

海水鹽度與眼柄切除對龍蝦(*Panulirus japonicus*)

成長影響試驗

葉光薰 林忠仙 鍾國仁

The Study on Influence of Salinity and Eyestalk Ablation on Growth of Lobsters (*Panulirus japonicus*)

Abstract

The experiments were carried out in ambient temperature for 90-135 days. 50 spiny lobsters were undertaken to determine what salinity was better for growth and 40 spiny lobsters were determined whether bilateral eyestalk removal could accelerate growth rate. Lobsters were reared individually in $30 \times 30 \times 40 \text{cm}$ (900cm^3) containers. Seawater treatment was closed circulation, and renewed once a month.

Lobsters grew better at salinity $28.3 \pm 1.6 \sim 37.7 \pm 1.7$ ppt. And there were no difference of growth between sexes. within 3.5 months lobsters have gained 32.2%, 49.7%, 49.9%, 55.1% and 40.2% in weight at salinity 24.3 ± 1.3 ppt, 28.3 ± 1.6 ppt, 33.7 ± 1.7 ppt, 37.7 ± 1.7 ppt and 41.9 ± 1.4 ppt respectively.

Bilateral eyestalk ablation could greatly accelerate the molting and also increase the weight gain of lobsters. The number of molts and weight gain were not different between sexes of ablated lobsters. within 3 months eyestalk ablated lobsters have gained 63.2% in weight and 24.2% when they were noneyestalk ablated. Survival of eyestalk ablation was good.

During the period of experiment at salinity $28.3 \pm 1.6 \sim 41.9 \pm 1.4$ ppt the mode of interval between two molts of lobsters was 62.2 days. And 53.2 days when eyestalk were ablated.

前 言

1906年 Hadley⁽¹⁾ 在試驗室中完成第一次對龍蝦成長的研究，結果顯示龍蝦成長需12年方能達到成熟體重 1磅。爾後 Tampleman⁽²⁾ 和 Wilder⁽³⁾ 研究認為在海中自然成長，龍蝦祇須 8年即可達一磅重。1951年 Wilder⁽³⁾ 控制高溫進行試驗，發現二年內即可讓龍蝦成熟，且達一磅重。目前美國利用高溫刺激，現已以 *Homarus* sp. 為對象邁向商業化養殖⁽⁴⁾

台東附近沿海捕獲的龍蝦 (*Panulirus* sp.) 主要有五種，其中以 *P. japonicus* 產量佔最大多數⁽⁵⁾。因其產量多，本報告即以其為試驗對象，從此探討海水鹽度對龍蝦脫殼成長的影響，以為日後試驗之依據。並探討眼柄切除與龍蝦脫殼成長之關係。希望得到快速的成長，能實際應用到養殖方面。惟加溫設備不足，故不能作對 *P. japonicus* 的成長有何種程度之影響試驗。但由 1月至 5月間氣溫之變化，亦足以顯示溫度對龍蝦之影響。

材料與方法

試驗所用的龍蝦皆在成功附近沿海捕獲，經在試驗水槽中以 $30 \times 30 \times 40 \text{cm}$ (900cm^3)⁽⁶⁾ 之箱網馴養一個月後方作正式試驗。試驗室海水以密閉循環方式處理，每個月換水一次。除鹽度與成長關

係試驗之水溫曾在 1月21日至 2月20日間控制 $25.1 \pm 0.5^{\circ}\text{C}$ 外，各組試驗之水溫在試驗期間皆未予以控制。試驗期間水溫變化如圖 1及圖 2。每天以過量之生鮮帶殼貝肉、帶殼蝦肉、魚肉或魚肝餵食，第二天將殘餌收回，並記錄脫殼情形，但所脫的殼續留在箱網中未即刻拿走。

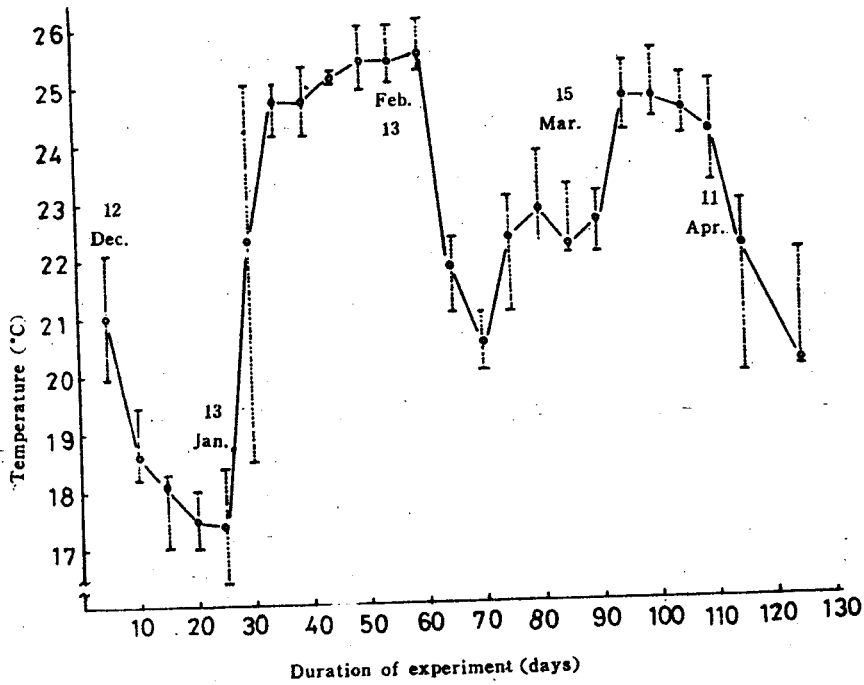


Fig 1: Variation of temperature during the period of experiment of relationship between salinity and growth of lobsters.

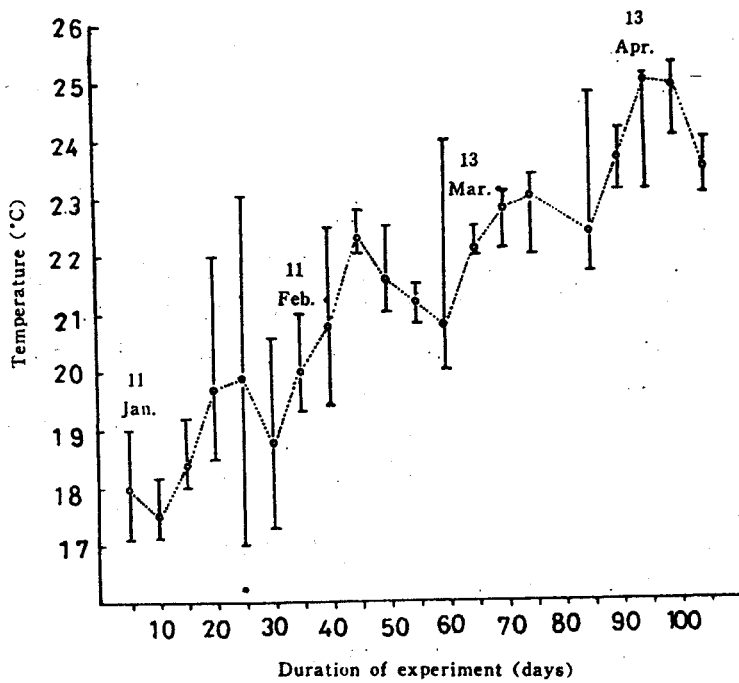


Fig 2: Variation of temperature during the period of experiment of relationship between eyestalk ablation and growth of lobster.

塩度與成長關係試驗共分五組，各組塩度 (S) 分別爲 (I) 24.3 ± 1.3 ppt, (II) 28.3 ± 1.6 ppt, (III) 33.7 ± 1.7 ppt, (IV) 37.7 ± 1.7 ppt, (V) 41.9 ± 1.4 ppt。每組雌雄龍蝦各五尾。

眼柄切除與成長關係試驗分試驗與對照二組，每組有雌、雄龍蝦各10尾。眼柄切除方式是用烤熱的剪刀於眼柄切除第一隻眼，隔一星期再切除第二隻眼。試驗期間海水塩度爲 32.2 ± 1.0 ppt。

結 果

1. 塩度與成長關係試驗：在不同塩度海水中龍蝦脫殼與成長情形見圖 3與圖 4。試驗期間各組脫殼與成長情形之比較爲 II III IV V 四組脫殼次數無顯著差異 ($P > 0.050$) 而 II III IV 三組間頭胸甲長增加之百分率無顯著差異 ($P > 0.050$)，體重增加之百分率亦無顯著之差異 ($P < 0.050$)，皆優於 I II 二組而 II 組又優於 I 組。試驗期間 I 組死亡 4 尾，II 組死亡 2 尾。各組雌、雄龍蝦體重增加之百分率亦無顯著差異 ($P < 0.100$)。

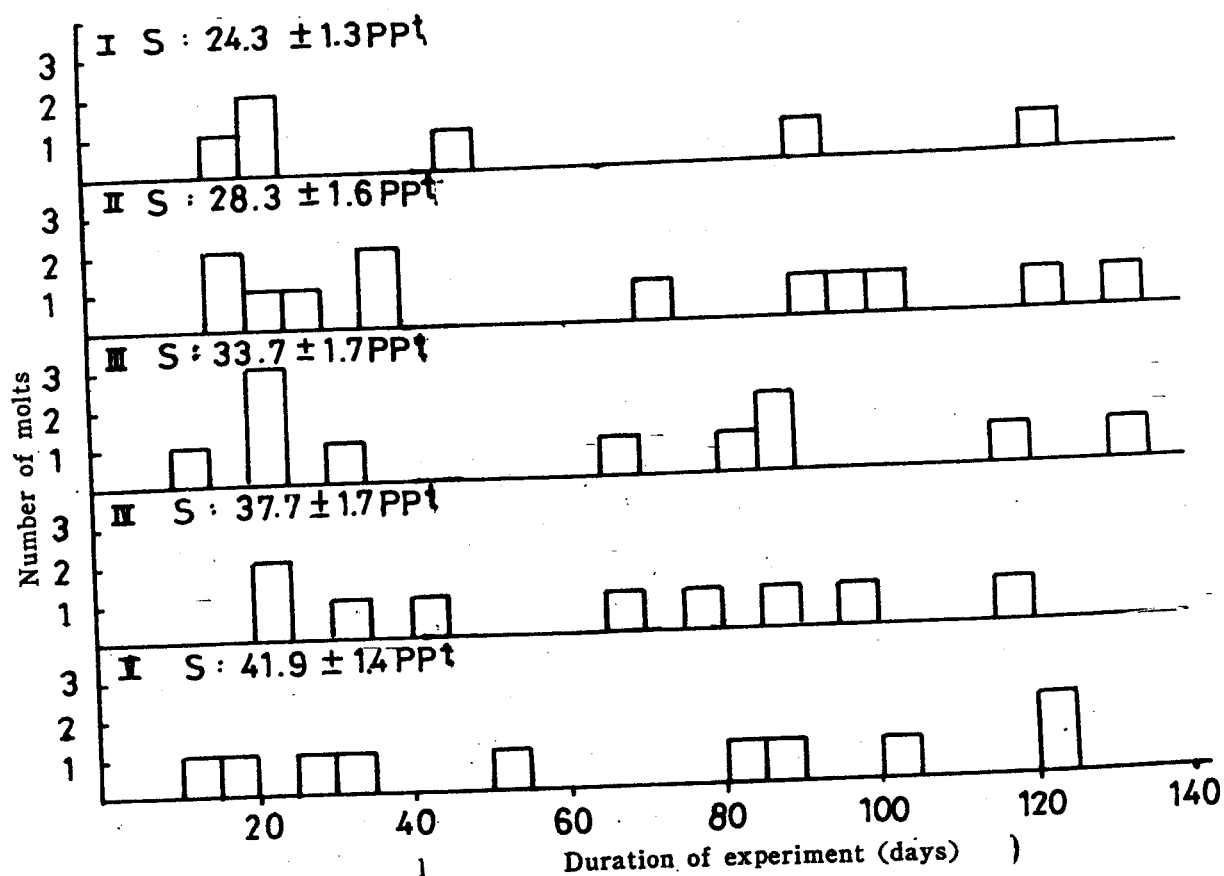


Fig 3: Number of molts of lobsters at different salinity in progress of experiment.

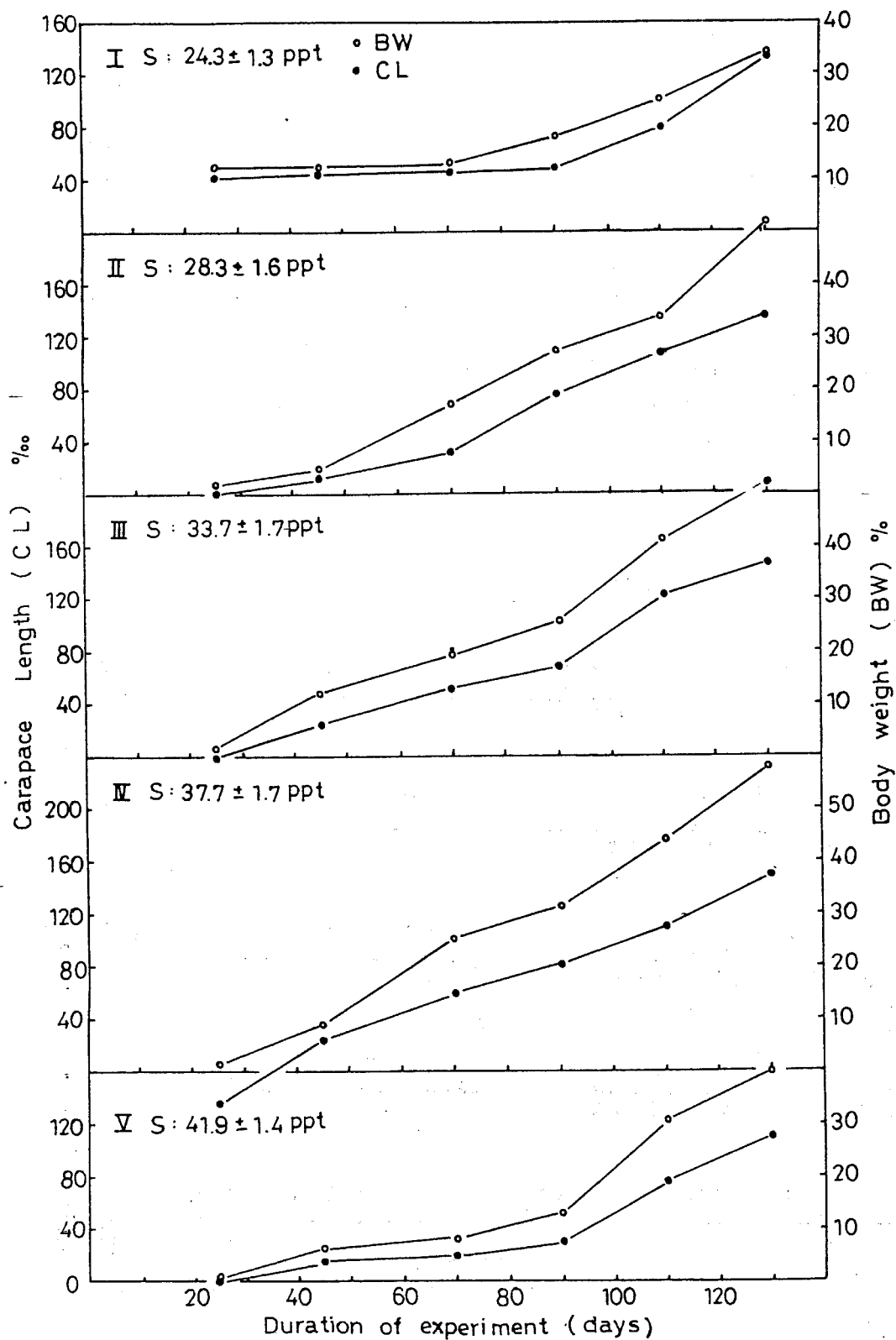


Fig 4 : Body weight gain (%) and carapace length increment (%) of lobsters at different salinity for the duration of experiment.

2.眼柄切除與成長關係試驗：龍蝦試驗期間之脫殼與成長情形見圖 5與圖 6。試驗組之脫殼數多於對照組 ($P < 0.10$) 頭胸甲長增加之百分率大於對照組 ($P < 0.050$) 體重增加之百分率亦大於對照組 ($P < 0.001$)。試驗組雌雄龍蝦體重增加之百分率無顯著差異 ($P < 0.10$)。

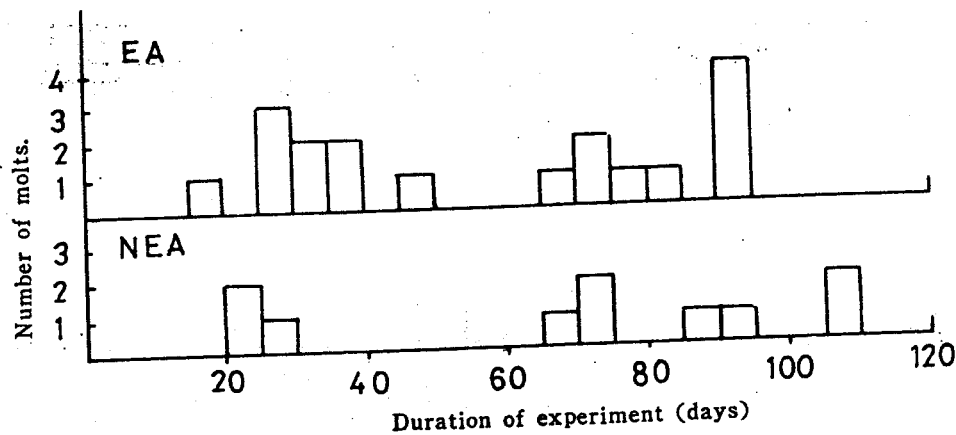


Fig 5 : Number of molts of lobsters of eyestalk ablation (EA) and noneyestalk ablation (NEA) for the duration of experiment

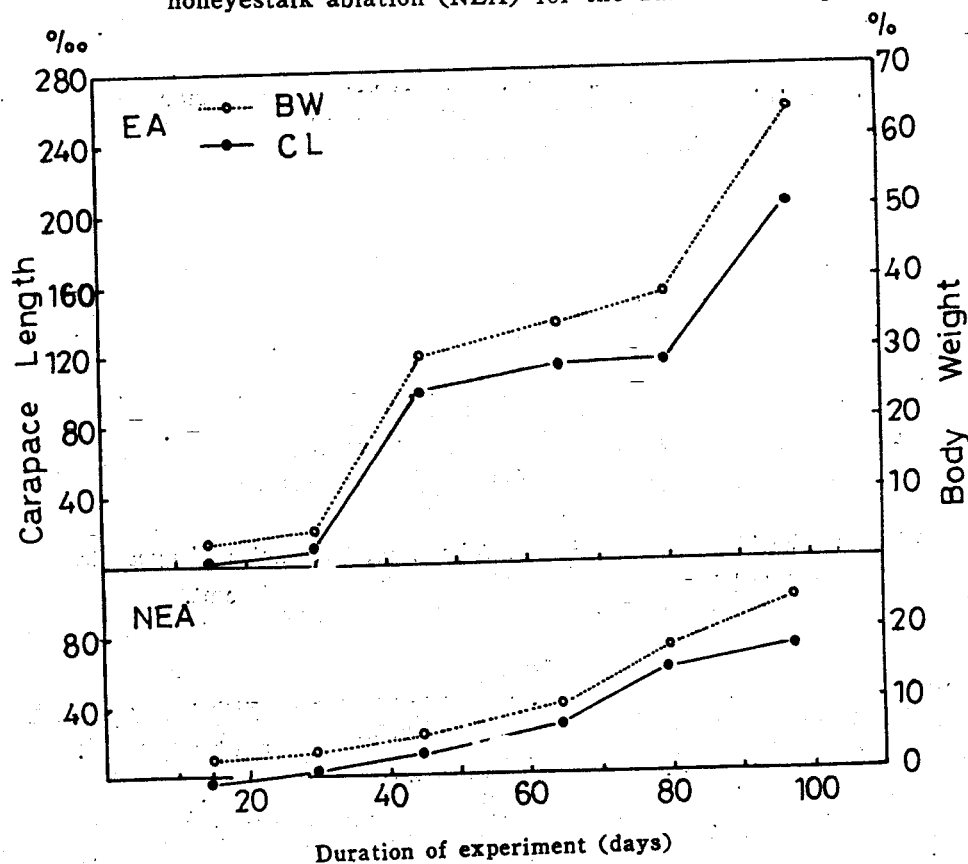


Fig 6 : Body weight gain (%) and carapace length increment (%) of lobsters of eyestalk ablation (EA) and noneyestalk ablation (NEA) for the duration of experiment.

3. 龍蝦切除眼柄死亡情形：一尾於切除第一隻眼柄後一天死亡，另一尾於切除第二隻眼柄後一天脫殼死亡，試驗期間亦有一尾脫殼死亡。龍蝦切除眼柄後，行動緩慢，抗捕力弱，但攝餌量大增。至試驗中期切除眼柄龍蝦行動依然緩慢，但抗捕力增強。眼柄基部有樹根狀之不完全再生現象，長者約2.5公分。

4. 脫殼間隔日期之觀察：圖7為試驗期間鹽度與成長關係試驗之II~V組龍蝦二次脫殼間之日數，其型量 (mode) 為62.2天。圖8為眼柄切除與成長關係試驗中眼柄切除龍蝦二次脫殼間之日數，其型量為53.2天。

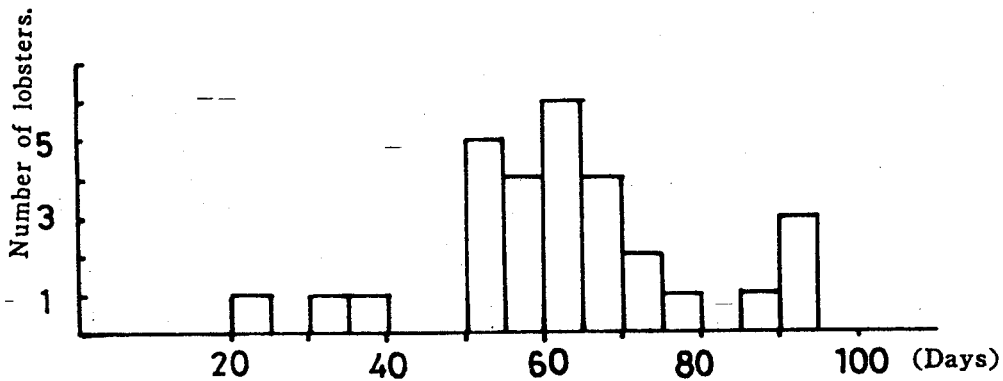


Fig 7 : The histogram for interval between two molts of lobsters at salinity.

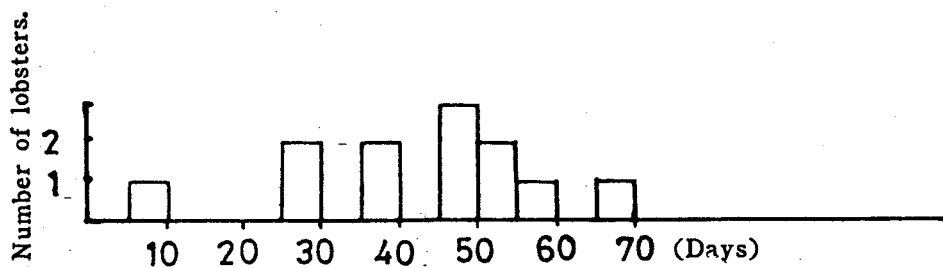


Fig 8 : The histogram for interval between two molts of eyestalk ablated lobsters during the period of experiment.

討 論

1. 通常淺海 (Sub-littoral) 的甲殼類對低鹽度海水的耐性較差⁽⁷⁾，因此 *P. japonicus* 在高濃度海水中的成長較佳，在三個月間，鹽度與成長關係試驗各組體重增加為 (I) 組：32.2% (II) 組：49.7% (III) 組49.9% (IV) 組：55.1% (V) 組：40.2%。

2. Castell 等人⁽⁸⁾ 以 *Homarus americanus* 作試驗發現眼柄切除之龍蝦，成長率為同試驗中對照組之50.4倍，然其餌料轉換率為對照組之0.01倍。本報告眼柄切除與成長關係試驗，雖無法計算餌料轉換率，但可估計試驗期間試驗組之食量約為對照組之3倍。3個月間，試驗組體重增加64.2%，對照組體重則增加24.3%。而試驗期間試驗組之脫殼率亦遠大於對照組，所以眼柄切除必能刺激龍蝦快速成長，但對龍蝦從孵化後成長至上市體型，眼柄切除是否有實際之效用，尙有待更進一步探討。

3. 鹽度與成長關係試驗之水溫於民國69年 1月21日至 2月20日曾控制於 $25.1 \pm 0.5^{\circ}\text{C}$ ，(IV)組於 1月 7日至 4月 8日之體重增加之百分率大於眼柄切除試驗之對照組 ($P < 0.20$)，已顯示溫度對成長之效應⁽⁹⁾，但同期間(III)組之成長却遠小於眼柄切除之龍蝦 ($P < 0.001$)。由各組溫度變化圖及成長圖顯示，水溫升高，龍蝦成長速率亦隨着增大。而眼柄切除之龍蝦成長對水溫之變化尤為敏感。

4. 試驗初期，由於對環境尚不能完全的適應，蝦於脫殼後其長度有不增長甚或萎縮的現象⁽¹⁰⁾。

摘 要

1. 試驗共90~ 135天，每尾龍蝦單獨分養，試驗室海水以密閉循環方式處理，每個月換水一次，水溫不予控制。

2. 鹽度與成長關係試驗分五組，各組鹽度：(I) $24.3 \pm 1.3\text{ppt}$ (II) $28.3 \pm 1.6\text{ppt}$ (III) $33.7 \pm 1.7\text{ppt}$ (IV) $37.7 \pm 1.7\text{ppt}$ (V) $41.9 \pm 1.4\text{ppt}$ 。試驗期間，各組體重增加各為 (I) 32.2% (II) 49.7% (III) 49.9% (IV) 55.1% (V) 40.2%。

3. 試驗期間，切除眼柄之龍蝦體重增加為64.2%，對照組為24.3%。

4. 各組雌、雄龍蝦之成長皆無顯着差異。

5. 試驗期間切除眼柄龍蝦二次脫殼間隔日數之型量為53.2天。鹽度與成長關係試驗之 (II) ~ (V) 組之型量為62.2天。

參 考 文 獻

1. Hadlly P. B. (1906) U. S. Fish Wild Serv Fish. Bull. p153
2. Templeman (1936) J. Biol. Bd. Can. 1.213
3. Wilder D. G. (1953) J. Fish Res. Bd. Can. 10.371
4. Van Olst J. C. and Carlberg J. M. (1979) Recent developments in lobster research CFF July/August. p13
5. 鍾國仁 (1979) 未發表之調查。
6. Van Olst J. C. and Carlberg J. M. The effects of container size and transparency on growth and survival of lobsters cultured individually. Proceedings of annual meeting world mariculture society.
7. Lockwood Aspects of the physiology of crustacea. p18
8. Castell J. D. Covey J. F. Aiken D. E. and Woddy S. L. The potential for eyestalk ablation as a technigue for accelerating growth of lobster for commercial culture proceeding of annual meeting world mariculture society.
9. Hughes J. T. and Sullivan J. J. (1973) Enhancement of lobster growth. Science 177. 1110-1111.
10. Aiken D. E. Molting and growth in decapod crustaceans with particular reference to the lobster *H. marus americanus* Workshop on lobster and rock lobster ecology and physiology p 44 : Commonwealth Scientific and Industrial Research, Organization , Austrailia, Melbourne, 1977.