The fishable biomass index has declined serially from 78,530 t in 2011 to 49,637 t in 2013 (Fig. 3a). The female spawning stock biomass (SSB) index showed a similar decline from 47,807 in 2011 to 32,049 t in 2013 (Table 1, Fig. 3b). While the point estimates indicate a decline, the yearly differences are not statistically significant. Both biomass indices have declined since 2011 and are currently below the long term mean (2008-2013) of the time series.

Exploitation

The reported exploitation rate (ER) index for 2013/14 was 13.7%, which is above the long term average of the time series (Fig. 4a). The potential ER index calculated from the base TAC has

trended upward since 2011/12 and is estimated at about 18% for 2013/14 (Fig. 4b) with about a 22% chance of being above the maximum removal reference¹. This trend is a direct result of the declining biomass. However, year to year differences are not significant. Season bridging amounts further increased the 2013/14 TAC from 9,000 to 9,767 t. If this amount had been taken the resulting ER would have been 19.7% with over a 40% chance of exceeding the maximum removal reference¹.

Current Outlook

The SSB for *P. borealis* in the EAZ is currently well within the Healthy Zone of the PA Framework (Fig. 5).

Eastern Assessment Zone – *P. montagui*

Fishery

The catch of *P. montagui* in the EAZ declined steadily from about 4,000 t in 2000 to about 135 t by 2011/12 (Fig. 6). Increased fishing effort around Resolution Island within the land claims areas in 2012/13 increased the catch to 1,173 t. As of 3 January 2014, the 2013/14 catch was about 1,075 t. It is likely this represents the majority of catch for the season as ice conditions should have curtailed fishing.

Biomass

The 2013 fishable biomass index was about 3,534 t and the SSB index was 2,777 t (Table 2, Fig. 7). The large increase in both biomass indices in 2012, which was about two times greater than the previous maximum, would now appear to be an extreme survey year-effect, the results of which cannot be considered reliable in the context of the time series. Disregarding the 2012 estimate, both indices appear to be on a declining trend since 2009.

Exploitation

The reported ER index had varied without trend from 2008/09 through 2012/13 averaging 11% (Fig. 8). The decrease in biomass combined with a similar catch in 2013/14 to the previous season resulted in a large increase in the ER to about 30% for 2013/14 (Fig. 8). The potential ER index has a mean of 60.6% when the 2012/13 ER is disregarded because of the unreliable biomass from the 2012 survey. The potential ER for 2013/14 was 63.7%.

Current Outlook

The SSB in the EAZ entered the Cautious Zone in 2010 and except for the abnormal survey estimate of 2012 remained there. For 2013/14 there is about a 32% chance the resource is in the Critical Zone (Fig. 9). It is recommended that the TAC for 2014/15 be reduced. It is further recommended that managers develop a rebuilding plan for EAZ *P. montagui* since the resource is approaching the established Limit Reference Point and there is a significant chance it is in Critical Zone.

Western Assessment Zone – *P. borealis*

Fishery

With the implementation of a new management regime in the north, quotas for directed fishing of *P. borealis* were established for the first time in the WAZ for the 2013/14 fishing year at

¹ 20% ER is the maximum removal reference point in the Healthy Zone accepted by the PA Working Group but not yet adopted the Northern Shrimp Advisory Committee or implemented by Fisheries Management.

1,500 t (Fig. 10). Catch records as of 3 January 2014 show that about 973 t or 65% of the TAC had been caught. While the fishery is still open until 31 March 2014 and records may be incomplete it is likely that this catch will represent the majority taken in 2013/14.

Biomass

The fishable biomass and SSB indices, while insignificantly different year to year, appear to be on an upward trend (Table 3, Fig. 11). The mean fishable biomass index over the four surveys was about 18,000 t, while the mean SSB index was about 5,800 t. In 2013, the fishable biomass index was 22,000 t and the SSB index was 9,800 t.

Exploitation

P. borealis catch increased significantly in 2013/14 over earlier years in the WAZ (Fig. 10). This increased the ER to 4.4% (Fig. 12a) based on the catch reported through 3 January 2014. The existing TAC, if taken, would result in a potential ER of 6.8% (Fig. 12b). The potential rate is lower than the 10% initial ER accepted as part of the new management system.

Current Outlook

The SSB for *P. borealis* in the WAZ is currently well within the Healthy Zone of the PA Framework (Fig. 13) established at the 2013 ZAP (DFO 2013). Since both biomass indices are trending upward and the potential ER is below the 10% initial ER accepted by stakeholders during the developmental stages of the WAZ, a small increase in the TAC for *P. borealis* for the 2014/15 fishing season could be considered.

Western Assessment Zone – *P. montagui*

Fishery

Results from the research survey series renewed interest in fishing shrimp within the WAZ. Increased effort resulted in increased catch of *P. montagui* each year from 2010/11 (Fig. 14). The new management system significantly increased the TAC from 1,000 t to 5,000 t for the 2013/14 fishing season. *P. montagui* catch significantly increased accordingly with reported catches of 4,867 t or about 97% of the TAC through 3 January 2014 (Fig. 14). Records may be incomplete since the fishery is still open until 31 March 2014 but this likely represents the majority of the total catch for 2013/14.

Biomass

The fishable biomass and SSB indices have not changed significantly in the four surveys conducted (Table 4, Fig. 15). However, fishable biomass observed in 2013 is the lowest in the series (Fig. 15a). SSB was also slightly lower in 2013 but remains above the four-year series mean (Fig. 15b). The mean fishable biomass index for the four surveys was about 54,500 t, while the mean SSB index was about 24,200 t. In 2013, the fishable biomass index was 45,650 t and the SSB index was 26,960 t.

Exploitation

With the TAC increase and corresponding catch, the ER has increased significantly in 2013/14 to 10.7% (Fig. 16a). Since 97% of the TAC was taken, potential ER was only slightly higher at 11% (Fig. 16b). The potential rate is higher than the 10% target accepted for the development of the WAZ fishery by stakeholders. This is a direct result of the lower fishable biomass observed in 2013 than that used to establish the TAC.

Current Outlook

The SSB for *P. montagui* in the WAZ is currently well within the Healthy Zone of the PA Framework (Fig. 17) established at the 2013 ZAP (DFO 2013).

Conclusions

Eastern Assessment Zone

Pandalus borealis

- The *Pandalus borealis* resource is currently in the Healthy Zone well above the Upper Stock Reference.
- The mean exploitation rate, based on reported catch, for 2008-2013 is 9%. Decreases in biomass over the past two years have increased the 2013 estimate to 13.7%.
- The mean potential exploitation rate, based on the Total Allowable Catch, for 2008-13 is 14%. Decreases in biomass over the past two years have increased the 2013 estimate to 18.1%, with a possibility of being over the maximum removal reference, if taken.

Pandalus montagui

- The *Pandalus montagui* female spawning stock biomass index continues to decline, now in the lower quarter of the Cautious Zone approaching the Limit Reference Point. There is a 32% probability of being in the Critical Zone.
- The reported exploitation rate estimate for 2013/14 is high at 30%. The potential exploitation rate for 2013/14 is very high at 64%.
- It is recommended that the Total Allowable Catch for *Pandalus montagui* in the Eastern Assessment Zone be reduced to a level considered more sustainable.
- It is further recommended that managers develop a rebuilding plan for *Pandalus montagui* in the Eastern Assessment Zone.

Western Assessment Zone

Pandalus borealis

- The *Pandalus borealis* resource is currently in the Healthy Zone well above the Upper Stock Reference.
- The exploitation rate for 2013/14 is about 4%. The current Total Allowable Catch represents a potential exploitation rate of about 7%.

Pandalus montagui

- The *Pandalus montagui* resource is currently in the Healthy Zone well above the Upper Stock Reference.
- The exploitation rate for 2013/14 is about 10.7%. The current Total Allowable Catch represents a potential exploitation rate of about 11%.

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(Approved January 20, 2014)

Sources of information

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Tables

Table 1. Fishable and female spawning stock biomass estimates for *Pandalus borealis* in the Eastern Assessment Zone for the 2006-2013 surveys. LCL and UCL are the lower and upper 95% confidence limits.

Year	Biomass	Weight (tonne)		
		Mean	LCL	UCL
2013	Fishable	49636.90	38427	60631
2012	Fishable	60533.67	43074	79960
2011	Fishable	78530.23	23900	135037
2010	Fishable	71064.51	40234	108703
2009	Fishable	78754.88	48850	110115
2008	Fishable	51053.43	37117	66708
2007	Fishable	43305.97	31015	58346
2006	Fishable	32815.89	21969	44152
2013	Female SS	32049.10	26762	37607
2012	Female SS	41189.85	29498	54383
2011	Female SS	47806.80	13470	82926
2010	Female SS	43800.31	19025	79665
2009	Female SS	38856.32	23122	56820
2008	Female SS	27653.12	22507	39368
2007	Female SS	27698.44	19249	39007
2006	Female SS	16805.06	10523	23026

Table 2. Fishable and female spawning stock biomass estimates for *Pandalus montagui* in the Eastern Assessment Zone for the 2006-2013 surveys. LCL and UCL are the lower and upper 95% confidence limits.

Year	Biomass	Weight (tonne)		
		Mean	LCL	UCL
2013	Fishable	3534.28	1738	6208
2012	Fishable	28845.47	8582	48946
2011	Fishable	7739.99	2871	14285
2010	Fishable	7422.75	5714	9290
2009	Fishable	15679.12	6190	29774
2008	Fishable	14667.04	7287	21973
2007	Fishable	4828.25	3389	6673
2006	Fishable	2667.14	210	5122
2013	Female SS	2777.54	1301	4949
2012	Female SS	23552.02	6218	40985
2011	Female SS	3124.24	1599	4721
2010	Female SS	5819.10	4509	7136
2009	Female SS	8775.54	4205	13955
2008	Female SS	10659.82	4269	17047
2007	Female SS	1970.63	903	3490
2006	Female SS	2134.38	50	4219

Table 3. Fishable and female spawning stock biomass estimates for *Pandalus borealis* in the Western Assessment Zone for the four surveys conducted. LCL and UCL are the lower and upper 95% confidence limits.

Year	Biomass	Weight (tonne)		
		Mean	LCL	UCL
2013	Fishable	21998.56	15906	28519
2011	Fishable	19692.10	12468	27961
2009	Fishable	15543.95	10603	21650
2007	Fishable	14615.00	8192	22356
2013	Female SS	9785.03	7106	12829
2011	Female SS	6376.60	4182	8909
2009	Female SS	3839.38	2184	4344
2007	Female SS	3231.00	2281	4344

Table 4. Fishable and female spawning stock biomass estimates for *Pandalus montagui* in the Western Assessment Zone for the four surveys conducted. LCL and UCL are the lower and upper 95% confidence limits.

Year	Biomass	Weight (tonne)		
		Mean	LCL	UCL
2013	Fishable	45647.22	32899	59438
2011	Fishable	71557.90	40264	108612
2009	Fishable	46672.87	35026	73342
2007	Fishable	54044.50	25723	84280
2013	Female SS	26955.19	18016	35736
2011	Female SS	32549.40	20296	46119
2009	Female SS	17998.70	13908	22322
2007	Female SS	19277.30	8902	32302

Figures

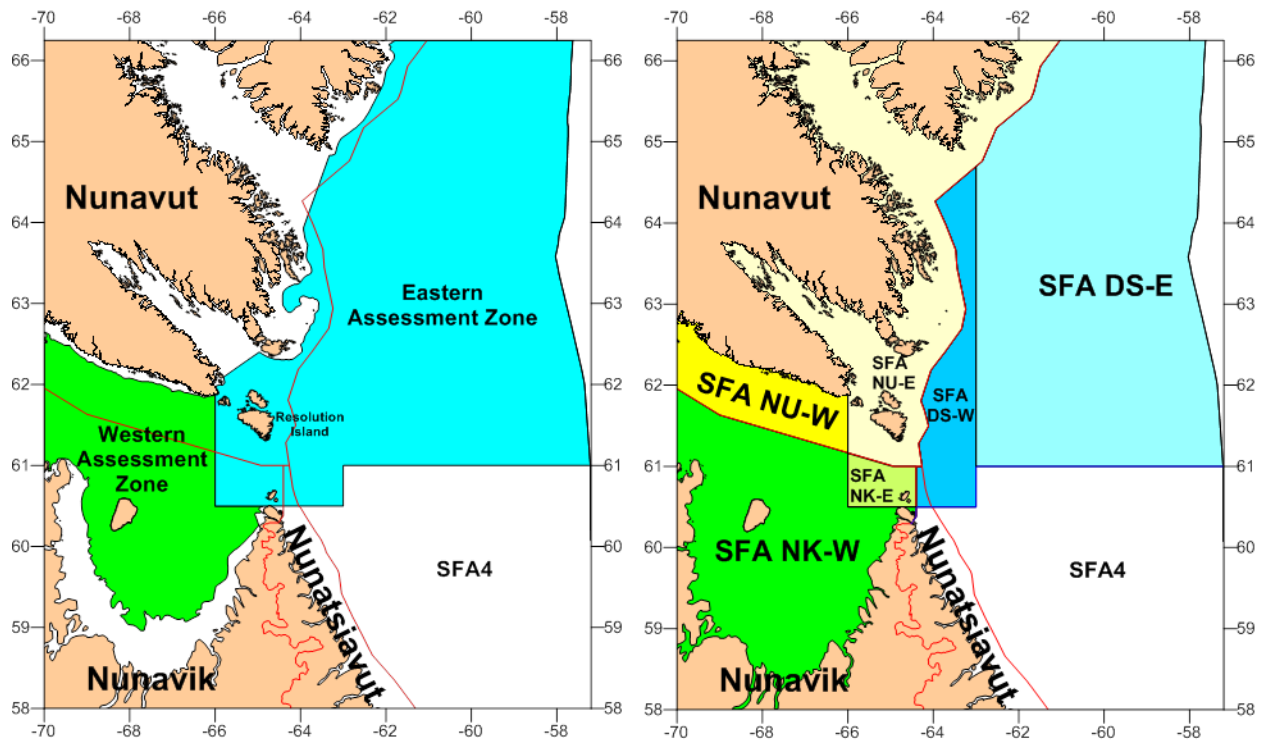


Figure 1. Location of the Western and Eastern assessment zones (left panel) and corresponding Shrimp Fishing Area (SFA) management units (right panel). Boundaries of the Nunavut (NU), Nunavik (NK) and Nunatsiavut Land Claims Areas are identified with red lines. Abbreviations for Davis Strait (DS), East (E), West (W) are used.

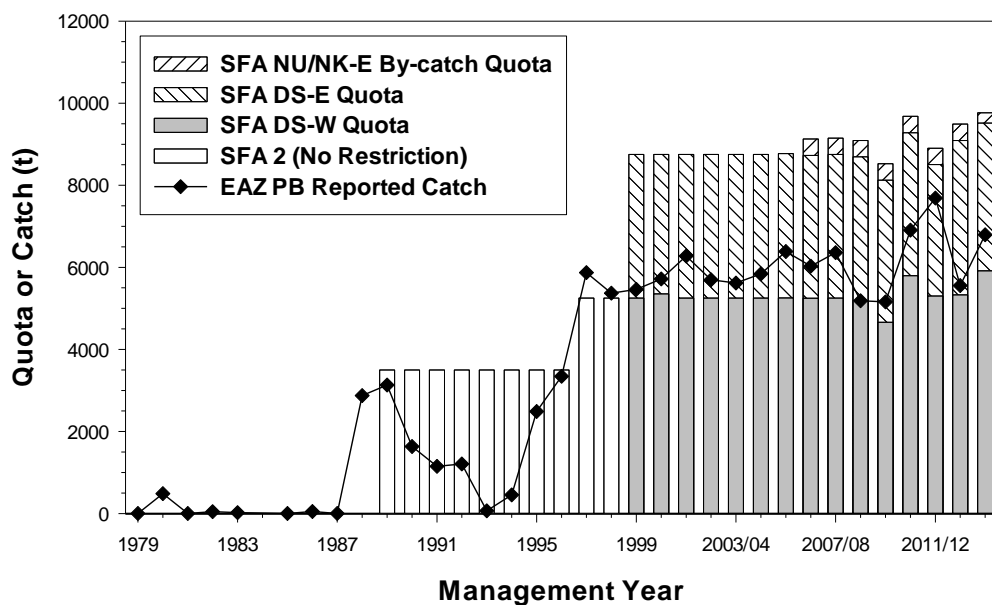


Figure 2. The Eastern Assessment Zone *Pandalus borealis* TAC and catch recorded in the Canadian Atlantic Quota Report (CAQR). Catch based on CAQR as of 3 January 2014; since fishery is still open catch may not be complete for the fishing year. Quota for 1999-2012/13 renamed to correspond to new management areas.

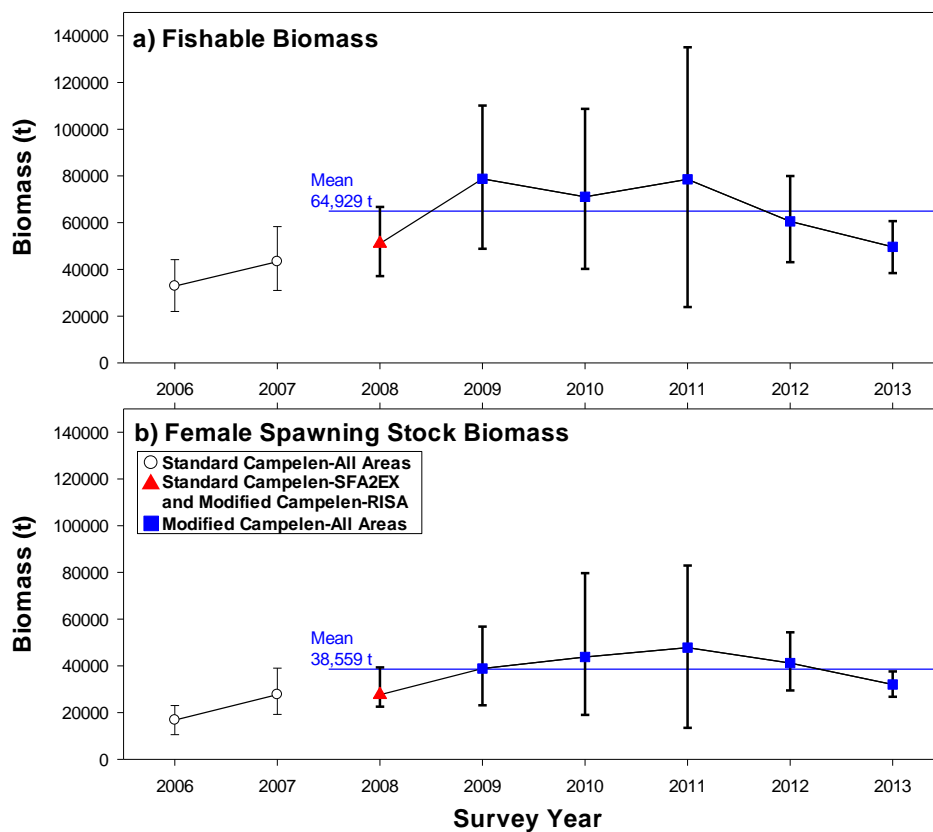


Figure 3. The Eastern Assessment Zone *Pandalus borealis* a) fishable and b) female spawning stock biomass indices for the survey years 2006-2013.

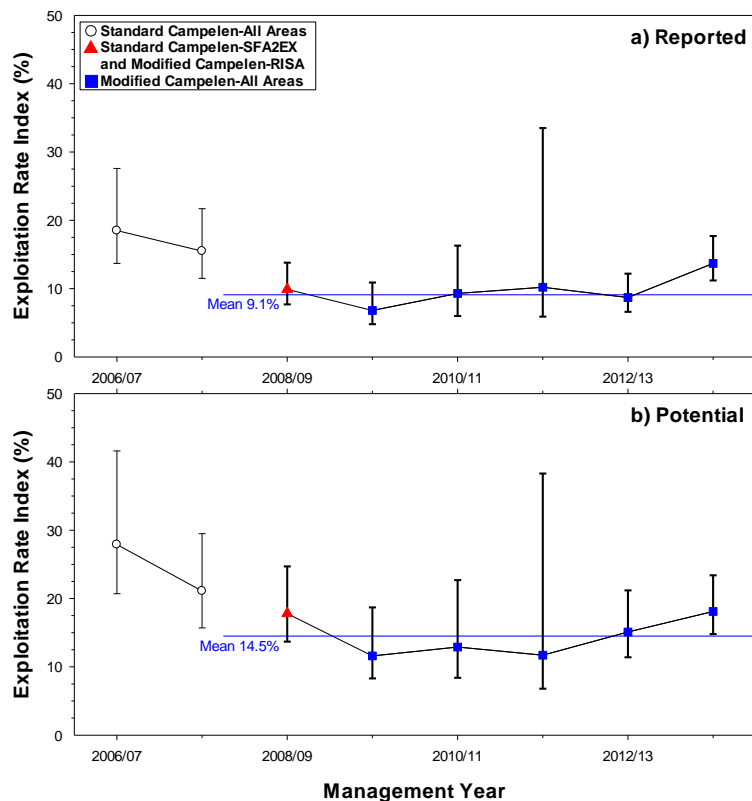


Figure 4. The Eastern Assessment Zone *Pandalus borealis* a) reported and b) potential exploitation rate indices for 2006/07-2013/14.

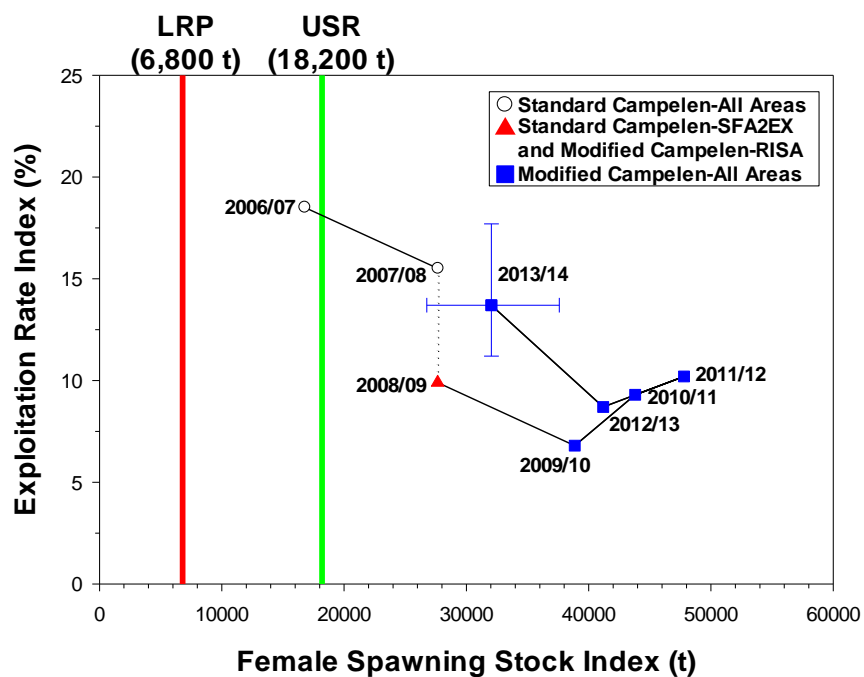


Figure 5. The Eastern Assessment Zone trajectory of *Pandalus borealis* female spawning stock biomass and exploitation rate indices in relation to reference points. USR=Upper Stock Reference and LRP=Limit Reference Point.

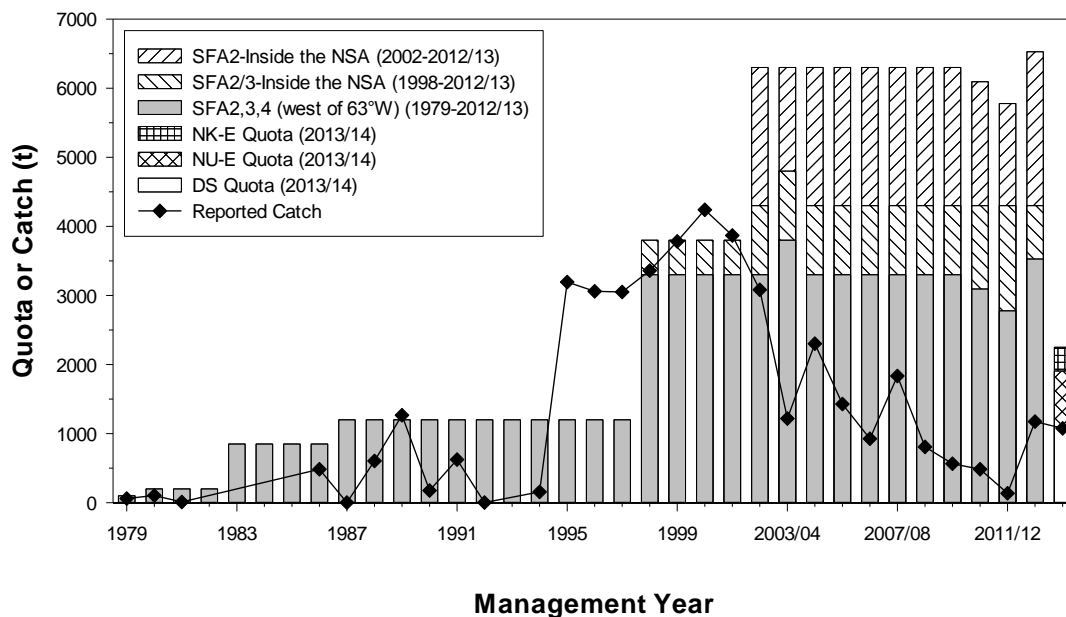


Figure 6. The Eastern Assessment Zone *Pandalus montagui* TAC and catch recorded in the Canadian Atlantic Quota Report (CAQR). Catch based on CAQR as of 3 January 2014; since fishery is still open catch may not be complete for the year. New management units were implemented for the 2013/14 season.

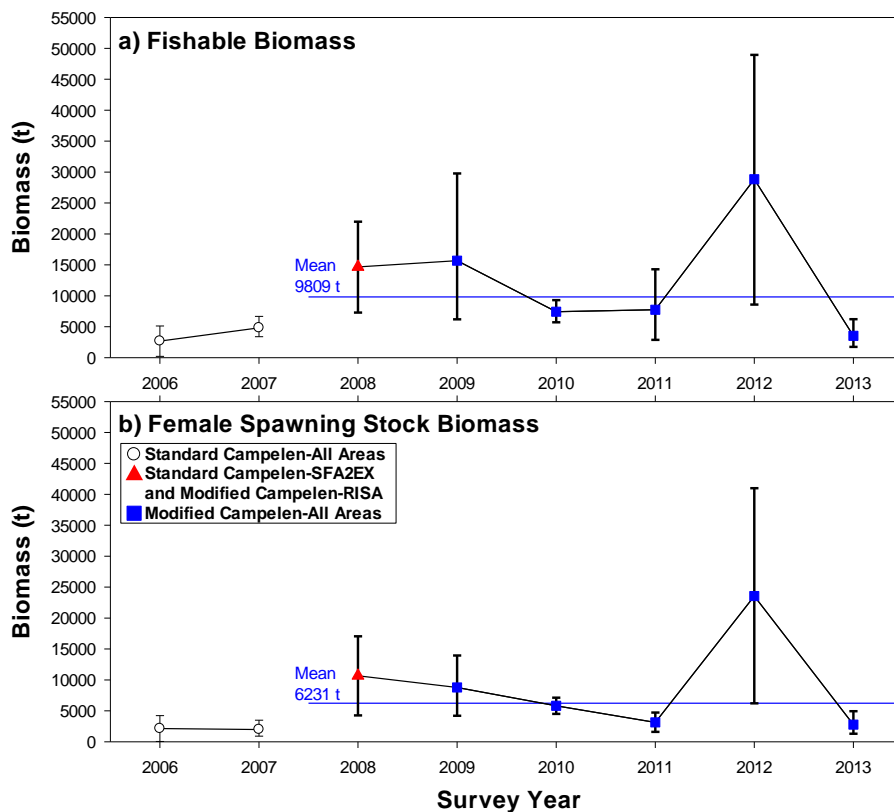


Figure 7. The Eastern Assessment Zone *Pandalus montagui* a) fishable and b) female spawning stock biomass indices for the survey years 2006-2013. Mean of years 2008/09-2013/14 excluding 2012/13 is shown.

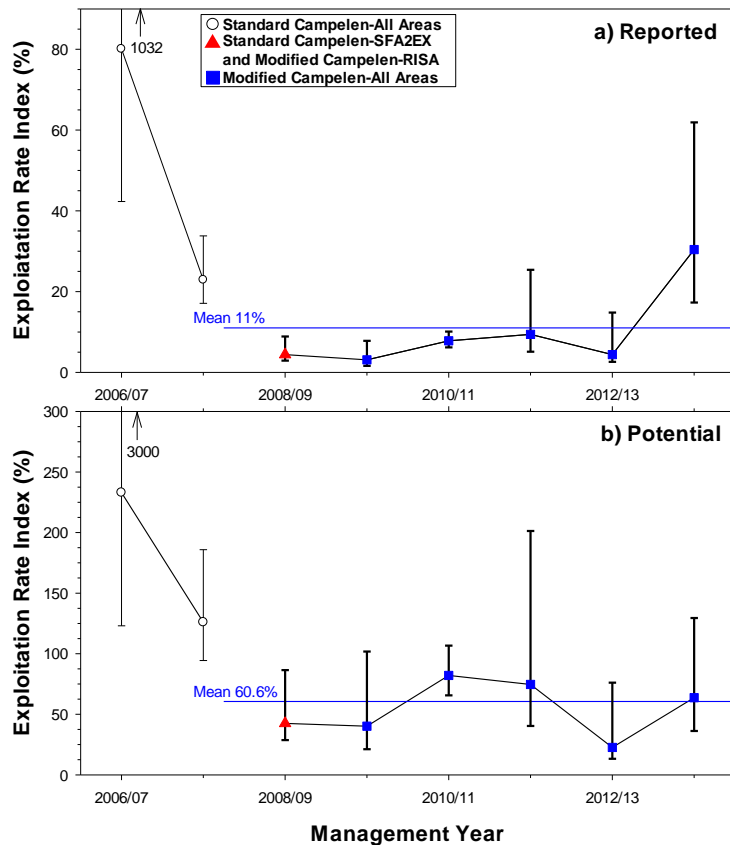


Figure 8. The Eastern Assessment Zone *Pandalus montaguui* a) reported and b) potential exploitation rate indices for 2006/07-2013/14. Mean shown includes 2008/09-2013/14 and excludes 2012/13.

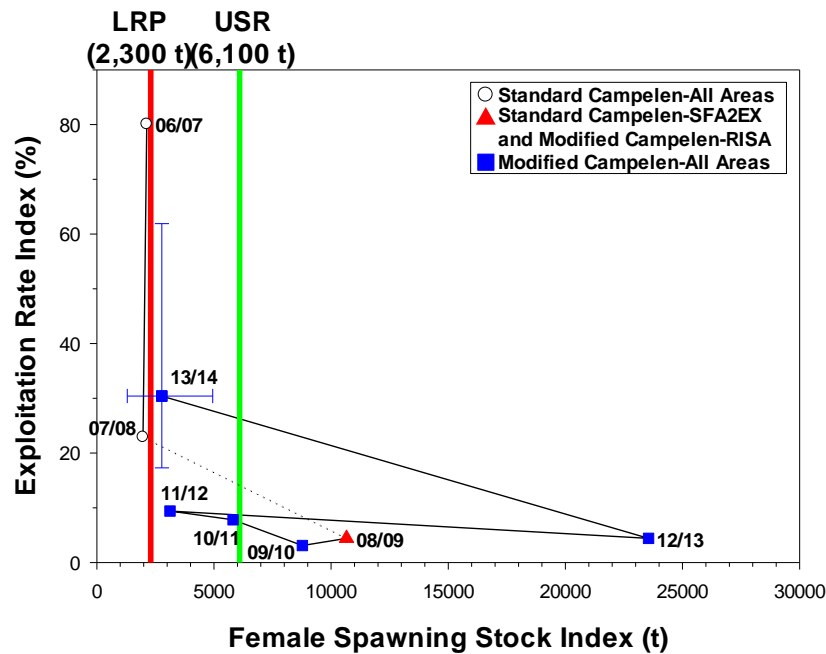


Figure 9. The Eastern Assessment Zone trajectory of *Pandalus montaguui* female spawning stock biomass and exploitation rate indices in relation to reference points. USR=Upper Stock Reference and LRP=Limit Reference Point.

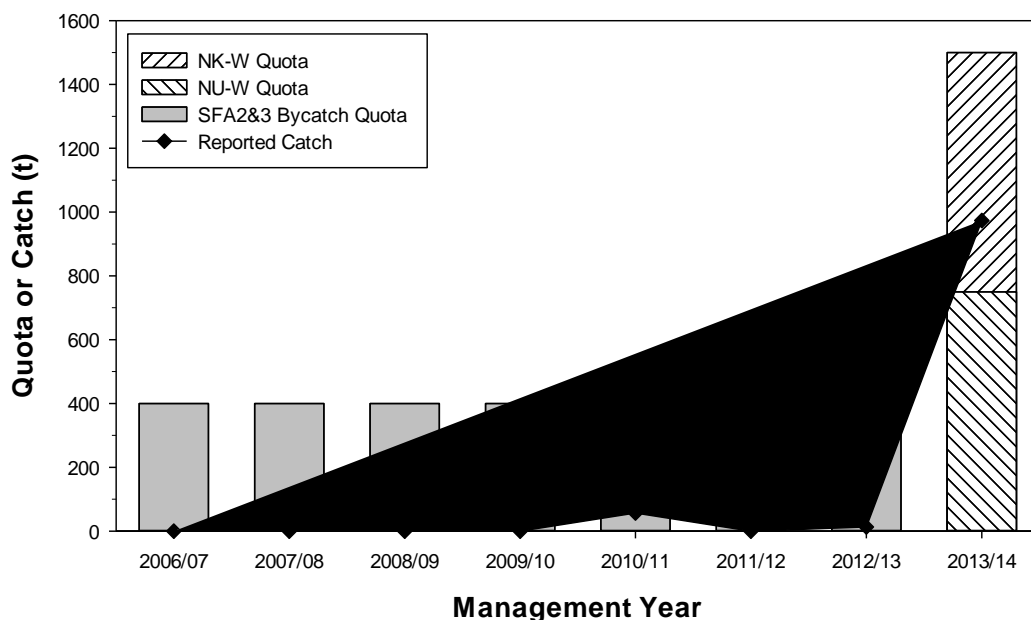


Figure 10. The Western Assessment Zone *Pandalus borealis* TAC and catch recorded in the Canadian Atlantic Quota Report (CAQR) for 2013/14 and observer records prior to 2013/14. Catch based on CAQR as of 3 January 2014; since fishery is still open catch may not be complete for the year. New management units were implemented for the 2013/14 season.

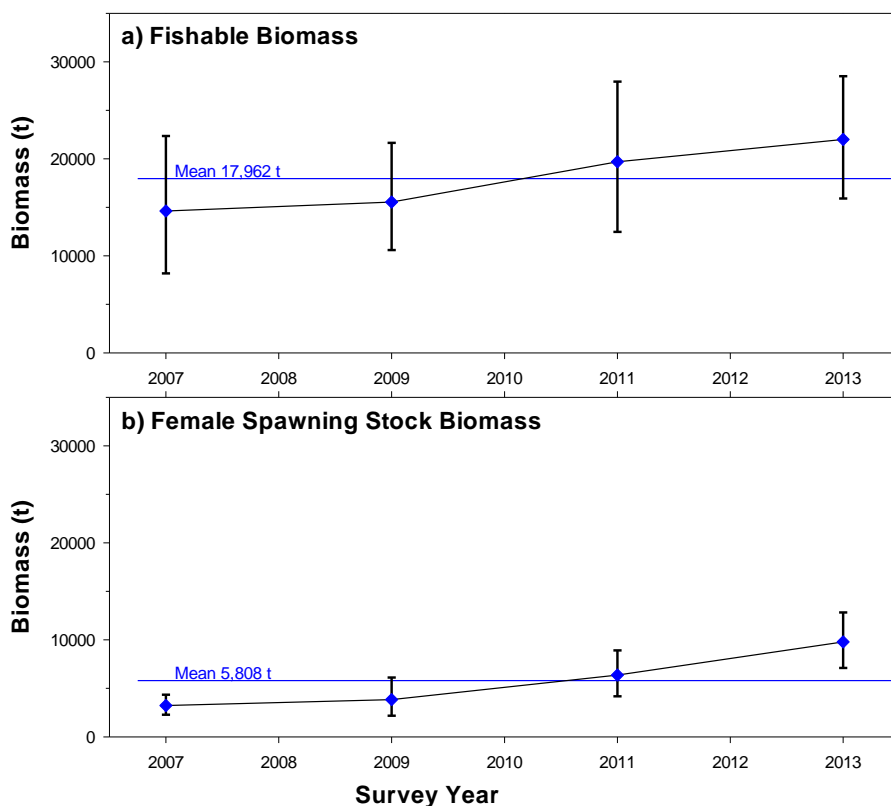


Figure 11. The Western Assessment Zone *Pandalus borealis* a) fishable and b) female spawning stock biomass indices for the survey years 2007, 2009, 2011 and 2013. All years fished with the Cosmos trawl.

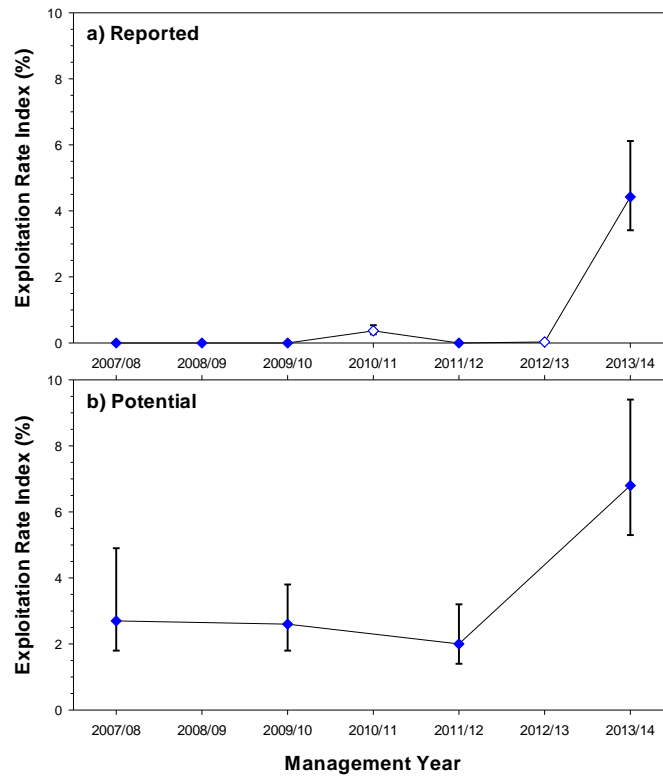


Figure 12. The Western Assessment Zone *Pandalus borealis* a) reported and b) potential exploitation rate indices. Note that there was no survey in 2010 or 2012 so the exploitation rate was based on the fishable biomass from the previous year's survey.

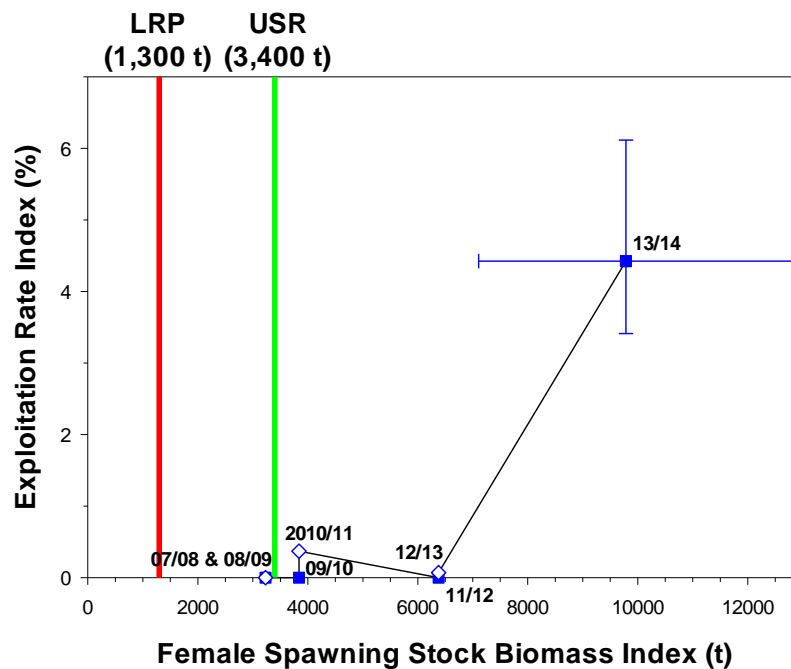


Figure 13. The Western Assessment Zone trajectory of *Pandalus borealis* female spawning stock biomass and exploitation rate indices in relation to reference points. Note open symbols represent years when no survey was conducted. The exploitation rate in those years was based on the fishable biomass from the previous year's survey. USR=Upper Stock Reference and LRP=Limit Reference Point.

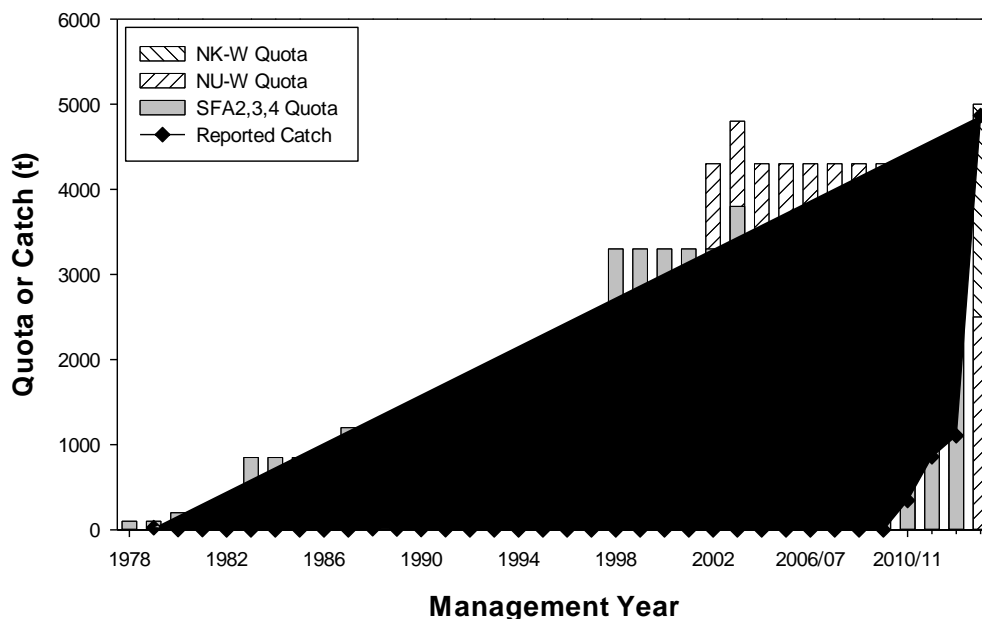


Figure 14. The Western Assessment Zone *Pandalus montaguui* TAC and catch recorded in the Canadian Atlantic Quota Report (CAQR). Catch based on CAQR as of 3 January 2014; since fishery is still open catch may not be complete for the year. New management units implemented for the 2013/14 season.

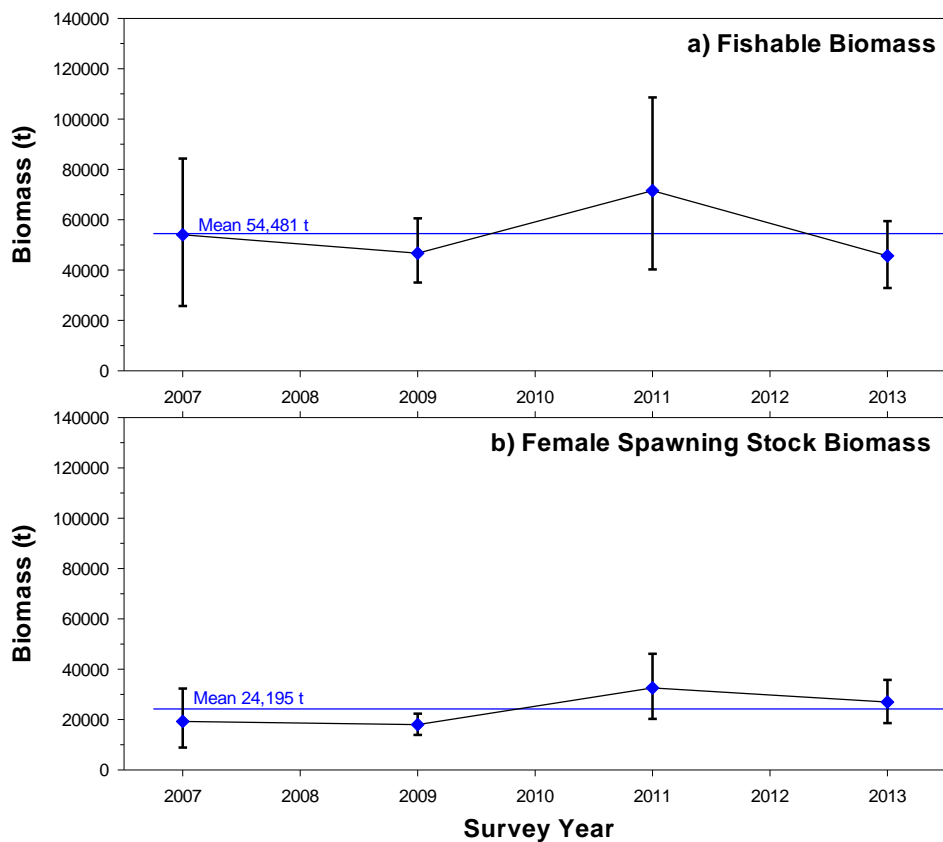


Figure 15. The Western Assessment Zone a) fishable and b) female spawning stock biomass indices of *Pandalus montaguui* for the survey years 2007, 2009, 2011 and 2013. All years fished with the Cosmos trawl.

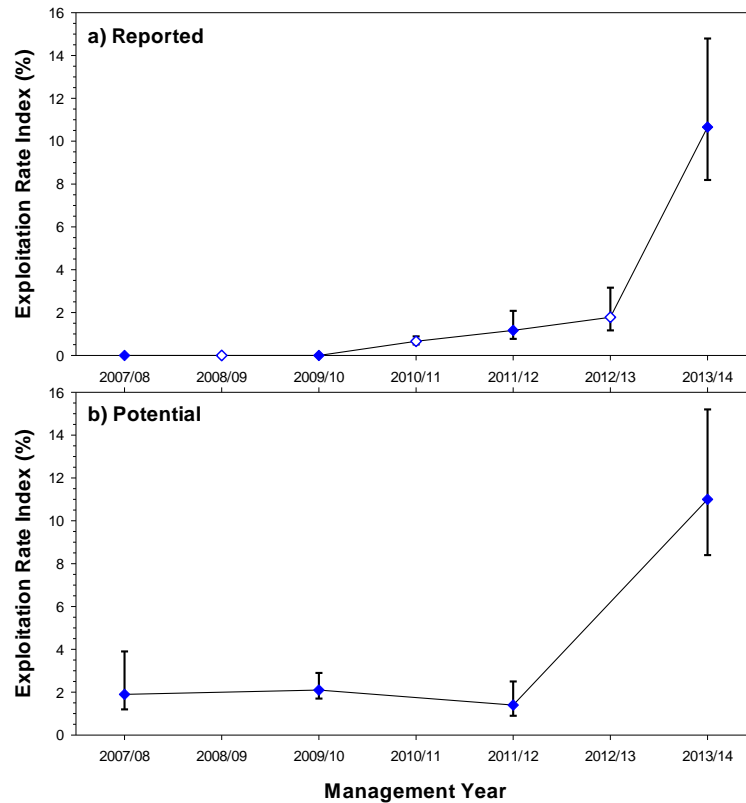


Figure 16. The Western Assessment Zone *Pandalus montaguui* a) reported and b) potential exploitation rate indices. Note open symbols represent years when no survey was conducted. The exploitation rate in those years was based on the fishable biomass from the previous year's survey.

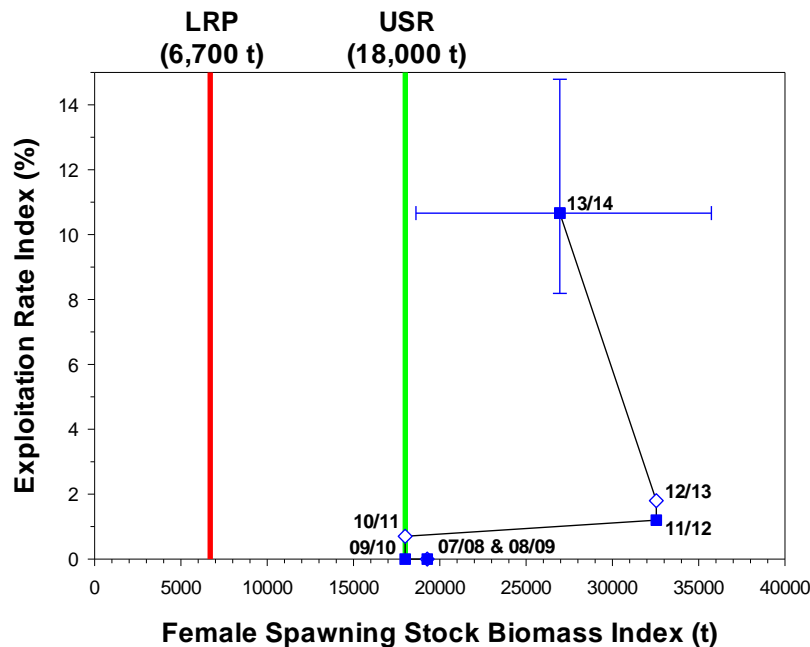


Figure 17. The Western Assessment Zone trajectory of *Pandalus montaguui* female spawning stock biomass and exploitation rate indices in relation to reference points. Note open symbols represent years when no survey was conducted. The exploitation rate in those years was based on the fishable biomass from the previous year's survey. USR=Upper Stock Reference and LRP=Limit Reference Point.

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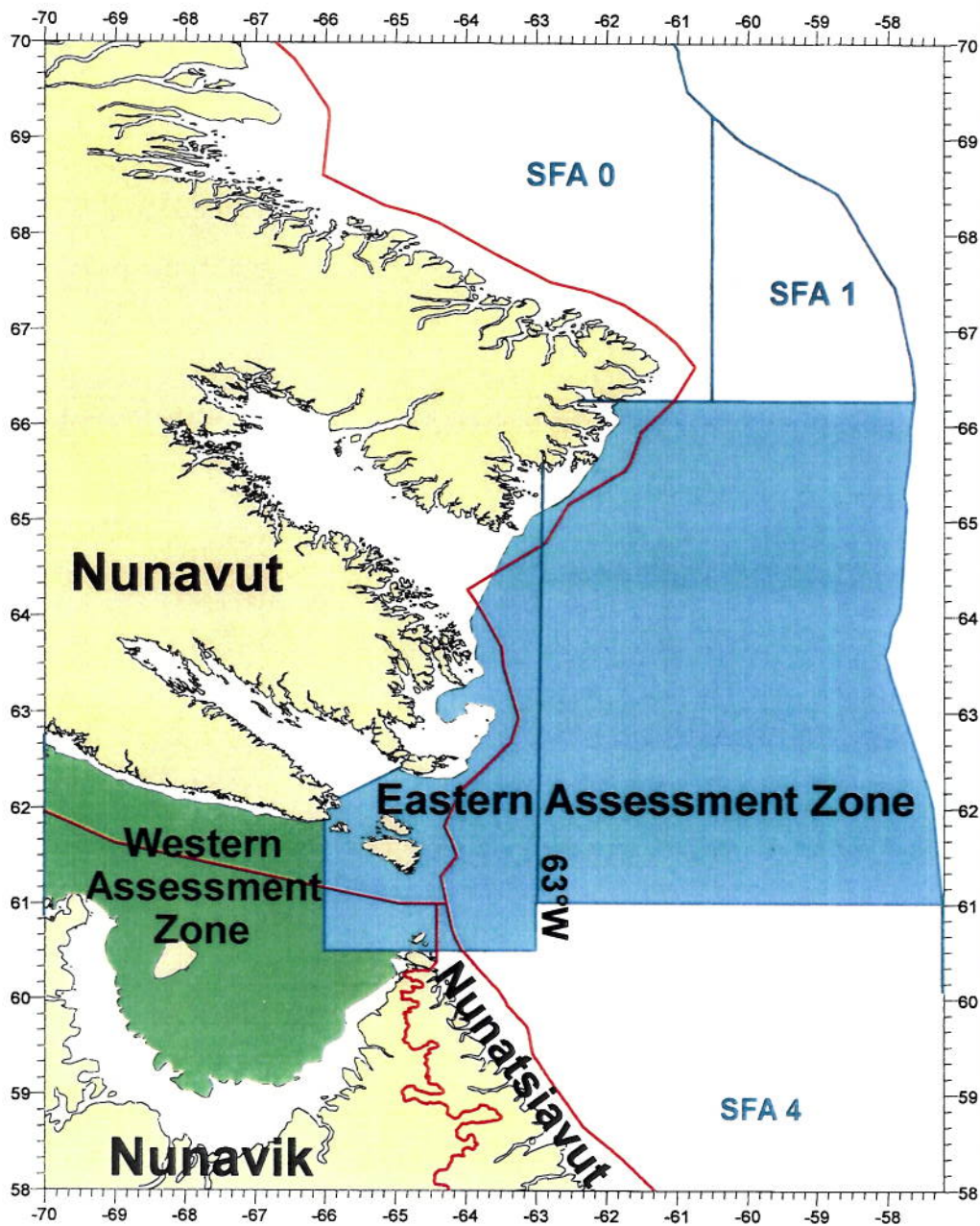
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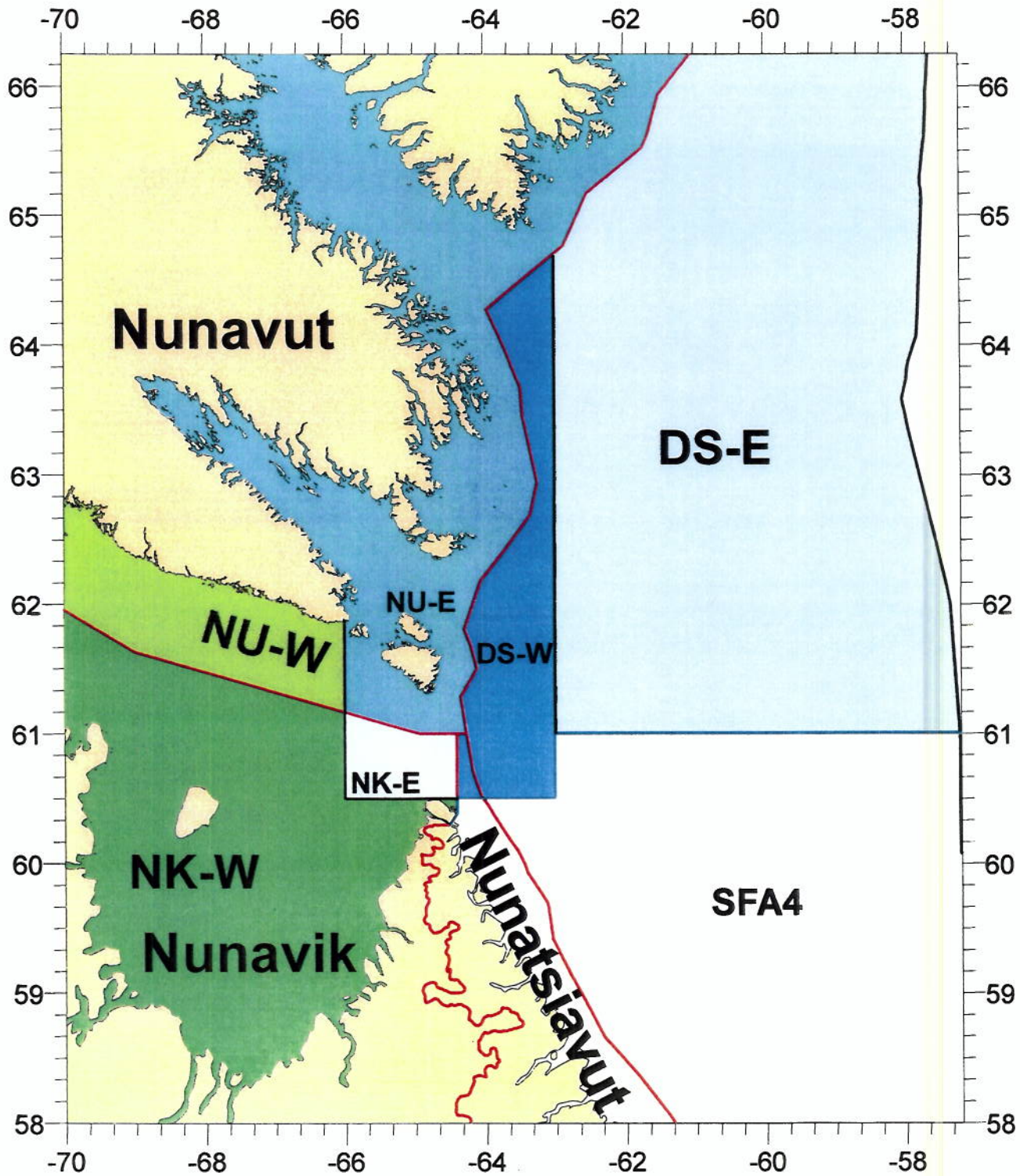
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Science Assessment Zones

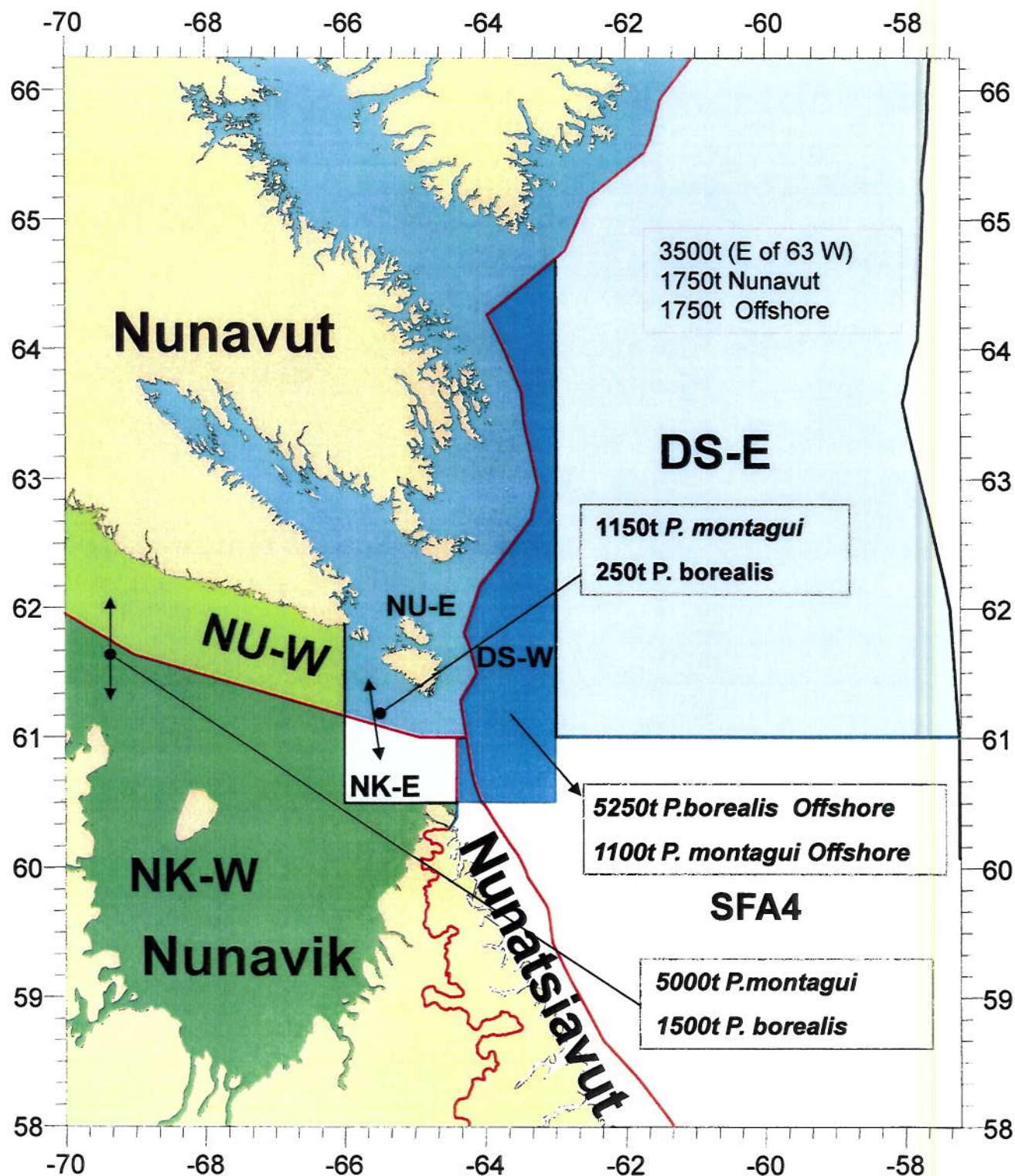


Management Units



A

Quotas per Management Unit 2013/14



Nunavut and Nunavik Management Arrangement for (2013-2015)

Western Assessment Zone	<u>TAC <i>P. montagui</i></u>		<u>TAC <i>P. borealis</i></u>	
	Nunavut	Nunavik	Nunavut	Nunavik
	50%	50%	50%	50%
Eastern Assessment Zone*	<u>Quota <i>P. montagui</i></u>		<u>Quota <i>P. borealis</i> (by-catch)</u>	
	Nunavut	Nunavik	Nunavut	Nunavik
	70%	30%	80%	20%

Nunavut and Nunavik Shares based on 2013/14 TACs

Western Assessment Zone	<u>TAC <i>P. montagui</i> 5000t</u>		<u>TAC <i>P. borealis</i> 1500t</u>	
	Nunavut West	Nunavik West	Nunavut West	Nunavik West
	2500t	2500t	750t	750t
	50%	50%	50%	50%
Eastern Assessment Zone*	<u>Quota <i>P. montagui</i> 1150t</u>		<u>Quota <i>P. borealis</i> 250t (by-catch)</u>	
	Nunavut East	Nunavik East	Nunavut East	Nunavik East
	805t	345t	200t	50t
	70%	30%	80%	20%