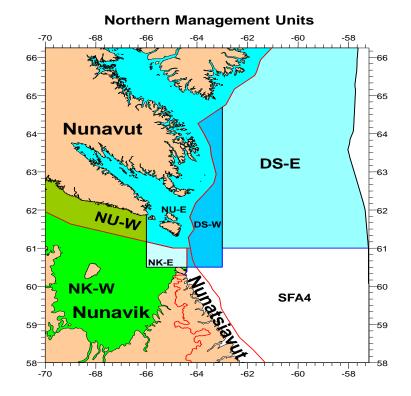
<u>)م-۲۵ ۲۰ خور ک</u>

<u>ליאז~ר</u>

⊾∿⊃̈́́́∩⁻: X
•

ለ**⊾∆**೨Ϲ": 'ຢິ∩`ኇʻ\∆ິ ለርኄʻኇ`Րິ ኄ⊳**ትՐ**⊲ʻል՝: Ϸ'**ት**໊⊃ິ∩⊲ና孑⊲ʻ౨ኇ ለ**┌**ኊኇ ⊳ዖ⊳໊Ϲ໊ϽΓ⊳⊂ഛິ (*Pandalus borealis*) ⊲୳L೨ Ϲ՞ኣ츥ິ (*Pandalus montagui*) ዖčJ<<`ഛິ ለ**ዲ**՟ዲጐሁኇິ ⊲୳L೨ Եዲ՟ዲ՟ሁኖ ኄ⊳ዖኣነል⊳⊀ິ ልጵິ

<u>_____</u>م⊷,ام.





⊳₽⊳™⊂™⊃Г° Р∿J*<∆° (Pandalus borealis)



⊂[ೄ]৸⇔^ϲ Բ∿⊍<∆^ϲ *(Pandalus montagui)*

ዄዾፚ፝፝፝፝፝፝ዾፚጜ

 Δ^{+} ለራሲፈንሀረቢላኈ PPPゃርኈጋГ Þነኦኈጋናበዻናረፈናጋኇ ለራሲኇኈ ለራሲ፦ጋቡ bበ፝፝፞፝፝፝፝፝፞፝し፟ና (NPAWG) ᠈ᡆᢣ᠘ᡃᡪᡏ᠌᠌᠆᠆᠙ᠺᠲ᠉᠂ᡨᠣᠴᠵ᠕᠊ᡆᡄ᠈ᡃ᠌᠌ᠵᢣᠵᢂ᠋᠋ᡗ᠆ᢟ᠊ᡬᡟᡆ᠋᠋ᠯᢛ᠘ᢣ᠋᠋᠉ᢣ᠈᠋᠆ᡌᢂ᠆᠘᠂ᡔ᠕ᡔ

᠕᠆᠋ᠴᢦ᠋ᢗ᠘᠋᠊᠘᠋᠆᠆ᡘ᠆᠙ᢂ᠋᠆᠆᠘᠆ᡧ᠘᠆ᢂ᠆ᢣ᠅ᢓ᠅ᠫ᠘᠘᠆ᡔ᠅ᢕ᠘᠘ᡔ ᡃᢀ᠆ᡐᢣᡆ᠌᠘᠊ᠼ᠋᠆ᡗ᠆ᠳ᠘ᡆ᠋ᢞ᠂ᠳᢣ᠋᠋᠆ᠫᡰ᠘ᢞ᠕᠂ᡣᡄᢣ᠋᠆ᡪ᠘᠘᠋᠓᠄᠕᠈ᢄᡔ᠋ᡗᡬᡆᡦ ᡤᡃᡆᡄ᠋ᠲ᠘᠋ᠴ᠋ᠵᢣᡆᢑ

 Δ^{+} ርበ[©]/Lሩ ወረና ራም የ ወራ የ (ልቃላሲ 2021)-Γ, Δህጋር ይደና ይደና የ መንግ ምንግ የ መንግ ምንግ የ መንግ ምንግ የ መንግ ምንግ የ መንግ ምንግ የ መንግ የ መንግ ምንግ የ መንግ ምንግ የ መንግ የ መንግ ምንግ መንግ ምንግ መንግ ምንግ የ መንግ

ቴÞΡኣኁልϷኆ ΔኈႱσ (EAZ)–Γ. ϹၑϭϤ Ρ·ϲʹቴ℩℠Ոና∩_ͻσ ϥ_ϥΔናል∿Ⴑσ ϥዖ΅ႱናσኈႱσ (LRP)–ኄነኆ ᠘ᡝ᠘ᢉᡃᠵ᠋᠕᠆ᡩᡅᢕᢄᢣ᠘ᡩ᠆ᡩ᠆᠕᠆᠘ᠴ᠕᠋᠕᠆᠕᠆᠕᠆᠕᠆᠕᠆᠕᠆᠕᠆᠕᠆᠕᠆᠕᠆᠕᠆᠕

ᠵ᠖᠆ᡩ᠕᠆ᠴ᠘᠘ᡩ᠂᠘᠆᠕᠆᠕᠆᠕᠆᠕᠆᠕᠆᠕᠆᠘᠆᠘᠆ᡭ᠆ᡭ᠉ᢕ᠘᠆ᡔ᠆ᠺ᠊ᢄ ᠋᠋᠆᠋᠋᠋ᢣ᠅᠋᠋ᢕᡄᢣ᠉ᠫ᠊ᢄᡩ᠋ᠵ᠖᠉᠆ᡗ᠉ᠫ᠅᠉ᠫ᠋ᢉᢂᡩᢣ᠕᠆᠘ᡧ᠋᠉᠆᠕᠆᠘᠆ᠴᢁᡩ᠕᠆ᡕᡄᠴ᠕ᡃ᠖ᢕᢝᡶᡧ Δነイ≪Ϸ⊂∿ႱႻ Ϸ₽Ϸჼኑ⊂ჼንጋ୮ ₽°Ⴐ<Δჼ ϷჼႦϷነ⊀ჼነረልትϷ⊀ና ϧ∩L≯ͽና (NSAC)-ነď-ͽ Ĺነት 9, 2021-Γ.

 $\Delta^{\circ}_{\Delta} = \Delta^{\circ}_{\Delta} = \Delta^{\circ$

(⊳∆J/Lל∿ 1).

治したる ふんっ ふつしょう ふうしょう

ᢄ᠋ᡃᠲᢄ᠈᠊ᠺᢛᠵ᠋᠋ᡩᡄ᠋᠋᠋ᡩᡄ᠋᠘᠋ᡄ᠕᠋᠋ᠧ᠖᠋ᡱᠣ᠆ᡘᡄ᠖ᢣᢄ᠋ᢙ᠋ᢤᡄ(USR)᠆ᠴ *Pandalus montaqui* ᡧ᠋᠘*᠋ Pandalus* ^~J°∩C>+^_°D~2021-2022 ∆&J⊂C&P< ∆J<6. Ć^c ⊃ĠL>+% ^~J°∩C∩L>%⊃% ᢄ᠈᠈ᡩ᠋ᠫ᠊ᡣ᠋ᢂᠫᡏ᠘᠆ᠴᢘ᠕᠆ᡄᡅ᠋ᡔ᠋᠊ᢁ᠘᠆ᡘ᠆ᡭ᠆᠙ᢂᢣ᠅᠘᠆ᢣ᠉᠘᠆ᠺ᠆ᢂ᠅ᠺ᠘᠆ᠺ᠉᠋

՟৬՝ィႱᡄ∿ዏ ∧ኆᡅᡝ᠊᠋ᠫᡣ ᲮᲘᲚႱ⊀ዏ ᲮᲘ∽ዎႱႾჼႶํჃႶJ ᲮᲘLᲘና∩ႾϘჼንና ചል∧൩ 2020−୮ ⊲∆ናኪኆ 2021−⅃

ΡΡΡ[&]C[®]DΓ Ρⁱλ[®]D^cΠϤϚłϤⁱ→σ Λϲͺω[®] Λϲͺϫ-ΔΠⁱ bΠ[®]U^c (NPAWG)-ⁱd^c δΡλⁱbΔωΡ[®]D^c ⁱd^cΠⁱσⁱδ^c ΛC[®]ⁱσ^{*}Γ^c δΡλΓ^dⁱδ^k (USR)-σⁱ 70 >δⁱCⁱC^Dσ^k dⁱPⁱ/σ^cΓ DPcP_LU^j₂D[®] ^pⁱcPⁱσ^k¹Dⁱσ^k¹Dⁱ^k²/_L²d^{c^{*}}Γ^c ΔσPⁱΓ dⁱL→ Λδ^kδ^k¹Pⁱ/_L²D^{k^{*}} d^b₂^c Π²D^{k^{*}} ^pⁱcPⁱσ^k¹C^{k^{*}} Δ^bD^{i^k²} δ^{k^{*}} d^{k^{*}} d

 $\Delta b^{\circ} / \Delta c \ and \ and \ boxes and \ below a start of the start$

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 $σ_{L}$ Δ⁴σ_Lλ⁵ΥΠJ, PPP[%]C⁶DΓ P³λ⁸D²ΠΔ⁴ζ⁴⁵Δσ Λς_Lσ⁶ Λς_Lζ²D¹ b²⁴C⁶(NPAWG)-¹d² Δ²L⁴γ⁵C⁵C⁵ d⁴C⁶γ⁴C⁵ d⁵γ⁴C⁵ d⁵γ

ﻣــ੭ﻣ∆ʰd∩ 1−Γ ⊲ʰLــ ⊲≀ٌٌٵ⊲ܡ ▷∆J٢L२ʰ 2−Γ.

⁵b>h^cn_cD^sD^c ⁵d^cn^bσ^sh^{Δ^c} A^Cb^sσ^sn^c ⁵b>h^cd^sb^s(USR)-σ^b d^s^bp^bCDr/L t^c **70 > t^c αΔtDr/ασfT αc J^abσ^sb Δ^sσP^s<-cqt^c A^Cb^sσ^sn^c D^s nn^cσ^sn^c (SSB)-J α_a Δ^bdn^sbσ αDa^saDt^a** A^st^a^c (WAZ 4^tL^s a, αDσ Δ^sb³dCDt^a^c A^s^s^c^s^c d^tL^s b^s^s^c^c d^sb **5D**^tt^sADt^c Δσ^c (WAZ 4^tL^s EAZ)-Γ. Δ^sb³cn_cσ^sJ^c ΔL^sTDCcn_cσ^sJ^c J b₂CΓ (DFO)-^{bd^c} **4D**^{c^sd^tDt^tt^s t^s^tJⁿCn^ccn^{s^s} Δt²CDn^st^s^tA^c</sub> bnLt^{s^s} d²D^{c^s}d^tDt^tt^{s^s} d^cD^sσ^st^c (USR)-^LJ a^tADn^st^c (C^s-DJ^s^s) Cd^tADt^c d²Dσ Δ^sb³dCDt^{s^s}} ለበር⊳የ•ഘ^ቈጋኇ[▶] ለኦ⊳ኇ[•]ዮ-ኇ (TAC)–[•]ህኛ ዻናበነትചላቴናር፦ናኇ[•]Ր, ጋናቴ^ቈር⊳ኛ ላኄፈትചላናኇፑ[▶] ሥ⊳ኇኇ፟ዄኇ ዻናበ[∿]ኇ፝ጜኯዾኇ፞ኇዥ, ዻዯ፟፝፞፞፞፞፞፞፞፝ና-.).

ΔΔΔ^bdΠ 1. $P^{L} = \mathcal{B} \cap C \mathcal{D} = \mathcal{D} \mathcal{A}^{L} \mathcal{A} \mathcal{A}^{L} \mathcal{A}^{$

⊳۲۲۹ ⁻ ۳٦۳۷ که	ለ ዲ ^ኈ ሬ [°] ሀም ^ር ነው አነጻ አንት የ (VAZ)		b ዉ ∿ዉ∿ሁσ ኄ⊳≯ኣኄ∧⊳⊀⁻ ∆σ∿ሁ (EAZ)	
	ᡥ᠋᠆᠋᠂ᠳ	ՙժ՟Ո՝ԺՙԿ∆՟	ᡥ᠋᠆᠋᠋᠂ᠳ	ʻd⁻∩ ʰ ϖʻኣ∆⁻
	مےم∆≀∿لح	᠕ᢗ᠋ᡃ᠋᠖᠂ᢅᠣ᠂ᡗ᠊	مےم⊿≀&∿لح	᠕Ϲʹᡃᡖ᠋᠂ᢅ᠋᠋᠆ᡗ
	ݐ ٩ [∞] ڶ ^ۥ ᠳ ^ݛ ڶσ	ይ⊳ታ L⊲ ,♥, (NSB)	ݐ ٩ [∞] ڶ ^ۥ ٛσ [؞] ڶσ	ՙ Ե⊳ ⊁Ր⊲ՙል՝ (USR)
	(LRP) (40-> \ °)	(70->ኣˁ)	(LRP) (40-> \ °)	(70->հˁ)
⋗ ₽⋗ "⊂ "⊃Г [∊] Р J'<∆ [∊]	4,100 ∆⁵⊂∿°ċ⊂	7,200 ∆⁵⊂∿°ċ∽⊂	15,800 ∆⁰⊂∿°ċċċ	27,600 ∆⁵⊂∿°ċ⊂
(Pandalus borealis)	*~~~~	*~	*_Ċ*Jn.<7%Lt%	*_Ċ [*] IJn.
Ը ^ւ հէ՝ Բ [ൣ] JԿՀՃ՝ (<i>Pandalus</i>	12,300 ∆Կ⊂൩∿安൳	21,500 ∆⁵⊂∿°ċċ	3,100 ∆⁵⊂∿`ċc	5,400 ∆⁵⊂∿°ċ⊂
montagui)	*⊃⊂*	*⊅⊂%	*_ĊIJnA71L+~	ᡟᠴĊᡃ᠋ᡃᡅᡏ᠋ᠮ᠘ᡟ᠋᠋ᡃ᠋

Λోປ[™]Π^cΠ_c^μ → Φⁱλ[™]Ͻ^cΠ⊲Ϛ/⊲^s→ Λ⊂[™] (PA) dⁱCPⁱλ[™]CPⁱL^{*} Δ_c^{*}U_σ Pandalus borealis ⊲ⁱL → Pandalus montagui − σ^cΔ[™] → ⁱdCPⁱ + ^a^{*} → ^c^{*}U_σ^{*} → ^c^{*} → ^c^{*}U_σ^{*} → ^c^{*} →

∧**ዲ∿ዲ℃**ႱႧϲ ۥ₽⊳ᢣᠠ᠌᠈♥⊳⊀₀ ∇⊄₀ (MAZ):

1. Δ/Lー▷ሲጵና የሪና በኮምኑΔና Λርቴናም ዮና ቴ▷ትՐ⊲ናልና (USR) 广ݨݐና *Pandalus borealis* Ϥ·Lຼ *Pandalus montagui–ຼ*ς Lーູ້ך.

ϧϲϧͺϲͺϼͺϻͻͺ;Ϸͻ϶ϯ_;ΫϷ*ϧ*ͺϫϧϲ

- 2. ᠈ᢪᢪ᠅᠋ᠴᢩ᠆᠘ᠮᡆᡣᡆᠦ᠊᠆ᢂᡔᡄᢩᠻᡣᠦᢂ᠆ᡩᢣ᠋᠋ᡆ᠖ᡢᡤᡕ, ᢦ᠋ᢕ᠆ᠮᡆᢣᢂ᠆᠅᠘ᡩ᠕ᢕ᠖᠂ᡬ ᠖ᢣᡗᡆ᠋ᠻᢌᡃ (USR)– J *Pandalus borealis* Ϥᡃ᠘*ᠴ Pandalus montagui–*ᢧ, ᠘᠆ᡃᢩᡔᠶ.

$$\begin{split} & \forall \mathsf{DP} \mathsf{L} \mathsf{L} \mathsf{P} \mathsf{P} \mathsf{L} \mathsf{A} \mathsf{C}^{\dagger}: \mathsf{CP} \mathsf{D} \mathsf{L} \mathsf{L} \mathsf{P} \mathsf{C}^{\dagger} \mathsf{A} \mathsf{C}^{\dagger} \mathsf{P} \mathsf{P} \mathsf{L} \mathsf{A} \mathsf{C}^{\dagger} \mathsf{C}^{\dagger} \mathsf{A} \mathsf{C}^{\dagger} \mathsf{A} \mathsf{C}^{\dagger} \mathsf{C}^{\bullet} \mathsf{C}^{\dagger} \mathsf{C}^{\bullet} \mathsf{C}^{\bullet} \mathsf{C}^{\bullet} \mathsf{C}^{\bullet} \mathsf{C}^{\bullet} \mathsf{C}^{\bullet} \mathsf{C}^{\bullet} \mathsf{C}^{\bullet} \mathsf{C}^$$

۸<ᡤ᠊᠋Ϲ᠅ᢗ᠅ᡫᢄᡃ d

L∆ 7, 2021 **℃د ۲**

▶**△ᲙィL⊀[®] 1** – ▶₽₽[®]C[®]⊃୮ ▷'ኦ[®]⊃ና∩⊲ና៸⊲[©] → ∧፫ᡅσ[®] ∧፫ᡅ⁻∍∩[®] ᲮՈ[®]ᡶ⊀⁻: Խ൧∆Ⴀ[®]Նσ[®]Ր⊂ ▷σ[®]Ե៑⊲[®] (ձೆ[®]≫⊲ኪ 2021)

>ΔJ/Lt* 3 - [$\Delta\Delta\Delta^*$ /Lt*] ΔΔΔ<

ቴኮኦኣናልኮተ^c ፊσ የ ም. baC. የ ርተσ ማትረት ኮቴኮነት በማገበ. Δጋ ማ. የ ርተσ ማትረት የ ውኔኮነት በማገበ. ኮታ ቴ ር ማ የ 2020/053.

ϷየϷʹϹʹϽΓ ϷʹϟʹϟʹՈϤʹ**ϭʹϤʹ Λ**ՐϤႱ**ʹ**ኣϷϟͿʹ Ϥʹ**Ϸϟ**Δϟʹ ϧ**ϹͰϟ**ϛ (NPAWG): ʹϧͻΔϲʹʹϧϲʹϧʹϧϹ Ϸϭ·ϳϲϤʹͽ

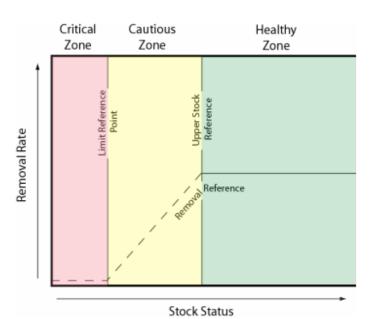
&୭⊲∩ 2021

<u>╡᠋᠋ᠻᡃ᠈ᡃᡗ᠘ᠳ᠋᠋᠘᠆᠘ᠴ᠋᠋ᢗ᠘᠘᠋᠋᠆᠋ᠺ᠘</u>ᠳ᠋᠍ᡫ

▷የ▷ናΌΓ ▷ንትናሃናብ⊲ናኇናገና ለՐ⊲ሁኣ▷የገና ዺ፞፞፞፝የካለሏትና b∩Lትና (NPAWG) ኣዋር▷ﺩ▷ናሃLየና ፴ልለሲ 2020. ▷ንትናሃናበ⊲ናኇናገና ለՐ⊲ሁኣ▷የገና ፈናምነለሏትና b∩Lትና Δﺩ▷ናጋቦኑ Δbየናበሶጐምነሪና ⊲▷ﺩናበጜበሶኮጋና, በJΓ⊲ና∩▷የና, ⊲ልኮጋንሃLየσ ሁ≪L▷የና ዺዛሬጋ ለኆሲትናዛ⊲ምና Δጜጋኆሲምናገና ΔLናΓ▷Cኆሲምናገናጋ bሏCΓ. የፌነժምዮዮምን ▷የ▷ናርናጋΓ ▷ንትናሃናበ⊲ናምናገና ለՐ⊲ሁኣ▷የገና ፈናምነለሷትና b∩Lትና Cdየናዲናርበና ፈናርርጭበ/Lየም 1.

<u>۸٬۲۵۰۲ ۲۰ ۲۰ ۲۰ ۲۰۲۲ ۲۰</u>

Λ'ধՌ∿Ն ϷΡϷʹ·ϹʹϿϹ Ϸ'ϟʹͱʹϚͶϤʹ·ϭʹʹͿ· ΛՐϤႱ·ϞϷϟͿ· (ΡΑ) Ϥʹ⅌·ϟΔϟϚ ϧႶͺϟϚ ϷʹͽϷϟՐϤʹ℩ΛϷͺϿՈ· Δͺͺϲͺ·ʹ· Ϸ'ϟʹϟʹϚͶϤʹϭ·ʹͿϚ ΛՐϤႱ·ϞϷϟͿ· Ϥʹ⅌·ϹϷϟͰϟͿ· ϷΡϷʹ·ϹʹϿϹ ΡʹʹህʹϚΔϚ *(Ϛʹ·Ϲͺͺʹ >Ϥ*ͺ*ϲʹϯ*ʹͿϤͰͺͺͺϹʹϞʹϷϭ ⅆʹϞͿʹϚΔϚ *(Ϛʹ·Ϲͺͺ·ͺĹͺ·ϹͿΔ)* ΛϹʹϐʹϭ·ʹϒϚ ϤΡ·ͺϛͺʹϞϲϭ Ϸ'ϟʹϟʹϚͶϤʹϭ·ʹͿϚ ΔϭʹʹϞ (WAZ), ϤͰͺͺͺͺϼϹʹϞͿϲͺϤʹϯͰͺϯͽ Ϸ՚ϟʹϟʹϚͶϤʹϭ·ʹͿϚ ΛϹϤႱ·ϞϷϟͿ· ϤʹϷʹϹϘϟͰϟͿ· Ϲʹ·ϟϼʹϞϧ ΛϹʹϐʹϭϷϟϫϾ ϧϲͺʹʹϧϲϭʹϧϲʹʹϒϲϤʹϭʹͿϲ ΔϭʹϞϧ (ΕΑΖ).



4%J4" 1.** Δ&J=cn&J^c 4De M&J^c barlo% L=&&&"D" 7D&4J^c 4*CaΔ"?L&⁵J^c 4D"CD4F^c

<u> የትርነት ግለ የትላል የኮገሩሪያ ነር የትላል የ (URP)</u>

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- <u>UU2014, 2014</u>
- <u> የኮርተσላ፣ σ፣ J^c ▷ ቴ ▷ ነት ቦላ፣ በ^c ▷ σ ቴ Ե շ 2020/053</u>
- <u>ኄ⊳ኦኣъъъ́ ጋና ∩∩ፍነተL⊀ና 2020/072</u>
- <u>b∩Lσ⊳⊀^c 2020/024</u>

(የኮ~ቴናጋℾኮ በበናና/L⊀ና ኄጓሁነቭኄሁምዮና) ⊲ዛ∟ኌ ኄ⊿በቦ ኄ▷ኦLዹዮበበዮኄLኄし⊂ ጋ∿ႱႫႠႫႶኮ የኮ⊂∿し⊂

ለዖ፨ኣሏኦሩ (CAPP) ላዛሬ bበጐራ ጋቦኑ ጋምታኖ ርካያሳ ወዲቃዣ ልጭታ ውንን ቴብሶሩ (NFA) ላዛሬ ጋ ϷϒϷʹʹϾʹͽϽΓ ϧϽϞϟϧͶϔϚ (ΝϹ), ΔϞ϶ͻႱϟͷϽϷϞϚ ϷʹϐͱϟͰϟϚ ϤͺϤͶʹϞϧϚϽϚ ϤͰͺͻ ϷϫʹͶϹͼʹϒϚ ϷϒϷʹϚϚϽϹ ᢞᢣᡧ᠋ᢌᡝᠵ᠘᠊ᢄ᠆ᡔ᠆ᡐ᠆ᡐᢕᠮᡈ᠋᠆ᢤ᠆᠕᠆ᡐ᠘᠅ᠺ᠆᠉᠆᠅ᡩ᠙ᢣ᠘ᢞᠧ᠆ᢣ᠅ᡩᢁᡔ᠘᠆᠘᠆᠘᠆᠘᠆᠘᠆᠕᠆᠕᠆᠕᠆᠕᠆᠕᠆᠕᠆᠕᠆᠕᠆᠕ ለՐፈናል» (LRP), ፈኒጋናርኮ», bበLትϷϞና Δረኪጋበኄረሥናፕትና ኄጋበቦ ሥንትንለግቦንኮሥኪፈኄኒኒር ፈናምንረፈሎጋቦ» ሳር ላጋበ፣ ጋርሥ ንግራ ነው የትርብራ ይዮም ረብም (ABN) ለያው እስም የላይ እስም የትር ላጋ የትር የግር ላጋ የትር የ ⊲⊃∟⊳ຩ∿ჾ⊲≦∟∩ჼ຺

DPD5C5DFD74515A36515AC4U4D7J5497A256AL25D8678676

⊳r4⊽₀	⊲٩°๛∿لح ⊳٬ᢣ٬୳ʿ∩⊲ʻۍ٬⅃ʿ ∆ۍ∿ل (XAW)		وح [∞] ح∞لح ⊳،۶۰,۱ _۵ ۵۷ و.۲۲ و.۲۲ βαγ و.		
⊂⊃⊄⊽ _® ५۲₄₅	የትሮቴና∩ር⊳ኇና⅃ና ቴ⊳ንՐ⊲ናል⊳⊀ኈ ለՐ⊲ናልኑ (LRP) (40–>∖°)	ʿժ՟Ոነኇኁሏና ΛርኄነኇኁՐና ኄ⊳ኦՐবናልነ (USR)¹ (80->ነ∿)	የ՝ሮኈነበርኦኇኄነና ኈኦኦዮ⊲ናልኦናኈ ለቦ⊲ናል፦ (LRP) (40–>ኁ°)	ʿժ՟Ոነዏʻኣ∆՟ ∧ርቴʻም՞Ր՟ ኄ⊳ ትՐ ⊲ʻል՝ (USR)¹ (80->ኣ _՟)	
▶ ₽ ₽°℃°⊃Γ ₽°J°<Δ° <i>(<°℃∟°</i> > <i>⊲</i> ת <i>⊲⊂</i> ° [Pandalus borealis])	4,100 Δ ^t Cn [°] σ ^c * _Φ C [®]	8,200 Δ ¹ C [~] σ ⁻	15,800 Δ ^b Cn ^b φ ^c * <u>σ</u> Ċ ^b ln <i>d^cfL</i> t ^w (<i>d^cf-</i> Γ <i>d</i> ^c D ^b C <i>e^b</i> C ^c 6,800 Δ ^b Cn ^b φ ^c <i>d</i> D-fNCD-LD ^c D ^b 2009)	31,600 Δ°Cn [°] , ở ^c * ^J C [*] ln <i>4</i> 5/L t [*] (<i>4[*]r-</i> Γ <i>4</i> D [*] C <i>«</i> [*] l ^c 18,200 Δ [*] Cn [°] , ở ^c 4D- TICD-LD [*] D [*] 2009)	
Cʻ\ċʻ P°J°<∆ʻ (<i>≤́•C∟ʻ Ĺ•CJ∆</i> [Pandalus montagui])	12,300 Δ⁵⊂൩ ^ͺ ᡩ ^ϲ <i>*_ϘϹ[·]</i>	24,600 ∆°⊂∿°°	3,100 Δ°Cn°; ÷ ^c * <u>></u> Ċ [*] h <i>A</i> [*] / L t [*] (<i>A</i> [*] - Γ A [*] D [*] C « ⁴ l ^c 2,300 Δ ⁶ Cn [*] ÷ ^c A D - ⁶ D C - D [*] D [*] 2009)	6,100 Δ ⁵ Cn [®] ÷ ^C * _D Ċ [*] h <i>d</i> ⁵ L t [*] (<i>d</i> r- [*] r ^c D [*] C e [*] t ^C 6,100 Δ ⁵ Cn [®] ÷ ^C <i>d</i> D- [*] NCP-D ⁵ D [®] 2009)	

L 5021751811 Pt-2 2P22 200 50215100 50255100 5025510 502551 PU2 C2 (C2C2 > 201 c) <u>ダリン C55もP5つらかシくA5(<^C_5L*CJA) C ペテ タア・ロット もD255ねD t クリン ba *u もし もD255ねD t.</u>

▷՚ት՟ᡝᡃᡗ᠋ᠬ᠋ᠫᡝ᠊᠋᠋ᠳ᠋᠋᠋ᡏ᠘ᡔ᠋᠆ᡧ᠘᠋ᢣ᠖᠋ᠴ᠖ᠴᢩ᠆ᡅ᠆᠋ᢣ᠈ᡷ᠋᠈᠋ᡝᡗᡣ᠋ᠺ᠋᠋ᠮ᠋ᠳ᠋᠋᠄᠘ᡔ᠋ᡧ᠋(EAZ)᠘᠋᠋᠆ᡘ᠋ᡝᡗᢂ᠋ᡔᢗᢂ᠂ᡧ᠘᠅ᢕᡔ᠅ ᠋᠋᠋ᢐ᠋ᢄᢣ᠘ᢩ᠆ᡗ᠊ᠫᠴ᠋ᡗ᠆ᡧ᠘᠋᠕ᢉᡆ᠋ᠵ᠋ᢕᢣᡃᡄ᠋᠋᠋ᡬᡀ᠋ᡗᡬ᠋᠋ᡗ᠘ᡩ᠋᠋᠋᠋᠋᠋ᠻᡝ᠋᠋ᠫ᠋᠋᠋ᡝ᠘ᡩ᠂᠋᠋ᢐ᠌ᡅ᠋ᢣ᠘᠈ᢣᢗᢕᠳᡐᡗᢕ᠋ᢛᡃ᠈ᡩᡄ᠋᠋ᡃ᠋ᡗᢂᢞᡁᠥ.

*ዄ_∆~∿し*σ℃

Ρ'~ጜ'ՈCϷσ'J' ጜϷትՐՎ'&ϷϞ' ΛՐՎ'&՝ (LRP) Δ/LΓ'>Ϸ`LC ϤϽ~ʻՈCϷ/Lσ`Ր`σ' Ϥ'L그 ϤϽΔ`~`σϤ'⊃Ո' የ/Ϥσ Ϥ'₽ՐϤ'CϷ֊Ϸ'Ո՟⊃Ր Δ'Ե⊃~ሲσ'J' ΔL'ΓϷϹ~ሲσ'J'-Ͽ Ե~CΓ P'~ተσϤ'Ո`Ր`ͽິ. CΔLΔՈ-ͻͿ, Ϥ'₽'/֊Ϸ`Ր՟ጋ՟ ϷϽ~ʻd'Ϸ∀σ'Ͽ`ϭϚ Λ~ረ֊Ϸ`Ր՟ጋ՟ ͽ~ቃ'Γ ϷL+~ሲት'd՟ͽና ϤϷ֊՟ՈσჼJ' ԵՈLት՟ Ϥ'Lͻ ͽ~ል'Γ ΔL'ΓϷϹ~ሲት'tϤ'd՟ ԵՈLት՟Ր՟, Ϸ«Ͽ՟σ՟ ϷΡϷ՟Ϲ՟ϽΓ Ρ՟ህ՟<Δ՟ ϷʹϐϷነትՐϤʻՈ՟ ԵՈLት՟Ր՟ (NSAC) ϷL+Δ՟ Γ[\]\ລ^c.

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ΔͺͺΓϟϞͺ LΔ 2020 ϷͺͺϹΓ ϷʹϲϟϭͺϤʹϭʹϤʹϷʹϷϷʹϷϒϤʹϺϚ ΛͺϫͺͰϐͺϞͺ ϷΓϷϷϷʹͼͺϤϷͺͺϭͺϷͺͺϪͺϐͺ϶ϲͺϭͺʹϤ ΔL ΓϷϹϲͺͺϭʹͿ·ͺͻͺϷͺͺϹͳϷʹϲϯϭͺϤʹϺʹϒϚͺϽϞϯϛͺϷʹϚʹʹϤϚϺϭͼʹϞΔϚ ΛϹʹϐʹϭʹϒϚʹ ϐϷϷϒϲϤʹϐͼ (USR) ΛϹʹϐʹϭʹϒϚͺϤϷʹͺͺʹϤϲ ϷʹϷʹϒʹϟϚͶϤʹϭϛʹͿϚ ϪϭʹϞͺ (WAZ) ϤʹLͺͻͺͺϼϹʹϞͿͺϤʹϚϹϷͺͻϺͼʹϤϹϷʹϛϪϚ ΛϹʹϐʹϭʹϓϚ ϐϷϷϒϲϤʹϐͼͺϒϹϚϿͼʹ·ϲʹϷͺϫͺϞͺϲϷϷʹϷʹϒ;ʹϒϲͶϤʹϭϛʹͿϚ ϪϭʹϞͺ (EAZ). ʹϤϚϺͼϭʹϞΔϚ ΛϹʹϐʹϭʹϒϚʹϐϷϷϒϹϤʹϐͼ (USR) ϽϞʹϚϷϹϷϛͺϷϚͳ;ʹϐϿͻͻϛͼʹϷϲͺϷϞͺϲʹϲϷʹϞϹʹϷʹϞϹʹϿʹͼʹϷʹϚʹʹϲϤϞʹϲ ΛϹʹϐʹϭʹϒϚʹϷϫʹϒϲ (SSB) ʹϐʹϞͿ·ϳʹϞϛϫϒϚ (ͶϹϚ;ʹͰϛʹϞ

₽₽₽ 'C'ጋГ Þ'≯'⁄'∩*ঝ'*&'J' ۸ſঝĿ'\₽₹J' ┥ं₽'∕∆` 6∩L}' ₽'6₽/%'&'~^^

ለቦላ፣ር⊳የ•፝፝፝ዹኁጋና ዾጜዾጘዾ֊ጏቡי ዺ፟ቝነላሏኑና bበLኦግዮ፝፝፝፝፝ጏና ለጜተዾበኍጏJ ኄናበነኇኁሏና ለርዄናኇግና ጜዾኦቦላናል፦ (USR) 70->ኣ፦ ዾLየኇግና ዾ፝ጜር፟፟፟፟ጏ፟ጚናጋ፝፝፝ ር፝፝፝ዺጜሮ ፚናኇዾናሩ፦‹‹‹ ላና ለርዄናኇግና ዾ፝፝ጏበቦኇግና (SSB) ዄዾኦLነጚርኦናና ጜ፟ጜጛ፟፟፟፟ጜ፟፟፟፝ጜ፟ኇ፟ጚና. ፚዹ፟ጘና bበLኑና ጋነተናፈዾኁጋና ዻልነጋናጏJ (2 ዾዺኌ፞ኇ፞ኇ 3) ፚናኇዾናሩ፦‹‹‹‹‹‹ ለርዄናኇግና ዾኌናሰቦኇግና (SSB) ላጋናርዾጏኇ ጋዮተዾLነጚርዾኇዻኄና ለርዄናኇጘና ዄዾፚኆ፞ጜኇ፟ጘና ላይ፞ጏጚና ዾነንናተናበላናኇጌና

L ్ ఎ దిక్ ఎ ్ దె ్ వి కి వి స్టార్ స్ సా కి స్టార్ స్ (DFO) సిఫిస్ గి ది కా కి సిని రిల్లి, రా స్టార్ స్లిప్ స్టార్ స్లార్ స్ల సారాల్ స్లార్ స్లార్ స్లార్ స్లార్ స్లార్ స్లార్ స్లార్ స్లార్ స్లార్లాల్ స్లార్ స్లార్ స్లార్ స్లార్ స్లార్ స్ల సారాల్ స్లార్ స్లార్ స్లార్ స్లార్ స్లార్ స్లార్ స్లార్ స్లార్ స్లార్ స్లార్ల్ స్లార్ స్లార్ స్లార్ స్లార్ స్లార్ స్లార్ స

<u>۵۴٫۵٫۲۵ ۲۰ ۵٬۵۰۵ ۵٬۹۰۵ ۲۰ ۲۰۵٬ ۵۰۲ ۵۰</u>

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దరా∿ు (EAZ) ⊲్Lు ⊲⊃ద్ద్రార్ రిగంగ్ రోగింగ్ రంగింగి.

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Δ_

ለሮዬራሳሪ ምንطጋንኮባለ ጊ'ምራንሆውንሳይ የትግዮ የሚኖት ግዮ የሚኖት ግዮ የሚኖት ግዮ የሚኖት ግዮ የሚኖት ግር እስለ የእስ እስ እ ρʰ᠆∿υ, ϤϞLϿ Λϧኪ⊲ቴシៃም∿υ ቴϷϡͰΔͼʹϽͽϤ· ϤϚͿϹͺϹ ϷͶ·ͻϹϚ ΛϧϷϞ·ϫͼͽϫʹϹʹϷϪͽͷϹϷϞϲ (DAT) ϐͷϽͶϳͼͽϓϹ.

ዮህ፦<፣Γኮ ጋኮ/ናϷብ ኣዦርϷ∟Ϸናጋዀ σ₽⊲₽°ዹናンቡ ፚለፐሪካϷጋው ϷΓፋ ∨ር₽የሀቢውምር ⊲ጋው ዮብ<<∇ የሀ< (EAZ) ዻጋንር ዾጏኇ Γየትርተሻና በር ሥት ግር ነት የትርት ግር የትግር የስር የትግር የስር የትግር የስር የእንደ የስር የትግር የእንደ የስር የ የ የ የ የ የ የ የ የ ᠂ᠣ᠘᠌ᠠᢄ᠂ᡧ᠆᠘᠖᠘᠆᠘᠆᠕᠆᠕᠆᠕᠆᠘᠆᠖᠘᠆᠙᠆᠕᠆᠘᠆᠖᠘᠆᠙᠘᠆᠙᠘᠆᠙᠘᠆᠕᠆᠘᠆᠘᠘᠆᠕᠆᠕᠆᠕᠆᠘᠆᠘ ᠈ᡣᡄ᠈ᠳᡆ᠂ᡣᡄ᠈ᢞᠬᢕᢦ᠈ᡩ᠆᠒ᢣ᠆ᠴᢉ᠅ᡆᢕᡧ᠋ᠴᢕᢞ᠆᠘᠂᠌ᢓ᠋ᡔ᠘ᢞᡆ᠋ᠫ᠈ᡩᠴᢕᢤ᠘᠆᠕᠘ᢞ᠕᠋ᠴᢤ᠘᠆ᢧ᠕᠅᠕᠘᠉᠕᠆᠕᠘᠂᠕᠘᠕᠘

 4 Lጋ bፈፈኒԺ Ϸⁱኦ፤ሩበላ፣ም፤ና ፊምኒ (EAZ). Δኄጋኒሥበ▷ሩ ▷ኄረ▷፣ጋና ጋናኒ▷ላናለኦ▷ኄናር፣ምኅና

᠘᠋᠋᠆᠋᠋᠋ᡃ᠆᠘ᡩ᠕᠖ᠴ᠈᠊ᢕᠵᡲ᠂᠘᠋᠋ᡩ᠉ᢕᠵᡲ᠂ᡬ᠋᠋᠋ᢉᢕᢣᠴ᠋᠋ᡬ᠘᠋ᡬ᠘᠋᠘᠘ᡬ᠕ᢉᡏ᠘ᢕᠴᠥ᠊᠘᠋ᡃᠯᠵᠴᡄ᠘ᢞᡬ᠋ ስር-ንምንታላታሪ ነት ግራ እንግረ የግራ እንግረ የግራ እንግረ የግራ እንግረ የግራ እንግለ የእግራ እስግለ እንግለ

ለታሥት ሚንምንትና ፈቴጋግርሥትና (TAC) ብጋም የሚትረልና ክብት መስከት የአውረም. ፊ/ደር አውሮ በ እስት የሰብ እስት የሰብ እስት የሰብ እስት የሰብ እስት እስት እስት እስ

<i%P`/Δ`> b

ΓΡ°-Γ<

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Ხ∩Lك[∿]Ր°ഛ^ϲ Ճ≫൙Կℾ Ხ∩L൙⊲⁵൙∿Ր°൙.

ዄዾፚ፝፝፝፝፝፝ዾዾዾዀ

Ϸ₽ϷʹϹʹϽΓ Ϸʹϟʹϟʹ**Λ**⋖ʹϖʹʹͿʹ ΛΓ**Ϥ**Ⴑ·**ϞϷ**ϯͿʹ Ϥʹ**Ϋ·**ϟΔϟʹ ϧΛLϟʹ ϷʹͽϷϟʹͽʹϻʹʹ

 $\Delta^{6} \Box_{n} = \Delta^{6} \Box_{n} =$

<u>ለኄር ለርፈኒፈንዮ</u>

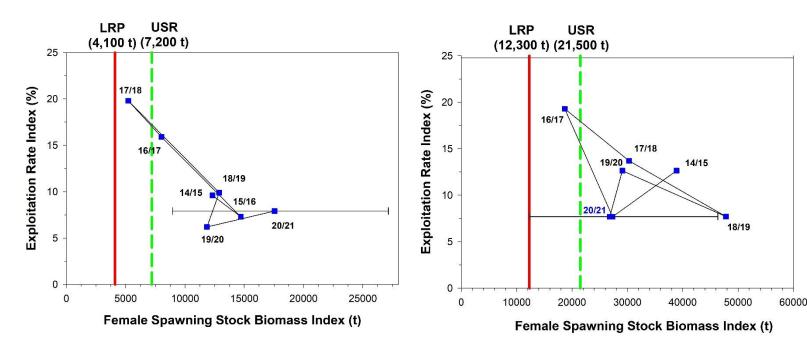
Δኄጏርኪኇኄ፟፟፟፝」^c Δሬናር (DFO) Δሬርኑኦላሪ

$$\begin{split} \mathsf{(PDn^{b} LHD\sigma} (\mathsf{PL} d\sigma \mathsf{(PC} d\mathsf{PC}^{b} \mathsf{(PC} \sigma^{b} \mathsf{(PC}^{c}), \mathsf{(QD}^{c})) & d \mathsf{(D} \mathsf{(PC}^{c}) \mathsf{(PL} d\sigma \mathsf{(QD}^{c}) \mathsf{(PL} d\sigma \mathsf{(PC}^{c})) & d \mathsf{(PC}^{c}) \mathsf{(PL} d\sigma \mathsf{(PC}^{c}) \mathsf{(PC}^{c}) \mathsf{(PC}^{c}) \mathsf{(PC}^{c}) \mathsf{(PC}^{c}) & d \mathsf{(PC}^{c}) \mathsf{(PC}^{c}) \mathsf{(PC}^{c}) \mathsf{(PC}^{c}) \\ \dot{\sigma} \mathsf{(QC}^{c}) (\mathsf{PL} d\sigma \mathsf{(PC}^{c} \mathsf{(QD}^{c}) \mathsf{(PC}^{c}) \mathsf{(PC}^{c}) \mathsf{(PC}^{c})) \\ \dot{\sigma} \mathsf{(QC}^{c}) (\mathsf{PL} d\sigma \mathsf{(PC}^{c}) \mathsf{(PC}^{c}) \mathsf{(PC}^{c}) \mathsf{(PC}^{c})) \\ \dot{\sigma} \mathsf{(PC}^{c}) (\mathsf{PL} d\sigma \mathsf{(PC}^{c}) \mathsf{(PC}^{c}) \mathsf{(PC}^{c})) \\ \dot{\sigma} \mathsf{(PC}^{c}) (\mathsf{PL} d\sigma \mathsf{(PC}^{c}) \mathsf{(PC}^{c}) \mathsf{(PC}^{c})) \\ \dot{\sigma} \mathsf{(PC}^{c}) (\mathsf{PC}^{c}) (\mathsf{PC}^{c}) \mathsf{(PC}^{c}) \mathsf{(PC}^{c})) \\ \dot{\sigma} \mathsf{(PC}^{c}) (\mathsf{PC}^{c}) (\mathsf{PC}^{c}) \mathsf{(PC}^{c}) \mathsf{(PC}^{c}) \mathsf{(PC}^{c}) \mathsf{(PC}^{c}) \mathsf{(PC}^{c}) \\ \dot{\sigma} \mathsf{(PC}^{c}) (\mathsf{PC}^{c}) \mathsf{(PC}^{c}) \mathsf{(PC}^{c}) \mathsf{(PC}^{c}) \mathsf{(PC}^{c}) \mathsf{(PC}^{c}) \\ \dot{\sigma} \mathsf{(PC}^{c}) \mathsf{(PC}^{c}) \mathsf{(PC}^{c}) \mathsf{(PC}^{c}) \mathsf{(PC}^{c}) \\ \dot{\sigma} \mathsf{(PC}^{c}) \mathsf{(PC}^{c}) \mathsf{(PC}^{c}) \mathsf{(PC}^{c}) \mathsf{(PC}^{c}) \mathsf{(PC}^{c}) \\ \dot{\sigma} \mathsf{(PC}^{c}) \mathsf{(PC}^{c}) \mathsf{(PC}^{c}) \mathsf{(PC}^{c}) \mathsf{(PC}^{c}) \mathsf{(PC}^{c}) \\ \dot{\sigma} \mathsf{(PC}^{c}) \mathsf{(PC}^{c}) \mathsf{(PC}^{c}) \mathsf{(PC}^{c}) \mathsf{(PC}^{c}) \\ \dot{\sigma} \mathsf{(PC}^{c}) \mathsf{(PC}^{c}) \mathsf{(PC}^{c}) \mathsf{(PC}^{c}) \mathsf{(PC}^{c}) \\ \dot{\sigma} \mathsf{(PC}^{c}) \mathsf{(PC}^{c}) \mathsf{(PC}^{c}) \\ \dot{\sigma} \mathsf{$$

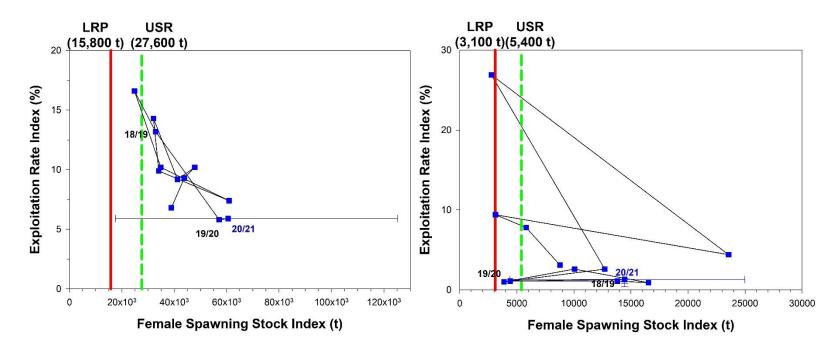
C«∿ὑ°Ր°⊃°−Δኈͻϲռσՙ⅃° ΔLՙΓϷϹϲռσՙ⅃·ͻ ϧͽϹΓ (DFO)

 $P = L^{b} - L^{b} (D = A^{b} T \Delta L^{c} T P C = C + A^{b} + A^{b} + A^{c} + A^{b} +$

Ե∩L ℱ Ն ⊂∆ን⊳ℱ Ն	⊲ ⊃∞C⊳ ⊀L⊀ [₋]	৸ঢ়৸ৼ৾ৼ৾৸ঀ৾৾৾	ک⁺∟ ک 'L ک'L ک'د
፞ ነት ግ ዮ ም ነለ የ	ንጉ~ጋ" ጋሌ ጋላላ ማሥረ ማሥረ ማ	⊲ℙℶ"Ⴑჾ	₠∩₠₫৽, ል୭⊲⊾ 18
ኄ⊳ኦՐ⊲ናልካ (USR) 4:	⊲୳L⊃∆℅⊃'⊂⊳⊀╴⊲ಁ⅌'⊂⊳≀ഛ	⊳,۶Հ⊾∪∿⊅Շ,۲Հ,۵⊲չ	
٩ ٣, ٣, ٩٩, ٩٩, ٩٩, ٩٩, ٩٩, ٩٩, ٩٩, ٩٩, ٩٩		(WAZ) ⊲୳L೨ Ხെ∿െ∿৮	1 ⊳°ഛ\°d⁻ – 3 ⊳°ഛ\°d⁻
د.L (EAZ) ⊲۲	(<̈́>⊲∿⊲̈́⊂, + F̄°CJV)	⊳٬ᢣ᠈ᡗᡗ᠋ᠬ᠋ᢒ᠋ᠮᠴᢄ᠘ᠴ᠈᠙	Ե <u>գ</u> ∿գ⊳ ^ϲ ΔԵհ∿Ն (ΔԵհԿ ԼԴԿ)
⊲₽°ح°̇̀ບσ ⊳́'≯ʻłč∩⊲ʻσʻJʻ		(EAZ)	
Δσ ^ͺ ·L (WAZ) Λርኄናምዮ ⁻			
ʹϭ ^ϲ Ո ^ͱ σʹϞΔ ^ϲ ΛϹʹϧʹϭ _ʹ Ϲ ^ϲ	ንጉ~ጋ" ጋሌ አዮባፋላፊ ነበር ፈትላዊ ላ	⊲ℙℶ℆Ⴑჾ	⊳-ఎ⊃∆ిఒి, శి>⊲∿ 5
ኄ⊳ን∟⊲ _የ ♥, (NSB) 3:	(>⊲∿q⊂, + FeCJQ)	Ϸ᠈ᢣ᠈ᢞ᠋ᢕ᠋᠋ᠫᡃ᠋ᠶ᠘ᠴᡐ᠋	
₽₽~₽£₽₽₽,4,4⊂₽		(WAZ) ⊲ԿL೨ Եգ [∿] գ [∿] Նσ	9 ⊳∹₀qc –
د.L (EAZ) ⊲۲		Ϸ᠈ᢣ᠈ᡝᡄ᠋ᢉᢦ᠋ᡃᠳ᠋ᡗ᠘ᠴᡧ	11 ⊳≟ [⊾] d [⊂] ba [∿] a⊃ [⊂] ∆bհ∿
⊲₽∘ ~∿∪⊂ ⊳'≯ՙłິ∩⊲'൳'⅃ິ		(EAZ)	(ΔbϚ ^ኑ Lሥ)
Δσ [~] し (WAZ) Λርኄ፞ኇ [、] Րິ			
՟ ժ՟Ո ՟ ምՙኣΔ՟ ለርʹቴ ՟ ም ՟ Ր՟	ᢄ᠈ᢕ᠈ᢕᡐᡩᡄ᠅᠋ᢕ	⊲ℙ℩ℶ℠Ⴑσ	⊳-ב⊃∆⁵פל, אם⊲ת 15
ኄ⊳ኦՐ⊲ናልኑ (USR) 2:	USR (>⊲r.Jc' + L°⊂J∆)	Ϸ᠈ᢣ᠈ᡃᡄ᠋∩⊲ᡃᠳ᠋ᡗ᠘᠋ᠴᡧ	10 ⊳≟°d ^c – 12 ⊳°ഛ\°d ^c
₽₽ _~ ₽ _~ ٢٩ ⊳,۶۷ ₋ ∪۵ ۵,۹ ۵		(WAZ) ⊲୳L೨ Ხെ∿െ∿৮	Ե <u>գ</u> ∿գ⊳ ^ϲ ΔԵϚ ^₅ Ն (ΔԵϚંԿ L₽৬)
د.L (EAZ) ⊲۲		Ϸ᠈ᢣ᠈ᡝᡄ᠋ᢉᢦ᠋ᡃᠳ᠋ᡗ᠘ᠴᡧ	
⊲₽₅ᠳ _╱ ᡣᡄ᠊ᠵ᠈ᢣ᠋᠈ᡪᡕᡄ᠐⊲ᡕᡄᡕ᠋		(EAZ)	
Δσ∿ し (WAZ) Λ Ϲʹ ϧ ʹ σ ℃Ր ^ϲ			
ʹd ^ϲ Ոነ <mark></mark> σՙኣΔ ^ϲ ለϹʹ <mark></mark> ϧʹ <mark>ϲ</mark> ͺ	᠈ᢕ᠈᠆᠘᠅᠘ᠫ᠈ᢂ᠆᠕᠆ᠺ᠕᠆᠕	<u></u>	∿ ביל לי
ቴ⊳ ትՐ ⊲ናልካ (USR) 1:	USR (>⊲₁.ḋִ-' + Ű⊂JΔ)	Ϸ᠈ᢣ᠈ᢞ᠋ᢕ᠋ᠫ᠋ᡃᡉ᠘ᠴᢩ᠘	
₽₢~₢~₽₼₰₺₰₽₽₽		(EAZ)	10 ⊳≟⁰d⊆ – 12 ⊳≏⊿∿d⊆
Δσ ^ኈ し (EAZ) ለርኄ፞ኇ ^ͺ ዮິ			Ե <u>գ</u> ∿գ⊳ ^ϲ ΔԵϚ ^₅ Ն (ΔԵϚં՝ Լ ₽՝)
ʹ Ϳʹʹ ϘʹʹͿϽϭͺ ^ͻ ͻϒʹ	▷᠖ᠵᡗᢈ᠋ᠴᠦ: ᠖ᠴ᠘᠆᠋᠋᠋᠋᠘᠆᠋᠋	⊲ℙℶ℆Ե	^ւ ՔՈւզ, Սհ∨Մ 12
ቴ⊳ት∟⊲₂♥ (N SB)	ᡖᡆ᠋ᢗ᠋ᡏ᠊᠋ᡗᡃᡄ᠋ᡝᠳᡐ᠋ᡝ᠋ᠴ᠋	Ϸ᠈ᢣ᠋᠈ᢞᢕ᠋᠋ᠫ᠋᠂᠘᠋ᠴ᠋᠋᠂᠘ᠴ᠋᠋	
₽₰⊃₽₅⊄₽ҁ	ዾኈዾኁኯጏጚዀዾዀ	(WAZ) ⊲⁴L೨ ხ௳ [∿] ௳ [∿] სთ	10 ⊃ביּל־ – 12 ⊳•ם/יל־
	Δ ^ւ ϷϥϪϟͽϤͿϧϲͺϧϧϲ	Ϸ᠈ᢣ᠋ᡗᡊᢀᡃᠳ᠘᠆᠘ᡔᡧ	Ե <u>գ</u> ∿գ⊳ ^ϲ ΔԵϚ ^₅ Ն (ΔԵϚં՝ Լ ₽՝)
		(EAZ)	
	▷⁵᠔▷ィ▷᠋ᢖ᠊᠘ィ᠘ᢉ᠈▷᠈ᡕ⊲᠆ᢩ		
	∧ు⊲్రాో USR		
۲,۵۵,۵∪,۲,۶,۹ ב,,⊃, ۵⊌	ጋ [⊷] ᲡለՐ⊆⊂ቃ∿Ს NPAWG:	⊲ℙ℩ℶ℠Ⴑσ	مە∟ ئ'ئ ھ∧∩ 30
⋎∟⊲Րѧ۲⊳₄٦╴⊲ฺѩႇᡪ⊽⋟ℴ	∩∩հℯ₅۲۲₄⊂ ⊃⊾ๅ⊲๖∪₅Ն	᠔᠈ᢣ᠈ᡃᡄ᠋᠋᠕᠆ᡏ᠊᠈᠆᠘ᡔᡐ᠘	
Ե∩Lት⁻ (NPAWG) Ե∩Lℱ℉		(WAZ) ⊲ԿL೨ Եℶ∿ℶ∿ՆԾ	10 ⊳≟°d ^c – 12 ⊳⊶م5°d ^c
	ᡆ᠋ᠴᡆ᠘᠋᠋ᡗ᠋ᡔᢦ᠊᠋᠆ᡗ᠆ᡐᠵ᠋ᡗ᠋ᠴ	᠈᠈᠈᠂᠘᠂ᡔ᠈ᢣ᠈ᢣ	Ե <u>գ</u> ∿գ⊳ҁ ∇₽ _℃ (∇₽ϟ₀ ۲5₀)
	᠕ᡗᢦ᠋᠋᠋ᡣᡗᡊᢑ᠋᠉᠄᠋ᡬᡃᢪ᠋ᢕᠵ᠆ᡃᡶ	(EAZ)	
	ᡆ᠘ᡃᡄᢉᢦ᠋᠋᠋᠋ᢛ᠈᠘ᢣᡃᢛ: ᠌ᡃᠥᡆᢗ᠋᠋		
	᠈ᡣ᠈᠌᠋ᢙ᠈ᡩᢂᠫ᠘᠄ᡆ᠈᠊ᠣᢂ᠆		
	∧ፈሥል∿Ⴑ ∆ዄፈ∆۶ዄ∩Ր ^൳		
	᠋ᡩ᠋ᡏ᠋᠋᠋ᡔᢞ᠘ᡄᢞ᠋᠋᠂᠋ᡗᢞ᠋᠆ᡗ᠆ᢡ		
	(LRP ⊲୳L⊃ USR)		



 $\begin{array}{l} \textbf{4'} \overset{\bullet}{J} \textbf{4'} L \rightarrow 2. \ \textit{o} \ \textit{C'} \ \textit{d}^{\diamond} \ \textit{P'} \ \textit{C} \ \textit{A'} \ \overset{\bullet}{J} \ \textit{C} \ \textit{C} \ \overset{\bullet}{J} \ \overset{\bullet}{J$



 $\begin{array}{l} \textbf{4}^{*} \forall \textbf{4}^{*} \textbf{3} \textbf{4}^{*} \Delta \textbf{5} = \textbf{4}^{*} \Delta \textbf{5}^{*} D^{*} P^{+} \mathbb{B}^{*} \Omega^{*} \Omega^{+} \Delta \textbf{5}^{*} \Delta \textbf{5}$

PA ቴኮኦቦ⊲ናል°Րና Ϸժഛъ WAZ ϤʹL EAZ ቴኮኦኣዬርኮኦዮσሲ⊲ርሶ ⊲Γϟσ°Ր°ഛና ⊲ጋዬርኮላ°ฉዬጋና ኣዬዖዬበርኮታσ Ϸ°«೨°ጵና ቴኴሏ೨ቴናርኮበσ°Րና ዖህና<ምና ዖህሮኮናምዮቦ՞ഛና Ϥ՛L Ϥ«በሮሲσናታና Ϸ°«೨°ጵና Ϥ«በ°Ⴑഛና ለነተበቴዬበናበተና ቂ՛Lናዬጋምና ኣዬዖዬበርኮጋበ ቴኮኦስናበታበኮጋበ ዖህና<Ճና ቴኮኦኣዬርኮምዮቦ՞ഛና.

- ላ'L 6,100 t (ላ/ነት የናጋም), ጋ የ Γ ሲ ና በ ュ Γ ና.
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Fisheries and Oceans Canada

Pêches et Océans Canada

Ecosystems and Oceans Science Sciences des écosystèmes et des océans

Central and Arctic Region

Canadian Science Advisory Secretariat Science Advisory Report 2020/053

SCIENCE ADVICE ON LIMIT REFERENCE POINTS FOR NORTHERN SHRIMP (*PANDALUS BOREALIS*) AND STRIPED SHRIMP (*PANDALUS MONTAGUI*) IN THE EASTERN AND WESTERN ASSESSMENT ZONES



Top: Northern Shrimp (Pandalus borealis) *Bottom: Striped Shrimp* (Pandalus montagui) *Photo: Fisheries Oceans Canada, Newfoundland and Labrador Region.*

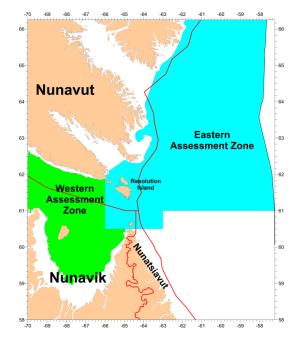


Figure 1. Eastern and Western Assessment Zones for shrimp fisheries in Arctic Region. Boundaries of the Nunavut, Nunavik and Nunatsiavut land claim areas are shown in red.

Context:

Fisheries and Oceans Canada's Fishery Decision-Making Framework Incorporating the Precautionary Approach describes a framework where reference points and harvest decision rules are used to make fisheries management decisions. The limit reference point (LRP) represents the stock status below which serious harm is likely occurring to the stock. The LRP is established based on biological criteria by Fisheries and Oceans Canada (DFO) Science. The Upper Stock Reference (USR) divides the Healthy Zone from the Cautious Zone and is established by DFO Resource Management in consultation with co-management partners, provincial and territorial governments, industry, and DFO Science, to enact harvest decision rules.

Since the reorganization of the Northern Shrimp (Pandalus borealis) and Striped Shrimp (P. montagui) surveys conducted in the Arctic Region in 2014, the joint DFO-Northern Shrimp Research Foundation survey has covered the Western Assessment Zone (WAZ) and Eastern Assessment Zone (EAZ) survey areas annually with the same ship and gear (DFO 2020a). LRPs for the WAZ were developed in 2013, however, the restart of the time series in 2014 means they are no longer valid (DFO 2018a). Data points acquired since the new survey began will therefore be used to establish new reference points for



the WAZ. Reference points will also be updated for the EAZ since the original points were calculated from only three surveys (Siferd 2015), which no longer correspond to the assessment area boundaries (DFO 2019a).

DFO Resource Management has requested that Science establish LRPs consistent with the Precautionary Approach (PA) framework for Northern Shrimp and Striped Shrimp in order to determine the point below which serious harm may be occurring to the stock (i.e., the Critical Zone), and propose an USR. This Science Advisory Report is from the May 12–13, 2020 Meeting on Science Advice on Limit Reference Points for Northern Shrimp, Pandalus borealis, and Striped Shrimp, Pandalus montagui, in the Eastern and Western Assessment Zones. Additional publications from this meeting will be posted on the <u>Fisheries and Oceans Canada (DFO) Science Advisory Schedule</u> as they become available.

SUMMARY

- The Precautionary Approach (PA) Framework for the Eastern Assessment Zone (EAZ) was
 established in 2009 on the basis of 3 years of survey data and the results of the *Precautionary Approach Workshop on Canadian Shrimp and Prawn Stocks and Fisheries*(DFO 2009b). The Western Assessment Zone (WAZ) PA Framework was deferred because
 of changes to the survey design in 2014 that reset the survey time series. The goals of this
 meeting were to establish the Limit Reference Point (LRP) and propose an Upper Stock
 Reference point (USR) for the WAZ and update the existing reference points for the EAZ.
- LRPs for Northern Shrimp (*Pandalus borealis*) and Striped Shrimp (*P. montagui*) in both the WAZ and EAZ are newly established as 40%, and the proposed USRs as 80%, of the geometric mean of the spawning stock biomass (SSB) index. These calculations are consistent with guidance in the DFO PA Policy.
- In the WAZ, the newly established LRPs for Northern Shrimp (4,100 t) and Striped Shrimp (12,300 t) are based on a 6-year time series (2014–2019). Similarly, a newly proposed USR is provided for each species (8,200 and 24,600 t, respectively).
- In the EAZ, the updated LRP for Northern Shrimp (increase to 15,800 from 6,800 t) and the proposed USR (increase to 31,600 from 18,200 t) are based on an 11-year time series (2009–2019). Re-calculation of the LRP and proposed USR for Striped Shrimp in the EAZ resulted in 3,100 t (increase from 2,300 t) and 6,100 t (no change), respectively.
- The LRPs and proposed USRs are based on the best available scientific information, but do not incorporate environmental or ecosystem factors into their calculations. Information pertaining to these metrics are lacking.
- The PA reference points for the WAZ and EAZ should be re-examined when a population model is developed or relationships between stock productivity and environmental or ecosystem factors are sufficiently developed to inform stock assessments.

BACKGROUND

Canadian Precautionary Approach Framework and Limit Reference Points

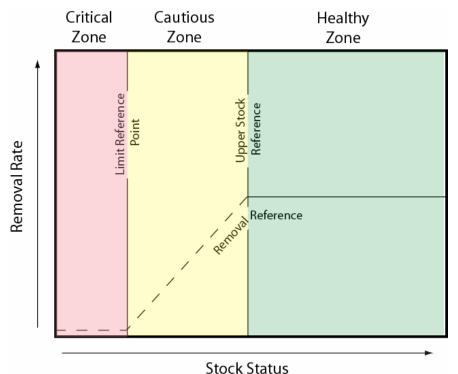
In 2009, Fisheries and Oceans Canada (DFO) published the <u>Sustainable Fisheries Framework</u> that provides the basis for ensuring Canadian fisheries are conducted in a manner which supports conservation and sustainability. The framework is comprised of a number of policies for the conservation and sustainable use of fisheries resources including "<u>A Fishery Decision-Making Framework Incorporating the Precautionary Approach</u>" (DFO 2009a). The Precautionary

Approach (PA) Policy applies where decisions on harvest strategies or harvest rates for a stock are taken to determine Total Allowable Catch (TAC) or other measures to control harvests. This is the case for Northern Shrimp (*Pandalus borealis*) and Striped Shrimp (*P. montagui*) stocks.

There are three components to the general decision framework for the PA:

- 1. Reference points and stock status zones;
- 2. Harvest strategy and harvest decision rules; and,
- 3. The need to take into account uncertainty and risk when developing reference points and developing and implementing decision rules.

The first component of the PA framework, reference points and status zones, is the subject of this advisory report. The PA is divided into three stock status zones: the Healthy, Cautious and Critical Zones (Figure 2). The Upper Stock Reference (USR) divides the Healthy Zone from the Cautious Zone and the Limit Reference Point (LRP) divides the Cautious Zone from the Critical Zone.





The LRP is defined as the stock status *below which serious harm is being done to the stock*. However, a challenge in setting an LRP is identifying the threshold of where and when '*serious harm*' occurs to the stock. This threshold is approximated based on the best available information, below which validation is exactly the situation to be avoided. LRPs are based on biological criteria and are established by DFO Science. In the Critical Zone, conservation/biological considerations are meant to be the primary drivers for management decision-making (as opposed to socio-economic factors) and there is to be no tolerance for preventable declines as the primary goal is to rebuild the stock out of the critical zone. Management actions pertaining to this zone are to promote stock growth and removals are to be kept to the lowest possible level regardless of the stock trajectory. When establishing an LRP, the guidelines advise choosing a stock metric that can account for changing productivity, generally the spawning stock biomass. An LRP should be determined by accounting for periods of high and low productivity over as long a time-series as possible, and based on the best information available on stock biology and fishery characteristics while acknowledging limitations of the data. However, in some cases there may be insufficient information on which to base choices of stock-specific precautionary reference points and harvest rules. In these instances, DFO has a guideline of 40% LRP and 80% USR. The PA Policy states:

"In cases where insufficient stock-specific information is available, these reference points may be considered as the best available guidance for management and for assessing the stock in relation to sustainability. Actual reference points for a stock may use other metrics and be set lower or higher than these references but should be demonstrably appropriate for the stock and be consistent with the intent of the PA."

Furthermore, while reference points should be reviewed periodically, neither the timeframe nor the triggers for review are specified in the PA Policy. Given that reference points have not been previously proposed for Northern Shrimp and Striped Shrimp in the Western Assessment Zone (WAZ; Figure 1) and that the current reference points in the Eastern Assessment Zone (EAZ) have been in place since 2009 (DFO 2009b), Resource Management has requested a review of the LRPs, and their rationales, to be carried out for these stocks.

Species Biology

Northern Shrimp is found in the Northwest Atlantic from Baffin Bay to the Gulf of Maine, while Striped Shrimp is found from Davis Strait south to the Bay of Fundy.

Both species of shrimp are protandric hermaphrodites. They function as males early in their lives then change sex and reproduce as females for the remainder of their lives. Females usually produce eggs once a year in the late summer-fall and carry them, attached to their abdomen, through the winter until the spring, when they hatch. Newly hatched shrimp spend three to four months as pelagic larvae. At the end of this period they settle at the bottom and take up the life style of the adults.

Recent research by Le Corre (2019, 2020) on the connectivity of management units via shrimp larval drift found that virtually the entire population of Northern Shrimp along the Canadian Atlantic coast (from Baffin Bay to the Scotian Shelf) is connected through larval drift processes with variable retention success in a given management zone. Also, larval drift was found to promote genetic homogeneity in areas with strong currents (Jorde et al. 2015). These findings improved our understanding of recruitment mechanisms and may in the future help to inform management of Canadian shrimp stocks.

Shrimp lifespan is uncertain but shrimp in the north are thought to live five to eight years. Growth rates and maturation are likely slower in the northern populations.

Fishery

The fishery began in the late 1970s in what is known as shrimp fishing area (SFA) 1. Exploratory fishing expanded into what is now the Davis Strait-East management unit (previously known as SFA 2) and then to areas southeast of Resolution Island in Hudson Strait. Quotas in these areas were based on fishery performance and not scientific survey data. In the mid-1990s, the fishery moved southeast of Resolution Island in SFA 2, where the main fishery

remains to date. Implementation of the Nunavut Agreement in 1999 shifted the main fishery east of the Nunavut Settlement Area.

Currently, the fishery in the EAZ and WAZ is managed by a TAC which is divided into individual quotas for 17 offshore licence holders and special allocations for Nunavut and Nunavik fishing interests. Changes to the management of the fishery in what were SFAs 2 and 3 created new SFAs and Management Units beginning with the 2013/14 fishing season (Figure 2). Nunavut Wildlife Management Board (NWMB) and Nunavik Marine Region Wildlife Board (NMRWB) advise on the allocation of quotas to Nunavut and Nunavik fishing interests, respectively. All fishing to date has been conducted by large vessels (> 100' overall length) with 100% At-Sea-Observer coverage.

Fishing gear in the EAZ and WAZ consists of single and, more recently, twin shrimp trawls requiring a minimum codend mesh size of 40 mm and separator grate (maximum 28 mm bar spacing). Since 2003, the management year has been April 1 to March 31. The fishing season is limited by the extent of sea ice, and is conducted between May and December in most years.

Northern Shrimp has been the main commercial species throughout the history of the shrimp fishery in this area. Historically, most of the harvest of Striped Shrimp occurred as by-catch in the directed Northern Shrimp fishery. Directed fishing for Striped Shrimp has become more important especially with quotas available in the Nunavut-West and Nunavik-West management units beginning with the 2013/14 fishing season.

Fishery catch per unit effort (CPUE) data are not considered to reflect stock status. Commercial fishing locations are not broadly distributed; fishing vessels target areas of high density. A mix of two shrimp species are disproportionally caught in the fishery and the composition of the two species in the catch determines which species is designated as directed, which biases CPUE calculations. Throughout the history of the fishery, economic factors (e.g., fuel prices, market price of shrimp) have influenced when and where the species are caught. In the EAZ, commercial vessel performance has changed over the years to target each species to achieve cleaner catches of just one species. Renewed effort in the WAZ is relatively recent. In some years, cleaner catches can be similarly achieved in the WAZ, however that varies in relation to the distribution of the two species.

ASSESSMENT

This is an assessment of LRPs for both Northern Shrimp and Striped Shrimp in the EAZ and WAZ (Figure 1). These two species have overlapping distributions, particularly in the Resolution Island area, resulting in an overlap of their fisheries. The total removal, both directed catch and by-catch, of each species is considered in the assessment.

DFO plans and the Northern Shrimp Research Foundation (NSRF) conducts annual surveys of the EAZ (Resolution Island Study Area; RISA-W, RISA-E and SFA 2EX) and WAZ (SFA 3) survey areas (Figure 3). Both species in the EAZ and WAZ were last assessed in 2019 (DFO 2019a) and updated in 2020 (DFO 2020a). Survey data in the EAZ are available for the period of 2006–2019, however, the first three years are not considered comparable with the rest of the series because of poor trawl performance, incomplete sampling coverage, and inconsistent timing, vessels, and gear (DFO 2018a). Therefore the first three years of data are excluded, and only 2009–2019 data are evaluated for the EAZ.

The WAZ (Figure 1) was surveyed biennially by DFO from 2007–2013. However, results could not be combined with the EAZ survey results because the surveys used different gear and occurred at different times of year. This prevented a comprehensive evaluation of the

distributions of shrimp and a more practical look at broader stock assessment over a larger spatial scale. In 2014, the NSRF was commissioned to take over the survey of the WAZ so that it is sampled in conjunction with the EAZ as a means to maintain consistent methods among management units. This action started a new time series for the WAZ. In 2019, the WAZ was surveyed for the sixth year in the new time series. The advice contained herein marks the first occasion that LRPs have been developed in the WAZ.

Fishable and female spawning stock biomass (SSB) indices from scientific surveys form the basis of this assessment. Fishable biomass is based on male and female shrimp from the surveys with a carapace length greater than 17 mm; this represents shrimp that are large enough to be retained in commercial trawls. SSB is based on all female shrimp from the surveys regardless of size. Fishery data are used to determine the observed exploitation rate index, calculated as catch from the reporting records (Canadian Atlantic Quota Report; CAQR) divided by the fishable biomass index from the same year. The potential exploitation rate index is calculated to represent the exploitation rate if the entire TAC is taken. Bootstrapped 95% confidence intervals are included for each of the indices.

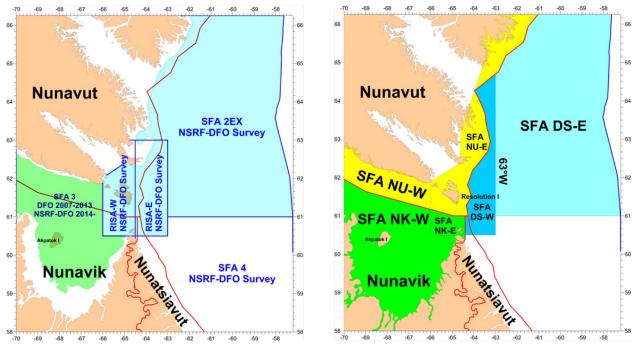


Figure 3. Locations of NSRF survey areas (left panel) within the Eastern (blue) and Western (green) Assessment Zones and the management units (right panel) referred to in this report. Shrimp Fishing Area (SFA), Exploratory (EX), Resolution Island Study Area (RISA), East (E), West (W), Nunavut (NU), Nunavik (NK) and Davis Strait (DS). Red lines show the borders of the Nunavut, Nunatsiavut and Nunavik Land Claims Areas.

For each assessment zone and shrimp fishery an LRP based on 30% and 40% of the SSB index was explored (Walkusz and Atchison 2020). Currently, a 30% LRP is being applied as a reference point by the Northwest Atlantic Fisheries Organization (NAFO) for the Northern Shrimp stock in SFA 1, which is adjacent to the EAZ. This was noted but not considered indepth during a two-day workshop in 2008 among DFO-Science, DFO-Resource Management, co-management partners and stakeholders in an attempt to establish LRPs in these shrimp fisheries (2009b). Additionally, LRPs and the USRs were adopted at 30% and 80%, respectively, of the geometric mean of female SSB for both Northern and Striped Shrimp in

other southern SFAs. The SSB was deemed to be a suitable proxy for B_{MSY} . The contributing factors leading to the use of 30 and 80% were three years of survey data (2006–2008) in Shrimp Fishing Area 2, and that it was consistent with the approach taken by NAFO. LRPs have since gone unchanged in the EAZ (Siferd 2015).

Adopting a 30% LRP as part of the 2020 process would be consistent with NAFO approach and how shrimp fisheries are managed in the Newfoundland and Labrador Region. However, the use of a 30% LRP is unsubstantiated for the WAZ and EAZ based on the best available scientific information for these particular fisheries (Walkusz and Atchison 2020). Furthermore, an LRP of 40% is suggested in the DFO PA Policy (DFO 2009a) for instances of data deficiency and uncertainty. Establishing LRPs based on 40% average SSB for the WAZ and the EAZ was determined to be the best way forward based on the information available and recent decreases in stock productivity in southern SFAs (e.g., SFAs 4–6, DFO 2019b; SFAs 13–15, DFO 2019c). Uncertainty remains with respect to biomass variability as it relates to environmental conditions (e.g., temperature). Patchy shrimp population distributions have led to occasional large catches and fluctuations and increased variance in biomass estimates for each of the assessment zones in different years. Other SFAs have longer data sets and can justify using 30% LRPs, while the WAZ and EAZ have shorter data sets, large fluctuations in biomass indices and a lack of stock trends. Furthermore, Striped Shrimp in the EAZ appear to have recovered from biomass levels equivalent to an SSB level near the 40% LRP; below this point the ability of the stocks to recover is unknown (DFO 2020b). Similarly, it is not known to what extent Northern Shrimp can recover from below their lowest recorded biomass levels (comparatively higher than Striped Shrimp in the EAZ). When the PA framework for the EAZ was initially established using 30% LRPs, the reference points were based on three years of data, the geographic area of SFA 2 and a different survey range. It was recommended that the initial EAZ PA framework be revised as soon as possible (DFO 2020b). One of the potential options would be to move to a dynamic LRP, which follows the pattern of the stock. Since information on shrimp stocks is limited in the WAZ and EAZ, a fixed LRP is recommended. The PA framework may be revised in the future when more data on variables affecting shrimp stocks in the WAZ and EAZ become available.

The recommended reference points follow DFO's PA Policy (2009a) and include new data to update existing LRPs in the EAZ and establish new LRPs in the WAZ. The geometric mean of SSB was used as a proxy for B_{MSY} . Furthermore, this framework suggests a starting point for calculating USRs. Accordingly, the LRPs and proposed USRs were calculated at 40% and 80%, respectively, of the geometric mean of SSB for both Northern and Striped Shrimp (Figures 4 and 5).

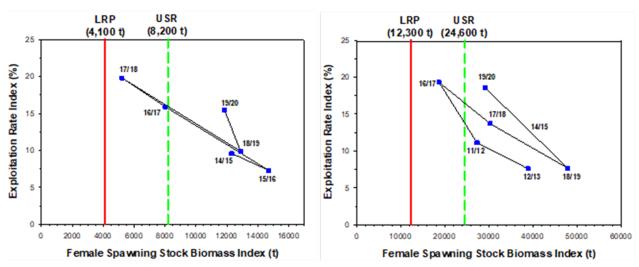


Figure 4. Newly established LRPs for Northern Shrimp (left) and Striped Shrimp (right) in the WAZ. The LRP (red line) is calculated as 40% of the geometric mean of the SSB index and the proposed USR (dashed green line) calculated as 80% of the geometric mean of the SSB index. Blue symbols are annual stock status values, numbers indicate the fishing season.

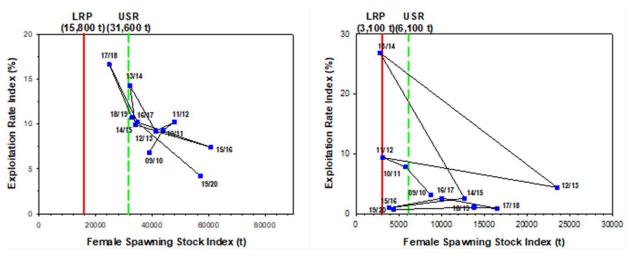


Figure 5. Updated LRPs for Northern Shrimp (left) and Striped Shrimp (right) in the EAZ. The LRP (red line) is calculated as 40% of the geometric mean of the SSB index and the proposed USR (dashed green line) calculated as 80% of the geometric mean of the SSB index. Blue symbols are annual stock status values, numbers indicate the fishing season.

Sources of Uncertainty

The sources of uncertainty that were not quantitatively incorporated into the establishment of LRPs for Northern and Striped Shrimp stocks in the WAZ and EAZ, include:

 Despite having data on temperature preferences of the two shrimp species, the distribution, availability and dynamics of preferred habitats is lacking. Future efforts should focus on moving towards an Ecosystem Approach to Fisheries Management to address knowledge gaps and drivers of stock variability, such as: larval drift related to the connectivity between management zones (stocks), habitat spatiotemporal variability, and ecosystem linkages (e.g., predator-prey interactions, oceanographic drivers). The lack of environmental information contributes to uncertainty.

- Given the short time series and the lack of observed trends, it is not feasible to identify periods of high productivity upon which to base reference points (as suggested in the DFO PA Policy).
- Trawls used in the survey are known to have a catchability less than one but the exact value is unknown. Therefore, the survey is an index of biomass and not an absolute estimate of the total biomass.
- Catch data are known; however, the total fishery-induced mortality is unknown (landed catch plus incidental mortality from trawling). Exploitation rates are a relative index rather than absolute.
- Survey of all stocks is completed in the middle of the fishing season. It is uncertain how much of the TAC has already been taken while the survey is ongoing. Results may be confounded by the timing of the survey and the concurrent level of harvest.
- It is uncertain to what extent these stocks have the capacity to recover from low levels of biomass. High biomass variability exhibited in these stocks can lead to their positioning within the proposed Cautious Zone of this PA framework. A longer time series and a better understanding of the drivers of stock variability may inform recovery potential.
- The stocks' natural mortality, including multi-species linkages, is currently unknown.
- Factors that may cause shrimp productivity to change are poorly understood within the WAZ and EAZ. For example, it is uncertain to what extent larval drift exists between these assessment zones, and to what extent shrimp productivity is impacted by their movements.
- Stocks of both species in both assessment zones exhibit relatively large inter-annual variability in biomass and no trends have been observed. The drivers leading to this variability are poorly understood.
- Northern and Striped Shrimp have populations spanning both assessment zones and their relative distributions are likely to change inter-annually. The stock structure of each species within and between assessment zones is unresolved. For example, it is possible there are multiple populations of the same species within a single assessment zone.
- DFO has recently discovered that a portion of what was previously identified as *P. montagui* from the Gulf and Scotian Shelf (Division 3PS) are in fact *Dichelopandalus leptocerus*. There remains uncertainty about whether this species has recently migrated to this area or may have been misidentified for several years. The same may be true in more northern areas including the WAZ and EAZ.

CONCLUSIONS AND ADVICE

The work described here represents new and updated science advice on reference points for the Northern and Striped Shrimp fisheries in the WAZ and EAZ. The advice is based on a traditional approach of calculating SSB from shrimp trawl surveys, and explores a time series of fishery-independent data. Data used to assess these fisheries are limited and highly variable, and currently no trends in stock status have been observed. Striped Shrimp in the EAZ have demonstrated an ability to recover from 40% of the SSB, the LRP, below which the ability of these stocks to recover is uncertain. Therefore, we recommend a PA consistent with DFO (2009a) that reflects insufficient stock-specific information: 40% LRP and 80% USR, with

respect to the geometric mean SSB index. These reference points represent the best available scientific information and constitute advice to management for assessing the stock in relation to sustainability.

In the WAZ, the newly established LRP and the proposed USR for Northern Shrimp and Striped Shrimp are based on a 6-year time series (2014–2019; Table 1). In the EAZ, the updated LRP and the proposed USR for Northern Shrimp and Striped Shrimp are based on an 11-year time series (2009–2019; Table 1).

Table 1. Established Limit Reference Points (LRPs) and proposed Upper Stock Reference points (USRs) for Northern Shrimp and Striped Shrimp in the Western Assessment Zone and Eastern Assessment Zone. Spawning stock biomass is reported in tonnes. Previous reference points are provided in parentheses.

Species	Western Assessment Zone		Eastern Assessment Zone	
Species	LRP	USR	LRP	USR
Northern Shrimp (<i>Pandalus borealis</i>)	4,100	8,200	15,800 (from 6,800)	31,600 (from 18,200)
Striped Shrimp (<i>Pandalus montagui</i>)	12,300	24,600	3,100 (from 2,300)	6,100 (no change)

The PA reference points for the WAZ and EAZ should be re-examined when a population model is developed or relationships between stock productivity and environmental or ecosystem factors are sufficiently developed to inform stock assessments.

OTHER CONSIDERATIONS

In general, management of key forage species, such as shrimp, under an ecosystem approach, requires the adoption of a conservative approach with lower fishing mortality reference points and higher biomass reference points than would be considered under a single species management approach.

In cases where insufficient stock-specific information is available, DFO's PA Policy (2009a) suggests reference points that may be considered as the best available guidance for management and for assessing the stock in relation to sustainability. The 40% LRP and 80% USR provided as guidance are the results of reviews and meta-analyses across a wide variety of fish stocks. However, it is uncertain to what extent this standard can be applied to shrimp fisheries. Here, 40% LRP and 80% USR of the geometric mean SSB index have been used to inform reference points for shrimp fisheries in the WAZ and EAZ without demonstrable validation of stock productivity. Indeed, most larvae released in any management area end up as functioning adults in another management area (in other words, most adults in any management area originated elsewhere; Le Corre et al. 2020). This in and of itself is evidence that the SSB index within an individual management area does not provide a defensible measure of the future health within any individual management area.

The PA reference points in both the WAZ and EAZ are based on the best available scientific information and need to be re-evaluated with new and/or alternative methodologies when data are available to corroborate the advice contained herein. Actual reference points for a stock may use other metrics and be set lower or higher than these references but should be justified for the

stock and consistent with the intent of the PA. Ideally, more robust LRPs and associated PA frameworks should be considered by Science and Resource Management when additional data are available.

LIST OF MEETING PARTICIPANTS

Name	Organization/Affiliation
Christi Friesen	DFO – Fisheries Management, Central and Arctic Region
Courtney D'Aoust	DFO – Resource Management, National Capital Region
Chantelle Sawatzky	DFO – Science, Central and Arctic Region
David Boguski (Chair)	DFO – Science, Central and Arctic Region
Kevin Hedges	DFO – Science, Central and Arctic Region
Chelsey Lumb (Rapporteur)	DFO – Science, Central and Arctic Region
Jessica Mai (Rapporteur)	DFO – Science, Central and Arctic Region
Joclyn Paulic	DFO – Science, Central and Arctic Region
Justin Shead	DFO – Science, Central and Arctic Region
Ross Tallman	DFO – Science, Central and Arctic Region
Wojciech Walkusz	DFO – Science, Central and Arctic Region
Manon Cassista Da-Ros	DFO – Science, Maritimes Region
Brittany Beauchamp	DFO – Science, National Capital Region
Susan Thompson	DFO – Science, National Capital Region
Katherine Skanes	DFO – Science, Newfoundland an Labrador Region
Krista Baker	DFO – Science, Newfoundland and Labrador Region
Hugo Bourdages	DFO – Science, Quebec Region
Eric Pedersen	Concordia University – Biology
Frankie Jean-Gagnon	Nunavik Marine Region Wildlife Board
Amber Giles	Nunavut Wildlife Management Board

SOURCES OF INFORMATION

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Center for Science Advice (CSA) Ontario and Prairie Region Fisheries and Oceans Canada 501 University Crescent Winnipeg, Manitoba R3T 2N6

Telephone: 204-983-5131 E-Mail: <u>xcna-csa-cas@dfo-mpo.gc.ca</u> Internet address: <u>www.dfo-mpo.gc.ca/csas-sccs/</u>

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