

SEYCHELLES FISHING AUTHORITY TECHNICAL REPORT

REPORT ON THE SPINY LOBSTER FISHERY Lobster Survey Report 2024





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LOBSTER SURVEY REPORT 2024



Source: <http://rules.fish.wa.gov.au/Species/Index/38>
Species: Panulirus ornatus

FINAL REPORT

Prepared by

Mrs. Kettyna Gabriel

Assisted by:

SFA: Ms. Stephanie Hollanda, Mr. Rodney Govinden



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1. Introduction

The spiny lobster fishery has been conventionally managed by seasonal closures and limited access (license-limited) regulations implemented by the Seychelles Fisheries Authority. These regulations have been in force to limit fishers primarily targeting coastal and shallow water stocks, where abundance is limited and easily accessible. In the past, assessments of fisheries dependent data have shown several significant declines in the coastal stocks when too many licenses are allocated or when the fishery remains open for 3 to 4 consecutive seasons. Consequently, the stock status is determined by assessing both fisheries dependent and independent (surveys) data. Results obtained are provided to managers with advice on whether the fishery should be open or remain closed.

The lobster fishing season opened for a fourth consecutive season on the 15th of January 2023 and closed on the 15th of March 2023 (**Figure 1**). Unlike previous years, the Participatory Lobster Monitoring Programme (PLMP) was not undertaken in October 2023. Instead, a Comprehensive Lobster Survey (CLS) was conducted around the granitic and coralline islands on the Mahé Plateau. In 2024, the PLMP resumed, focusing on 20 indicator sites around Mahé to assess stock status. This report aims to present the results of the 2024 PLMP survey and to present information on several stock indicators based on the combined data collected from the PLMP, CLS and 2023 fishing season (**Tables 1 & 2**). Moreover, it provides several recommendations and advice to managers based on the PLMP, CLS and fishery data to assist with decision-making on the status of the 2024- 2025 fishing season.

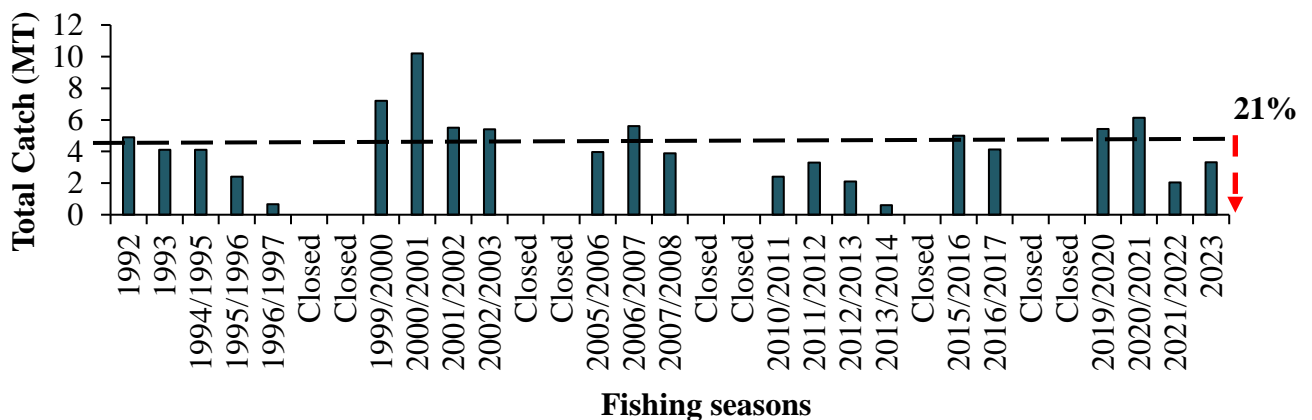


Figure 1: Overview of the catches (Metric Tonnes (MT)) from the lobster fishery from 1992 to 2023. The dashed black line of 4.20 MT indicates a mean seasonal catch since the monitoring began in 1992. N.B. 2019/2020 season spanned a complete three-month period, while the 2020/2021 season was extended to accommodate a one-month extension, resulting in a duration of over four months. In contrast, both the 2020/2021 and 2023 seasons were two months in duration. The red dashed line highlights change in the trend from the historical mean.

2. Fisheries Independent Survey

2.1. Total Catch

In 2024, 59 kg of lobsters were caught, as opposed to 76 kg in 2022, representing a 22% decrease (**Figure 2**). The catch composition consisted of three species, notably *Panulirus penicillatus*, *Panulirus longipes* and *Panulirus versicolor*. *P. penicillatus* remains the dominant species with a total of 31 kg, followed by *P. longipes* (23 kg) and *P. versicolor* (5 kg). Compared to 2022, this represented a 10%, 24% and 48% decrease for *P. longipes*, *P. penicillatus* and *P. versicolor*, respectively. When comparing the 2024 PLMP with the CLS¹ 2023 survey, the *P. longipes* and *P. versicolor* decreased by 23% and 63%, respectively, while *P. penicillatus* increased by 115%. Sites for the CLS survey were chosen specifically within the PLMP survey area, but not necessarily the same sites.

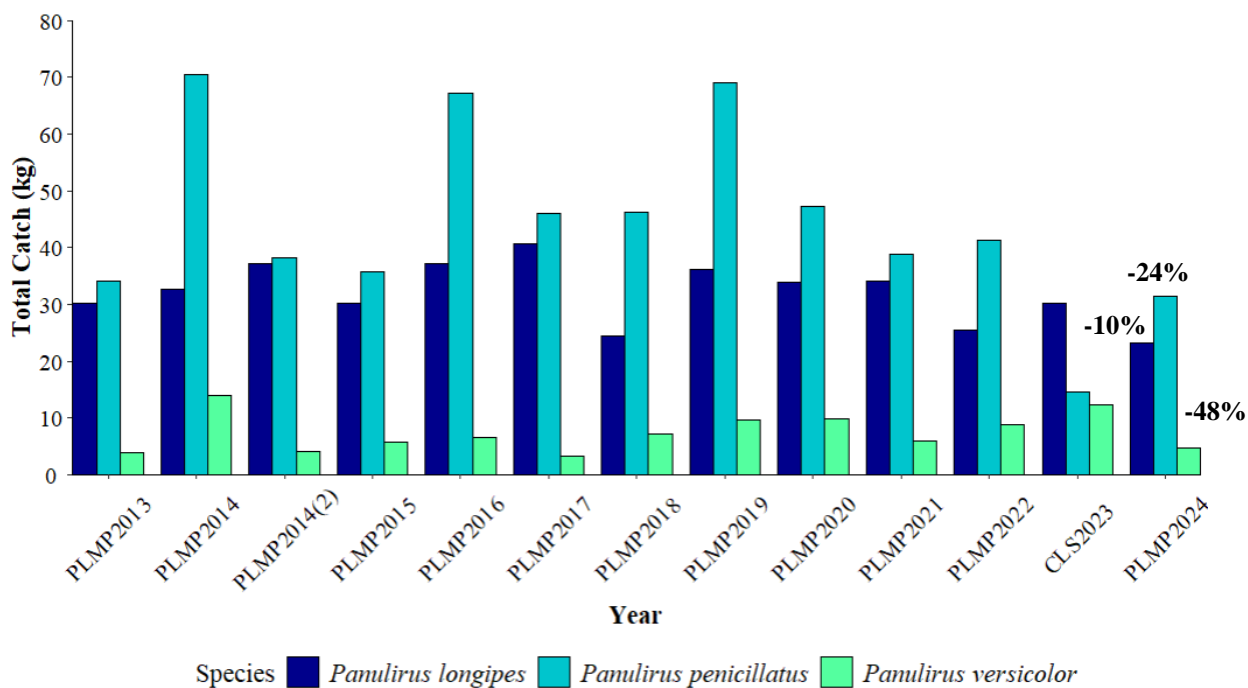


Figure 2: Total catch by species (in kilograms) across survey sites: 20 sites (2013–2022), 19 sites (CLS 2023), and 18 sites (2024).

3. Effort Trend Indicator

The average fishing effort and total catch (kg) are shown in **Figure 3**. From 2020 to 2024, a decline in both the fishing effort and total catch can be observed. An increase of 42% for both indicators was reported in 2019. In 2020, a decline of 28% in fishing effort and 20.8% in total

¹ Comprehensive Lobster Survey (CLS) conducted around the granitic and coralline islands on the Mahé Plateau.

lobster catch was recorded. This trend continued in the following years, with further declines of 5% in fishing effort and 13% in catch in 2021, 12% and 4% in 2022, respectively. Compared to 2022, the 2024 survey showed a further decline of 4% in fishing effort and 22% in catch (**Figure 3 and Table 1**). No comparison was made with the CLS 2023 for the fishing effort, as the transect length for CLS was fixed, whereas the PLMP transect length was not. The increase in the total catch is 30% below the long-term average of 84 kg (**Table 1**).

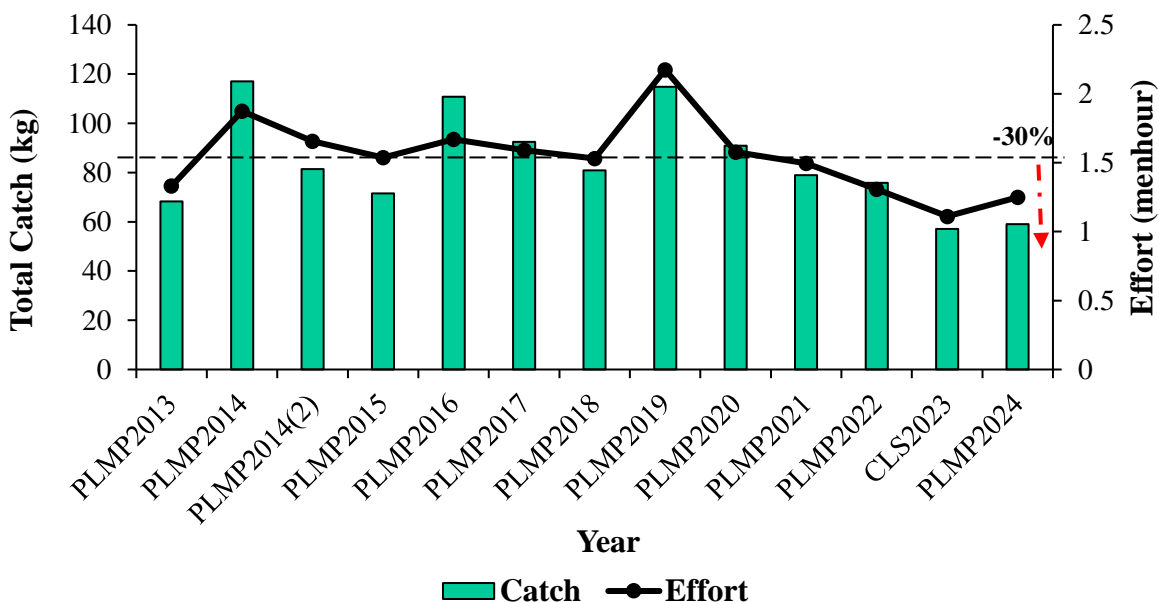


Figure 3: Average fishing effort (menhour) and total catch (kg) from 2013 to 2024. The red arrow highlights the change in trend. The black dotted line indicates the long-term catch average of 84 kg.

4. Abundance And Biomass Indicators

4.1. All Lobsters Caught

The average catch per unit effort (CPUE) in kg/menhour and no/menhour² from 2013 to 2024 can be observed in **Figure 4**. In 2024, the CPUE in kg/menhour was lower than in most previous surveys, with an average of 2.39 kg/menhour, except for the 2014 (2) and 2013 surveys. The CPUE no/menhour remained lower than most previous surveys except for 2013, 2018 and 2019, with an average of 5 lobsters per menhour. In 2022, the CPUE kg/menhour increased by 10%, and the CPUE no/menhour decreased by 2%. However, compared to 2022, the 2024 survey showed further declines in both measures of CPUE by 19% for kg/menhour and 8% for no/menhour, respectively. Similarly, the comparison with the CLS 2023 survey shows declines in 2024, with CPUE (kg/menhour) decreasing by 9% and CPUE (no/menhour)

² menhour = transect time per site multiplied by number of men (2) snorkelling.

by 13%. However, no significant differences ($p > .05$) were observed between the last 3 surveys in CPUE kg/menhour³ and CPUE no/menhour⁴. It is essential to highlight that the data presented in **Figure 4** encompasses all 20 survey sites except for the CLS 2023 and 2024 PLMP surveys. The CLS 2023 survey included 19 sites within the PLMP area, while only 18 sites were surveyed in 2024 due to force majeure caused by electrical issues on the research vessel. The CPUE data for the 18 sites from 2018 to 2024 is provided separately in **Figure 10A Appendix 1**. A similar declining trend was observed when excluding the sites not surveyed in 2024, compared to the 2022 PLMP survey sites (**Figure 10A Appendix 1**).

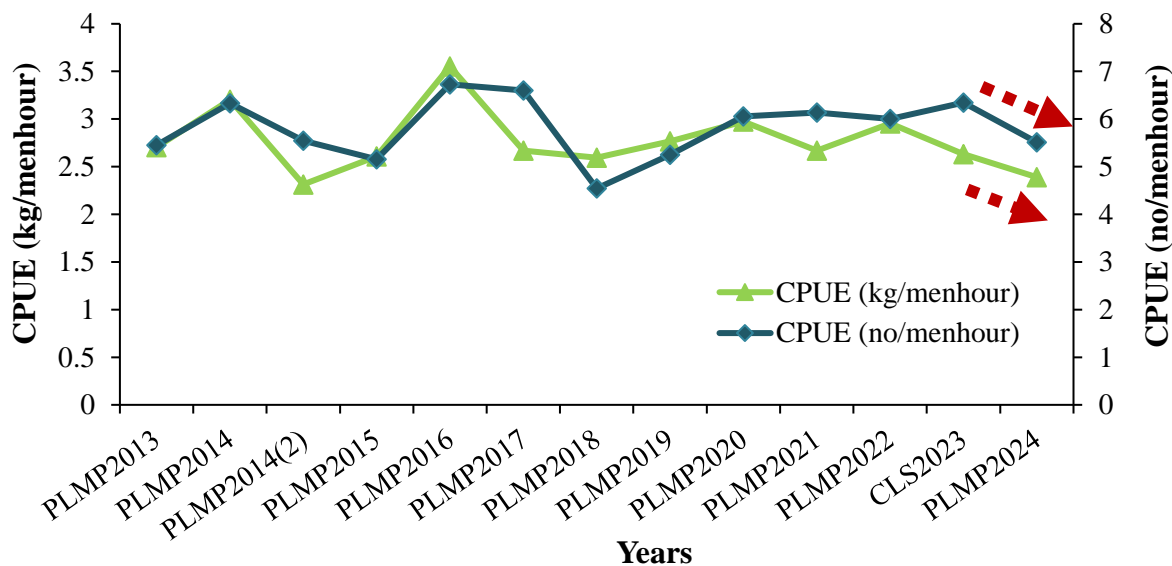


Figure 4: Average catch per unit effort in kilogram/menhour and numbers/menhour for all lobsters caught from 2013 to 2024. The red arrow highlights the change in trends. N.B. The 2024 PLMP survey had only 18 sites compared to the previous years.

4.2. Legal Sized Lobsters (>7.5 Cm Carapace Length)

The average CPUE for legal-size lobsters caught varies over the survey periods (**Figure 5**). In 2024, the CPUE in kg/menhour was lower than most previous surveys, with an average of 1.81 kg/menhour of lobsters, except for the 2014(2), 2017 and CLS 2023 surveys. CPUE in no/menhour was higher than most previous surveys except for 2016, 2020, 2021 and 2022, with an average of 3 lobsters caught per menhour. In 2022, the survey observed a 24% increase in CPUE (kg/menhour) and a 20% increase in CPUE (no/menhour) for legal-size lobsters. In contrast, the 2024 survey showed a 26% decrease in CPUE for legal-size lobsters, averaging 1.8 kg per menhour. The CPUE for the number of lobsters per menhour in 2024 was also 17% lower, with an average of 3 lobsters per menhour. This indicates a decline in lobster catch

³ Kruskal-Wallis test: $\chi^2(12) = 13.82$ $p > 0.312$

⁴ Kruskal-Wallis test: $\chi^2(12) = 8.145$ $p > 0.774$

efficiency between 2022 and 2024. However, compared to the CLS 2023 survey, the CPUE for legal-size lobsters in 2024 showed an 8% increase in kg/menhour and a 25% increase in no/menhour. No statistically significant differences ($p > 0.05$) were observed between the three previous surveys in CPUE kg/menhour⁵ and CPUE no/menhour⁶. It is essential to highlight that the data presented in **Figure 5** encompasses all 20 sites except the CLS 2023 and 2024 PLMP surveys. The CLS 2023 survey included 19 sites within the PLMP area, while only 18 sites were surveyed in 2024. The CPUE data for the 18 sites from 2018 to 2024 is provided separately in **Figure 10 B Appendix 1**. A similar declining trend was observed when excluding the sites not surveyed in 2024, compared to the 2022 PLMP survey sites (**Figure 10B Appendix 1**).

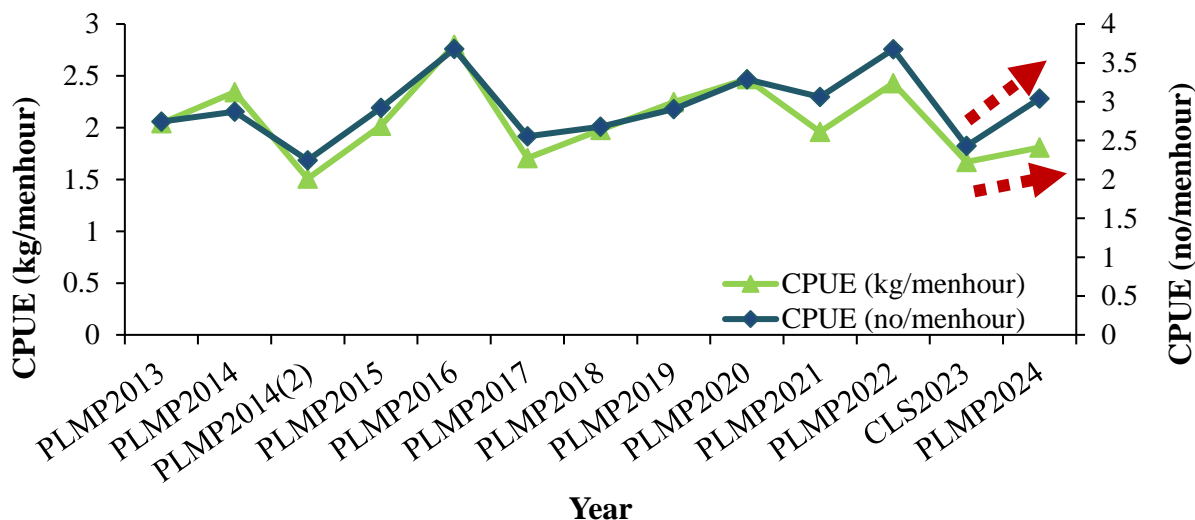


Figure 5: Average catch per unit effort for legal-size lobsters caught from 2013 to 2024. The red arrow highlights the changes in trend.

5. Length Based Indicators

A total of 132 spiny lobsters were sampled for carapace length (CL) and sexed during the 2024 survey, as opposed to 158 in 2022. Amongst the samples, 60 individuals were undersized (< 7.5 cm), whilst 72 individuals were legal size and above (> 7.5 cm). This represents a 5% and 24 % decrease in undersized and legal-size lobsters compared to 2022. In the CLS 2023, which recorded 139 undersized lobsters and 65 legal-size lobsters, the 2024 survey showed a 33% decrease in undersized lobsters and a 71% increase in legal-size lobsters. Males dominated females with a ratio of 1.3:1 in 2024.

⁵ Kruskal-Wallis test: $\chi^2(12) = 17.09$ $p > 0.146$

⁶ Kruskal-Wallis test: $\chi^2(12) = 10.353$ $p > 0.585$

Thirty-five percent (35%) of lobsters were berried females, of which *P. longipes* dominated with 19%, followed by *P. penicillatus* with 15% and 1% *P. versicolor*. The smallest berried female reported a carapace length of 5.51 cm, weighing 0.179 kg (*P. longipes*), whereas the largest berried female was 11.77 cm, weighing 1.134 kg (*P. penicillatus*).

5.1. *P. penicillatus*

The overall trend in the size of *P. penicillatus* for both males and females remain relatively stable as of 2021 (**Figure 6**). In 2022, average carapace lengths increased by 0.4 cm (4.3%) for females and 0.3 cm (3.3%) for males (**Table 1**). However, in 2024, the average carapace length for females decreased by 0.3 cm (4%) and for males by 0.26 cm (3%) compared to 2022 (**Table 1**). When comparing 2024 to 2023, the average carapace length for females decreased slightly by 0.01 cm (0.2%), while males showed a small increase of 0.10 cm (1%; **Table 1**). Male lobsters consistently exhibited larger carapace lengths than females throughout all survey years (**Figure 6**). The median carapace length for males fluctuates across the years, with no statistically significant variation between the last three fishing seasons⁷. Similarly, females display less variability in size, and median size remains relatively stable with no statistically significant difference observed⁸ (**Figure 7**).

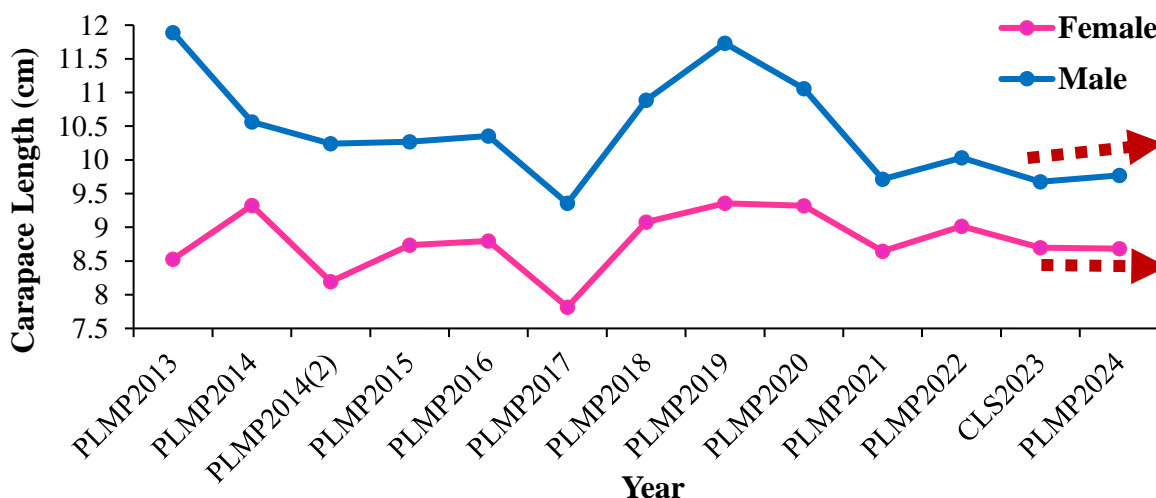


Figure 6: Average carapace sizes of *P. penicillatus* caught during the surveys between sexes from 2013 to 2024. The red arrow highlights the change in trend.

⁷ ANOVA test: $F(2,66) = 0.251, p > 0.779$

⁸ ANOVA test: $F(2,68) = 0.702, p > 0.499$

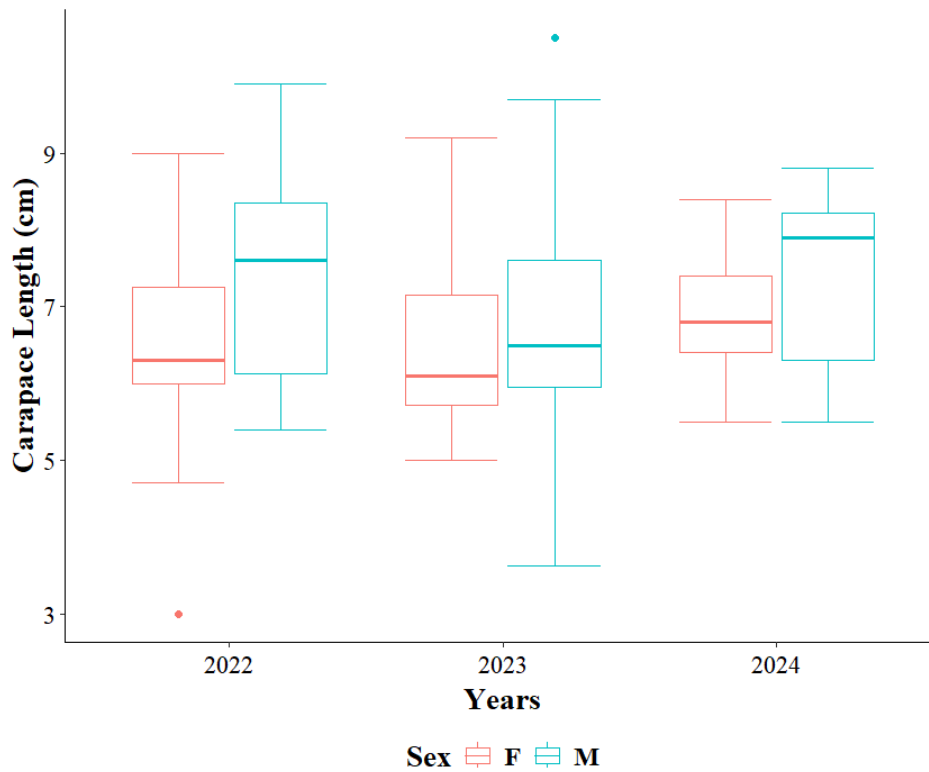


Figure 7: Boxplot illustrating variation in the carapace length (CL) distribution of *P. penicillatus*, grouped by year and sexes.

5.2. *P. longipes*

The overall trend shows that male and female spiny lobsters have increased carapace length since 2021 (**Figure 8**). Males have consistently had larger carapace lengths than females, and both sexes show a steady rise from 2022 to 2024, with males experiencing a slightly more noticeable increase. In the 2022 survey, the average carapace length of males increased by 0.3 cm (5%; **Table 1**) whilst females remained relatively stable. In comparison, the 2024 survey revealed an upward trend in carapace length, with females showing an increase of 0.3 cm (4.4%) and males showing a smaller increase of 0.05 cm (0.7%; **Table 1**). In the CLS 2023 survey, the average carapace length of females declined by 0.1 cm (2%) and males by 0.5 cm (8%; **Table 1**). However, between 2023 and 2024, there was an increase in both females and males, with carapace lengths rising by 0.4 cm (6%) and 0.5 cm (8%), respectively (**Table 1**). However, females caught in 2024 were statistically significantly larger ($p < .05$) compared to those caught in 2023⁹ (**Figure 6, Table 3 Appendix 2**). Male lobsters consistently exhibited larger carapace lengths than females throughout all survey years. The median carapace length

⁹ Kruskal-Wallis test: $\chi^2(2) = 6.403$ $p < 0.040$

for males remained relatively stable across the years, with no significant variation in size distribution¹⁰ (Figure 9).

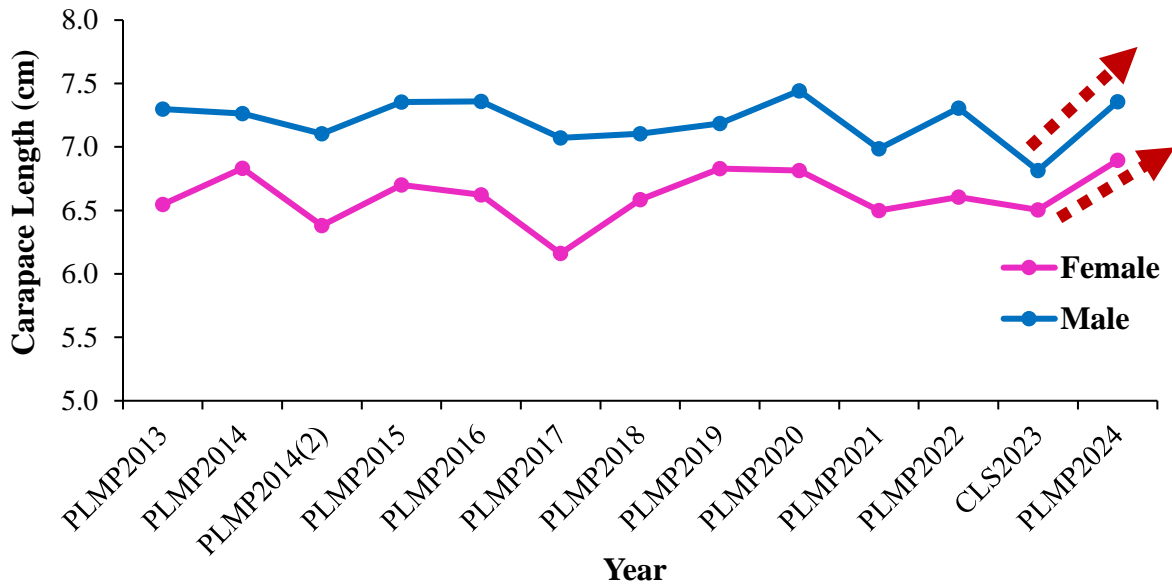


Figure 8: Average carapace sizes of *P. longipes* caught during the surveys between sexes from 2013 to 2024. The red arrow highlights the change in trend.

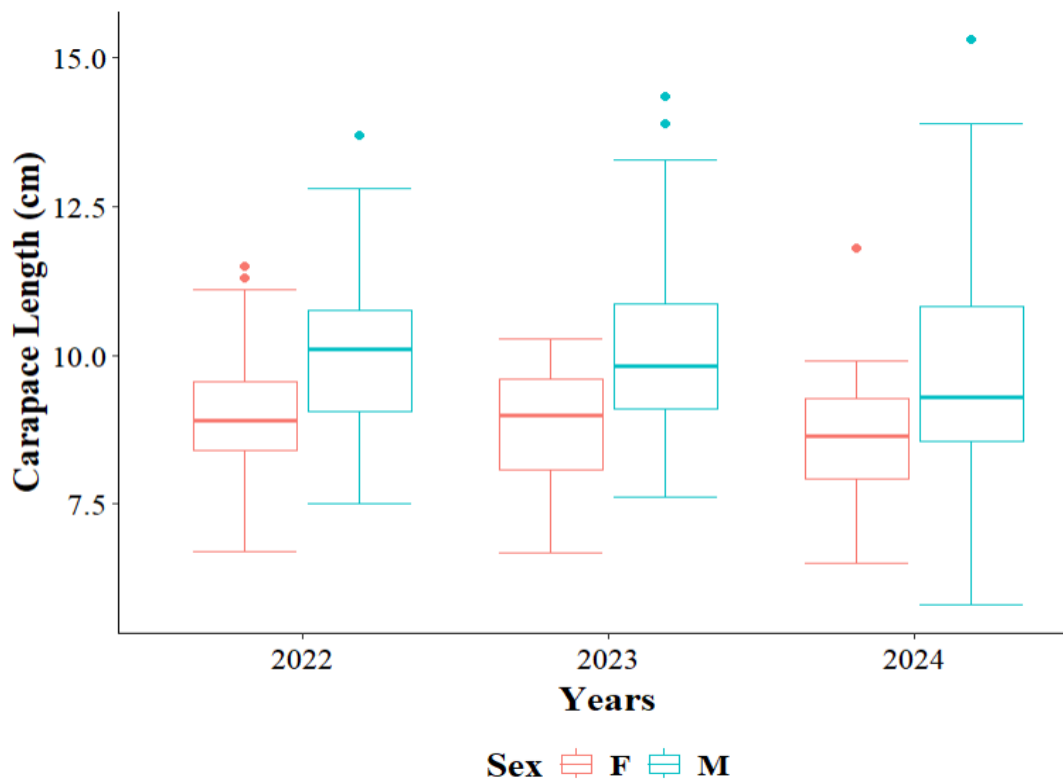


Figure 9: Boxplot illustrating variation in the carapace length (CL) distribution of *P. longipes*, grouped by year and sex.

¹⁰ Kruskal-Wallis test: $\chi^2(2) = 4.550$ $p > 0.102$

6. Lobster Stock Status Indicators

Table 1. Summary output for lobster survey 2024.

Fishery independent indicators	2022 ⁺ Survey	2024 ⁺ Survey	2023 CLS [±]	2024 Survey [±]	Comments
Catch (compared to long-term average of 84 kg)	76 kg	-	57 kg	59 kg	The catch for 2024 was 30% lower than the long-term average of 84 kg (Figure 1).
Catch legal-size lobsters (compared to long-term average of 63 kg_ 2019 to 2024)	3% decrease	-	17% decrease	29% decrease	The catch for legal-size lobsters was lower than the long-term average of 63 kg.
Catch (compared to previous survey)	4% decrease	22% decrease	25% decrease	4% increase	The catch in 2024 showed a 22% decrease compared to 2022 but a 4% increase compared to 2023 (Figure 1).
Effort (compared to previous season)	12% decrease	4% decrease	15% decrease	13% increase	Effort (menhour) decreased increased between 2023 and 2024 but decreased by 4% between 2022 and 2024 survey (Figure 3).
CPUE kg/menhour (all lobsters compared to previous survey)	11% increase	19% decrease	11% decrease	9% decrease	CPUE decreased for all lobster caught in 2023 and 2024 compared to the 2022 survey. However, the decrease was not statistically significant (Figure 4).
CPUE kg/menhour (legal-size lobsters compared to previous survey)	24% increase	25% decrease	31% decrease	8% increase	CPUE increased for legal-size lobster caught in 2024 compared to the 2023 survey. Whereas decreased between 2022 and 2024. However, the increase was not statistically significant (Figure 5).
CPUE no/menhour (all lobsters compared to previous survey)	2% decrease	8% decrease	6% increase	13% decrease	CPUE decreased in 2024 compared to the 2022 and 2023 surveys. However, no statistically significant difference was observed (Figure 4).
CPUE no/menhour (legal-size lobsters compared to previous survey)	20% increase	17% decrease	34% decrease	25% increase	CPUE increased for legal size lobster caught in 2024 compared to the 2023 survey but decreased when compared to 2022 and 2024. However, the increase was not statistically significant (Figure 5).
Mean size <i>P. penicillatus</i> M (compared to previous season)	3.3% increase	3% decrease	4% decrease	1% increase	Male mean size in 2024 decreased compared to 2022 and increased slightly between 2023 and 2024. However, no statistically significant difference was observed (Figure 6&7).
Mean size <i>P. penicillatus</i> F (compared to previous season)	4.3% increase	4% decrease	4% decrease	0.2% decrease	Female mean size in 2024 decreased compared to 2022 and increased slightly between 2023 and 2024. However, no statistically significant was observed (Figure 6&7).
Mean size <i>P. longipes</i> M (compared to previous season)	5% increase	0.7% increase	7% decrease	8% increase	Male increases in 2024 increased compared to 2022 and 2023. However, the increase was not statistically significant (Figure 8&9).
Mean size <i>P. longipes</i> F (compared to previous season)	2% increase	4% increase	2% decrease	6% increase	Females were statistically significantly larger in 2024 than in 2023 (Figure 8&9 Appendix 2).

Key	■ Indicator shows negative trend or comparison	■ Indicator shows positive trend or comparison	■ Indicator shows a stable trend
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⁺ Comparison between 2022 and 2024 surveys.

[±] Comprehensive Lobster Survey conducted in 2023 instead of the annual PLMP survey (SFA, 2024). Comparison between 2023 and 2024.

Table 2. Summary output for lobster fishing season 2023.

Fishery dependent indicators	2020/2021 Season ^ˆ	2021/2022 Season [°]	2023 Season [§]	Comments
Catch (compared to long-term average)	6140 kg	2050 kg	3322 kg	Catch increased between 2023 and the 2021/2022 fishing season. However, the catch was 21% lower than the long-term average of 4.24 MT (SFA, 2023; Figure 5).
Catch (compared to previous season)	13% increase	67% decrease	62% increase	Catch increased between the 2023 and 2021/2022 fishing seasons (SFA, 2023; Figure 5).
Effort (compared to previous season)	23% increase	57% decrease	31% increase	Effort (no. of fishing trips) increased by 31% between 2023 and 2021/2022, a fishing season (SFA, 2023; Figure 5).
CPUE (all gears compared to long-term average)	35% increase	5% increase	28% increase	CPUE for all gears increased from the long-term mean = 19.3 kg/trip (SFA, 2023; Figure 10).
CPUE (all gears compared to previous season)	8% decrease	22% decrease	24% increase	CPUE for all gears increased during the 2023 compared to the 2021/2022 fishing season.
CPUE (snorkelling) (compared to previous season)	10% decrease	24% decrease	25% increase	CPUE for snorkelling fishing techniques increased in 2023 compared to the 2020/2021 fishing season.
CPUE (scuba [#]) (compared to previous season)		64% increase	13% increase	CPUE for scuba fishing technique was 2.27 kg/menhour higher than in 2023 compared to the 2021/2022 fishing season.
Mean size <i>P. penicillatus</i> M (compared to previous season)	4.3% decrease	2.4% decrease	0.8% increase	Male size remains constant, with males caught in 2023 significantly larger than in the 2021/2022 fishing season (SFA, 2023; Figure 17).
Mean size <i>P. penicillatus</i> F (compared to previous season)	3% increase	0.01% increase	2% decrease	Female size decreased in 2023, however, was not statistically significant compared to 2021/2022 fishing seasons (SFA, 2023; Figure 17)
Mean size <i>P. longipes</i> M (compared to previous season)	0.9% decrease	24% increase	2% decrease	Male size decreased in 2023; however, this was not statistically significant compared to the 2021/2022 fishing season (SFA, 2023; Figure 20).
Mean size <i>P. longipes</i> F (compared to previous season)	0.7% increase	17% decrease	0.6% decrease	Female size in 2023 was not statistically significant compared to 2021/2022 fishing seasons (SFA, 2023; Figure 20).

Key	█ Indicator shows negative trend or comparison	█ Indicator shows positive trend or comparison	█ Indicator shows a stable trend
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^ˆ The 2020/2021 fishing season was extended for another 1 month thus contributing to the increase in the total catch (SFA, 2021).

[°] The 2021/2022 fishing season was open for 2 months only (SFA,2022).

[§] The 2023 fishing season was open for 2 months only (SFA,2023).

[#] Snorkelling and Scuba were the two methods used and were done separately in 2021/2022 compared to the 2020/2021 fishing season were Scuba was combined alongside Snorkeling.

7. Conclusion

The CPUE suggests that the overall biomass and relative abundance of all lobster caught have declined since 2022. The decline in CPUE was also observed between 2022 and 2024, further indicating declines in biomass and relative abundance of all lobsters and legal-size lobsters. This suggests there could be fewer lobsters in the fishable stock or undersized lobsters, which can indicate a recruitment issue. This, in turn, may affect the next fishable cohort. In contrast, the CPUE for legal-size lobsters increased slightly between 2023 and 2024, suggesting a potential improvement in the availability of mature individuals. However, this increase is still lower than the 2022 survey, indicating that the stock is experiencing some degree of stress, possibly due to fishing pressure (i.e., illegal fishing).

The CPUE for the 2023 fishing season indicates an increase from the previous season, which might suggest improved fishing efficiency. However, the overall catch has decreased compared to the long-term average, implying that while fishers are catching more lobsters per unit of effort, the total stock of lobsters may be declining. This suggests that fishers are catching fewer lobsters overall despite greater efficiency. It is also possible that fishers have targeted new or higher-density areas, hence influencing change in CPUE. However, the increased fishing efficiency may mask deeper issues, such as stock depletion and recruitment challenges, which the survey data highlight. Furthermore, the 2023 fishing season was extended for two weeks, which could have contributed to the increase in CPUE, as additional fishing effort may have allowed fishers to catch more lobsters per unit of effort. Other factors, such as localised depletion, targeting behaviour, illegal fishing or habitat change, which can also influence the CPUE trends, are not being accounted for, especially within the fishery. Therefore, while improved fishing efficiency can temporarily maintain or even increase catches, it does not necessarily mean that it can be interpreted as a definitive sign of stock recovery. Caution is warranted as the change in CPUE may not directly reflect changes in the stock abundance.

As for the size indicators, the 2023 fishing season showed a slight decrease in the average size for *P. penicillatus* (Male and Female) and *P. longipes* (Female), whereas *P. longipes* (Male) showed a stable average size. The 2024 survey observed a stable average size for both *P. penicillatus* (Male) and *P. longipes* (Male and Female), while *P. penicillatus* (Female) decreased slightly. The survey data suggests a stable increase in size, which could be seen as a positive sign for the stock, indicating that lobsters are reaching larger sizes. However, there

was no statistical significance in size changes, suggesting that the changes may not be substantial enough to draw definitive conclusions.

It is worth mentioning that the fishery has been open for 4 consecutive seasons; in the past, assessments of fisheries-dependent data have shown several significant declines in the coastal stocks when the fishery remained open for 3 to 4 consecutive seasons. The possibility of the stock experiencing some fishing pressure cannot be disregarded. Hence, caution should be taken when considering the opening of another consecutive season, as this may lead to a continual decline in overall lobster stocks.

Overall, the 2024 data indicate more legal-sized lobsters were caught per unit of effort compared to 2023 in weight and number. However, greater emphasis should be placed on comparing the 2022 and 2024 surveys, as the same survey techniques were used, and the sites remained consistent, making this comparison more reliable. The overall biomass and relative abundance of lobsters are declining, suggesting that ongoing pressure on the population may hinder recovery. To support stock replenishment, it is advisable to allow legal-size lobsters to remain in the population longer. Larger lobsters have greater spawning potential (Bertelsen and Matthews, 2001; Fanning et al., 2011), so permitting legal-size lobsters to reach a larger size before harvest would enhance future spawning stock. This approach would ultimately help boost the fishable population for the upcoming fishing seasons, contributing to a more sustainable and productive fishery in the long term. Caution should be exercised when deciding whether to open the fishery for another consecutive season, as this could potentially lead to a continued decline in overall lobster stocks. A precautionary approach is recommended to mitigate risks and allow for stock recovery.

8. Recommendation

Based on the analysis of the fishery-dependent and independent information collected, the Research Department proposes the following recommendations regarding the lobster fishery:

Fishery Closure:

- It is recommended that the fishery be closed for the 2024/2025 season to allow legal-size lobsters to contribute to future spawning and stock recovery, as the overall lobster population is experiencing some pressure.

Stock Monitoring:

- It is recommended that the annual PLMP survey be conducted in 2025 to evaluate and monitor the status of lobster stock.

Enhanced Enforcement:

- Strengthen monitoring, control, and surveillance (MCS) through increased patrols, use of technology (e.g., drones, VMS), and community-based surveillance networks to discourage illegal fishing activities during the closed fishing season.
- Introduce stricter penalties for illegal fishing activities to deter violations.

Public Awareness Campaign:

- Educate the public about lobster fishery regulations, the importance of sustainable practices, and the impacts of illegal fishing on stocks and livelihoods.

Post-Harvest Lobster Tagging Program:

- Explore the feasibility of implementing a tagging program to ensure the traceability of legal catches and discourage illegal harvesting.

Fishing Seasons:

- Development of indicators to enhance decision-making and provide recommendations for determining the opening of fishing seasons.

9. Reference List

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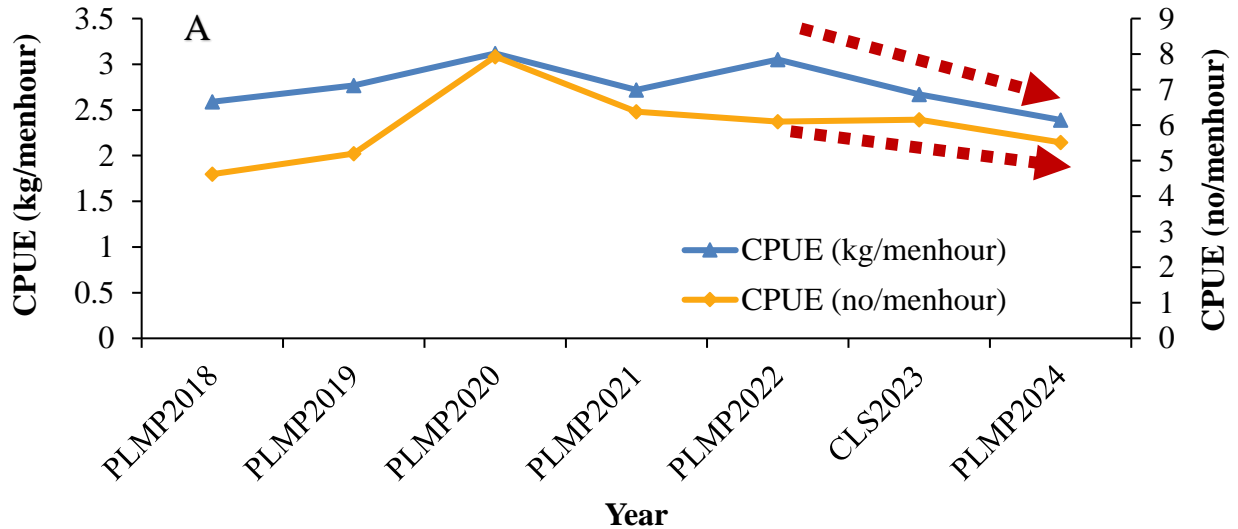
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Appendix 1

- The CPUE (kg/menhour and no/menhour) for all and legal-size lobsters over the last seven survey years shows a declining trend when comparing only the 18 sites surveyed in 2024 (**Figure 10 A&B**).
- Compared to 2022, both measures of CPUE declined for all lobsters by 22% and 10%, respectively, in the 2024 survey. Comparing the 2024 survey with the CLS 2023 survey, both CPUE measures decreased by 10% (**Figure 10A**).



- Similarly, the same trend can be observed in 2024 for legal-size lobster, with both CPUE being considerably lower than in 2022 by 30% kg/menhour and 22% no/menhour, respectively (**Figure 10B**). However, there is slight increase of 6% kg/menhour and 24% no/menhour in 2024 compared to the CLS 2023.

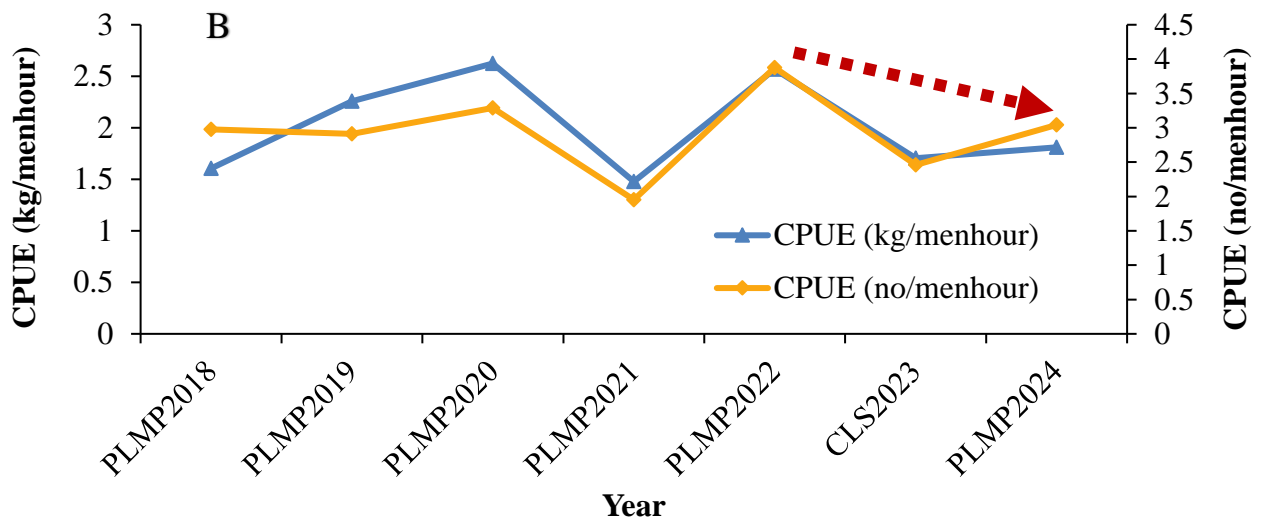


Figure 10: Catch per unit effort (CPUE) for A) all lobsters caught and B) all legal-size lobsters in kilogram/menhour and number/menhour survey years 2018 to 2024 across 18 sites. N.B: Anse Boileau and Barbarons were excluded from all the survey years as it was not sampled in PLMP 2024. The red arrow highlights the change in trend.

Appendix 2

Pairwise comparison between surveys.

Table 3: Pairwise comparisons between the average carapace length of *Panulirus longipes* females caught in the 2024 and 2022 PLMP survey and the 2023 CLS survey. P values were adjusted using the Bonferroni method.

Comparison Groups	P value	Significance level
2022 - 2023	0.45291148	ns
2022 - 2024	0.24202298	ns
2023 - 2024	0.01754258	$p < .05$

Significance level at 0.05. ns; nonsignificant difference.