

The Relevance and applicability of current regulations for the spiny lobster fishery in the south coast of Sri Lanka

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Abstract

Length/weight frequencies in different species of lobster and catch information were collected during the period 2001 to 2004 from lobster companies and lobster landing sites located on the south coast of Sri Lanka, and analyzed in order to update knowledge on the current status of this industry. A rapid assessment was carried out from April to May 2006 to evaluate the applicability of the existing minimum legal limit. The study found that between 36% and 45% of the daily catch consisted of undersized animals with less than 6 cm carapace length (CL). Although harvesting of berried females was prohibited, they were found in the catches throughout the lobster fishing season, with the highest proportion (47%) being recorded during September to January. Carapace length at the onset of sexual maturity for *Panulirus versicolor*, *P. penicillatus*, *P. homarus* and *P. longipes* were determined as 6.0 cm, 5.2 cm, 4.0 cm and 3.4 cm, respectively. It became clear that the present minimum legal limit (6 cm CL), does not allow *P. penicillatus* and *P. versicolor* to attain to 50% maturity level and is a result of all lobster species (except *P. ornatus*) being covered by a common set of regulations. Moreover, an increasing trend of harvesting undersized lobsters was recorded during the study period. The highest proportion (36%) of undersized lobsters in the catch was recorded during August to October. When the occurrence of berried females and the high proportion of undersized lobsters in commercial catches are considered, it would be more appropriate to declare the period September to October as the closed season for the spiny lobster fishery in the Southern coast, instead of the present practice of having two separate closed months (February and September).

Keywords: carapace length, closed season, minimum legal size, size at onset of maturity

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Introduction

The different species of *Panulirus* (Crustacia: Decapoda: Palinuridae) inhabit a wide variety of rocky habitats in the shallow waters of the tropics. A total of nineteen species of the genus *Panulirus* are distributed across the tropical and subtropical belt (between 35 °N and 35 °S latitude, Plecher, 1993). According to Prem-Kumar and Daniel (1975 Cited by Jayakody, 1991), *P. homarus*, *P. ornatus*, *P. versicolour* and *P. penicillatus* are the main species commercially exploited in the Indian Ocean.

Sri Lanka is renowned for its rich Palinurid fauna and six species have been recorded (De Bruin, 1962). Commercial spiny lobster fishery is restricted to the inshore region of the rocky coast line. *Panulirus homarus* dominates the south and west coasts, while *P. ornatus* and *P. versicolour* dominate north and east coasts, respectively (De Bruin, 1962).

Although spiny lobsters are found throughout the coast line of Sri Lanka, they are more abundant along the southern coast where the bottom consists of rocks and ledges (Jayakody, 1991). The annual production of 200 mt from the southern coast is dominated by *P. homarus* which contributes to 70-80% of the total catch (Jayakody, 1986) followed, in descending order, by *P. penicillatus* (5%), *P. longipes* (5%), *P. ornatus* (5%), *P. versicolour* (3%) and *P. polyphages* (<1%). The spiny lobster fishery earns significant amounts of foreign exchange for Sri Lanka with around 95% of the landing being exported. This represents around 2% of the total fishery exports and amounts to 5% of the income from them (DFAR, 2004).

Although lobsters are found year round, due to operational difficulties, fishing is restricted to the non-monsoonal period. The Southern coast lobster fishing, therefore, starts soon after the South – West monsoon and peaks between the months of August to March with 90% of the production being recorded during this period (Anon, 2000). In Sri Lankan waters, lobsters are mainly harvested using lobster rings, bottom set gill nets, trammel nets and by divers (Jayakody, 1991), but other countries in the region use traps, hooks, gill nets and even trawl nets although to a lesser extent (Joseph, 1971 Cited by Jayakody, 1991). Around 1000 fishermen are directly engaged in the Southern coast lobster fishery during the season while an estimated 30000 people are dependent on the industry (Taylor - Moor, 2002).

Lobsters have been fished with little effort in the past. With the expansion of the live lobster export industry, however, the increased demand has resulted in over exploitation. In the southern coast lobster fishery, the average annual catch rates have now reduced

from 3.3 kg to 1.24 kg from 1986 to 1991 accompanied by an increase of 40% the fishing effort (Aruldpragasam, 2000).

The management of Spiny lobster fishing in Sri Lanka was started as early as in 1971 with the first set of regulations prohibiting catching of spiny lobsters, keeping them in possession and sale of lobsters having carapace length of less than 8 cm, being gazetted in 1973 (Gazette 1973). The minimum legal size has been selected considering the size at first maturity of the dominant species – *P. homarus*. Two aspects of the “Size at maturity” need to be considered by scientists, namely, physiological maturity - when the gonads are capable of producing visible gametes - and functional maturity – when all secondary attributes have developed sufficiently to ensure successful mating with visible offspring production in the natural habitat (Aiken and Waddy, 1980). A new set of lobster regulations was published in the year 2000 which changed the minimum legal size as 10 cm carapace length (CL) for *P. ornatus* and 6 cm CL for other species. The new regulations additionally declared February and September as “closed” months for Southern coast lobster fishery.

The present study aimed at assessing whether the revised regulations of 2000 were practical and led to the desired results. Furthermore, attempts were made to identify the relevance of the current minimum legal size limit of 6cm CL on non dominant species.

Materials and Methods

This study was conducted during the period October 2001 to June 2004. Production data were collected daily from 21 landing sites and 2 lobster purchasing centers from Rathgama to Kotuwegoda. The measurements included length /weight of lobsters on a species basis, changes in the catch per unit effort, variations in average weight, proportion of berried females, proportion of individuals below 6 cm in CL, and the sex ratio. A rapid assessment on the said parameters was carried out during March 2006 and April 2006 to update the available information. Both Carapace and tail lengths were taken to the nearest mm using a measuring board. Lobster fishermen, collectors, exporters, community leaders were interviewed to determine their attitudes towards existing lobster regulations and to obtain their views on possible revisions. Secondary data used in this study were obtained from lobster companies, National Aquatic Resources Research and Development Agency (NARA) and Ministry of Fisheries and Aquatic Resource Development (MFARD).

Results and Discussion

The average catch per unit effort in the study area was 0.75 kg boat⁻¹day⁻¹ (± 0.18 kg boat⁻¹day⁻¹) from 2002 to 2004 (Fig.1). These values were elevated in the months following the months in which the fishery is banned, which lies within the monsoonal period.

The proportion contributed by each of the six spiny lobster species to the total production is given in Table 1. It can be seen that in 2003, the highest percentage contribution (45%) was from *P. homarus*, while lowest (2%) was from *P. ornatus*. *Panulirus penicillatus*, *P. longipes*, and *P. versicolour* contributed 23%, 19% and 11% respectively.

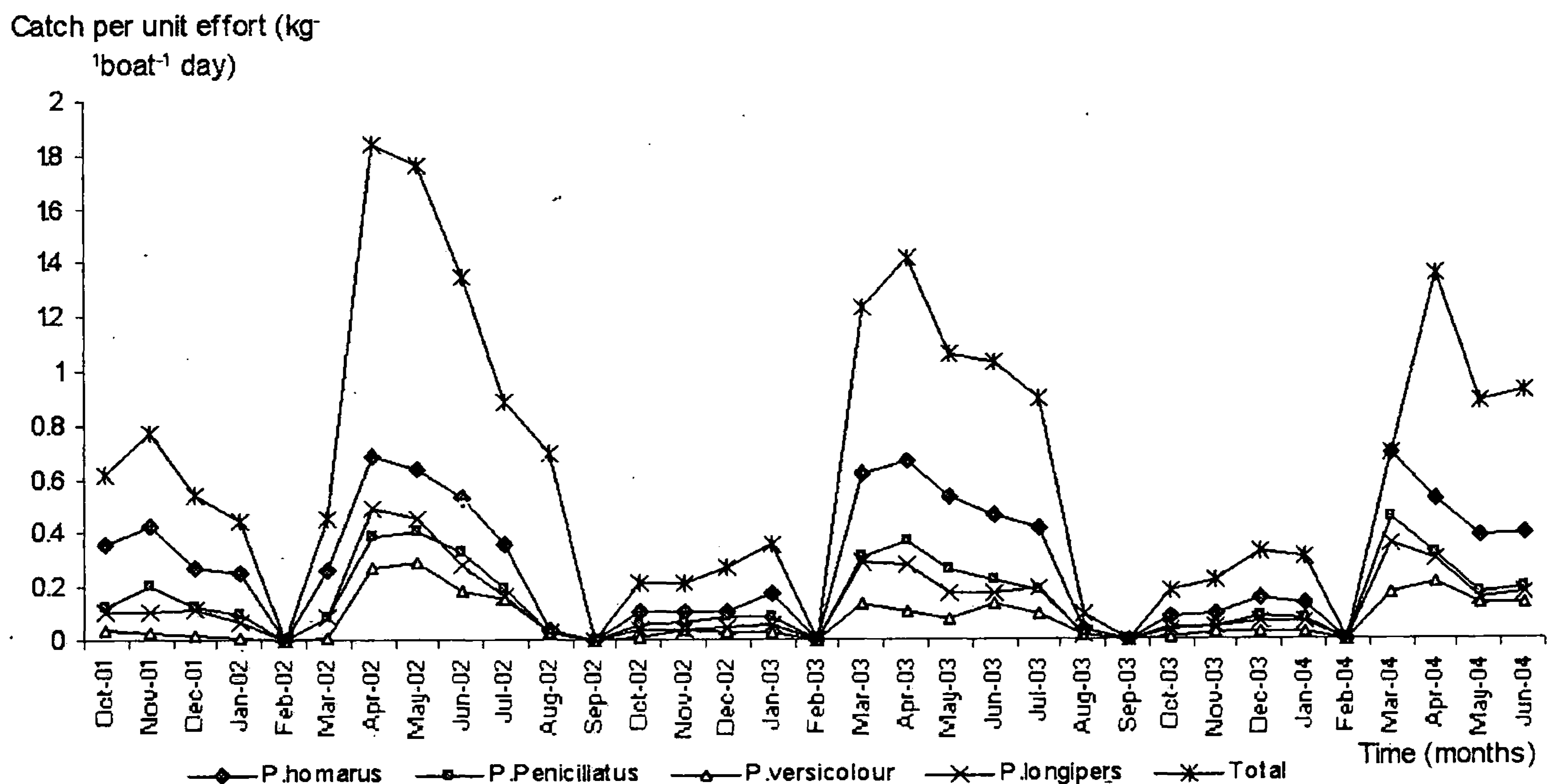


Fig. 1. Catch per unit effort for each month.

Table 1. A comparison of the Percentage contributed by different species of spiny lobsters to the total catch in 1986* and 2003.

Species	1986 %	2003 %
<i>Panulirus homarus</i>	70-80	45
<i>Panulirus penicillatus</i>	5	23
<i>Panulirus longipes</i>	5	19
<i>Panulirus ornatus</i>	5	2
<i>Panulirus versicolour</i>	3	11
<i>Panulirus polyphages</i>	1-2	-

(*source: Jayakody, D.S. 1991)

The proportion of undersized lobsters caught (except *P. ornatus*) during the study period ranged from 36% to 45%. These proportions as well as the number of individuals below 200 g in weight showed an increasing trend over the period (Fig. 2 and Fig. 3). Highest percentage (36%) of undersized lobsters was recorded between August to October.

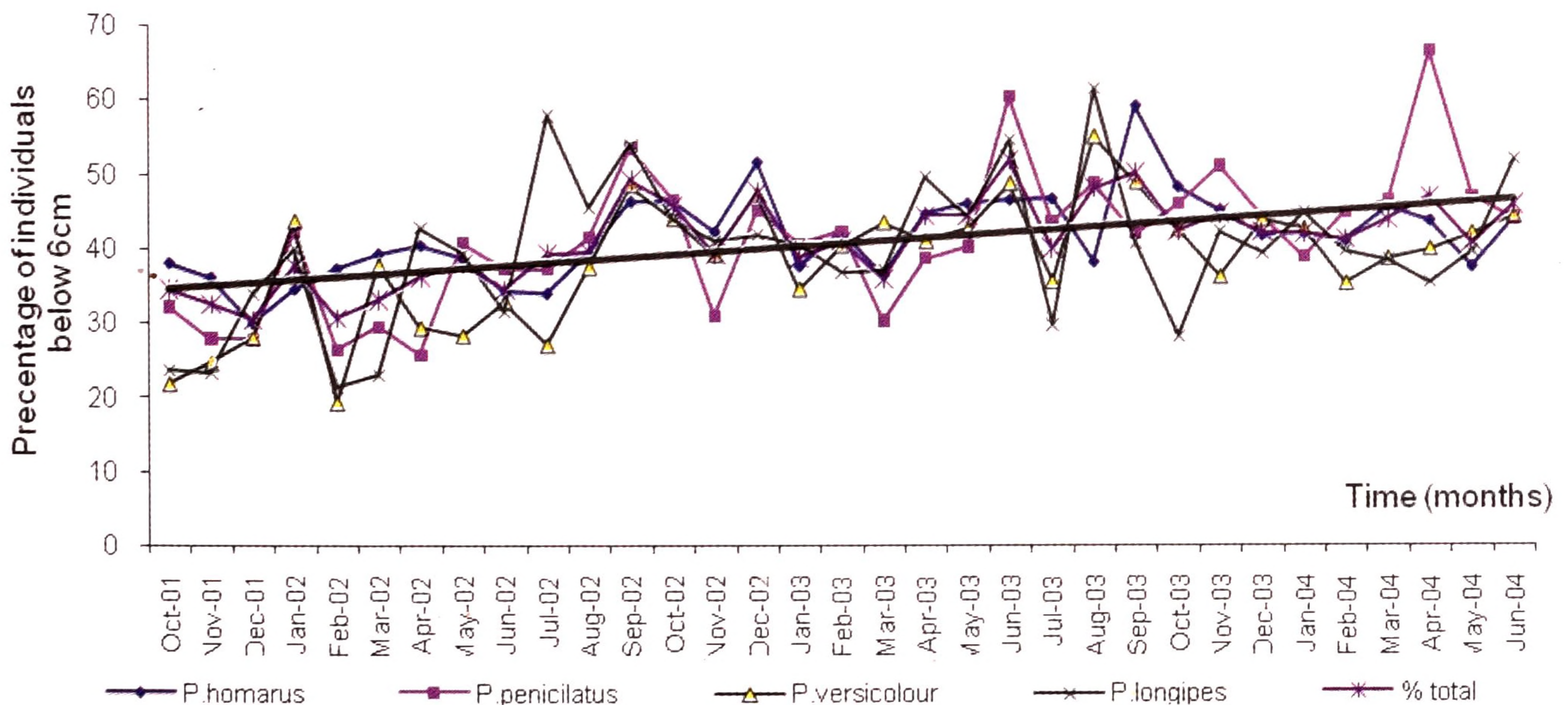


Fig. 2. Relationship between the proportion of individuals with less than 6cm carapace length and time.

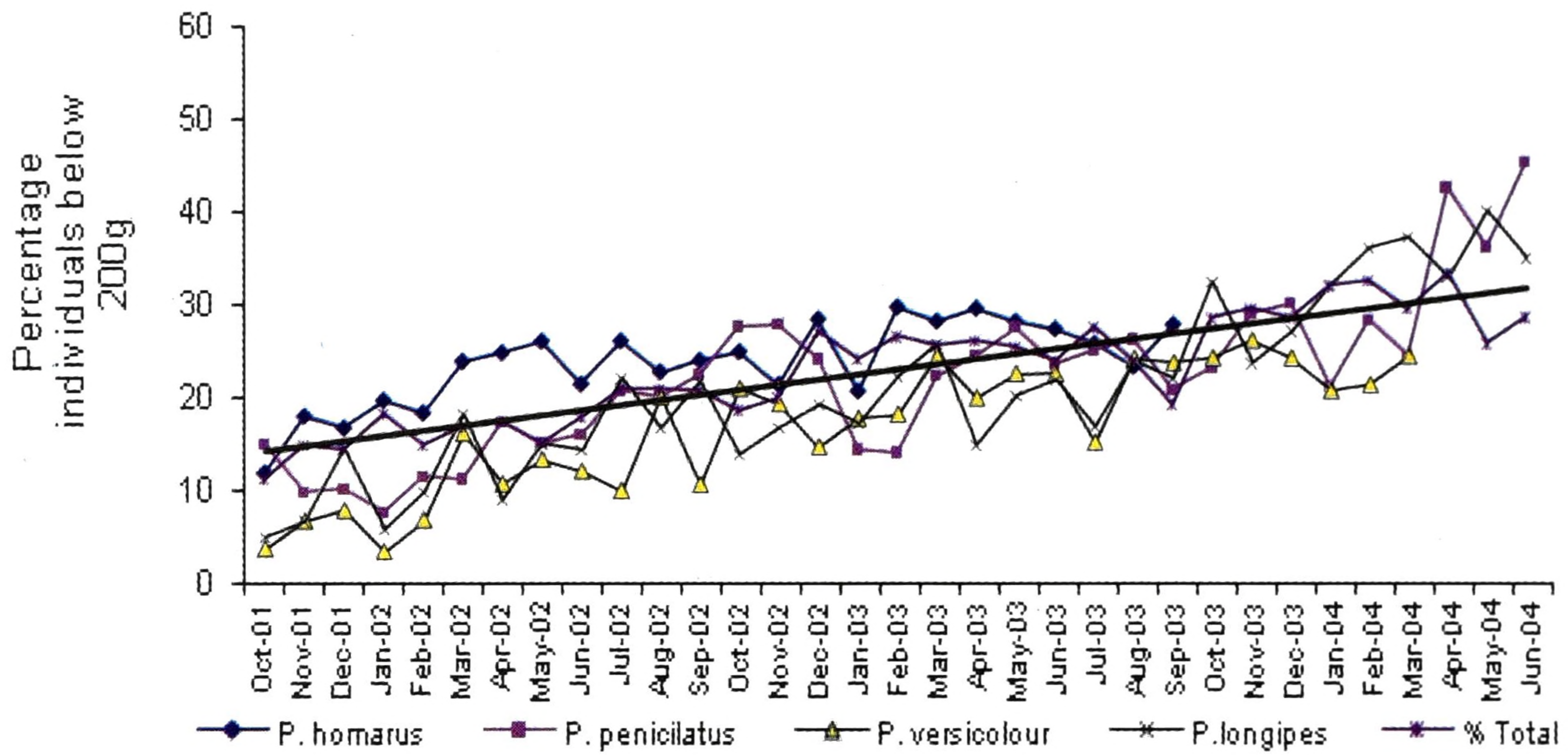


Fig. 3. Relationship between proportion of individuals below 200g carapace length with time.

The average weight of lobsters during the study period showed a declining trend. The lowest average weight was recorded for *P. penicillatus* (182g ±18) while average weights varied between 288-360g for the other three species. The proportion of berried females caught was highest (48% ±3.7) during the period November to January with much lower levels (10% ±0.9) recorded during the rest of the year (Fig. 4).

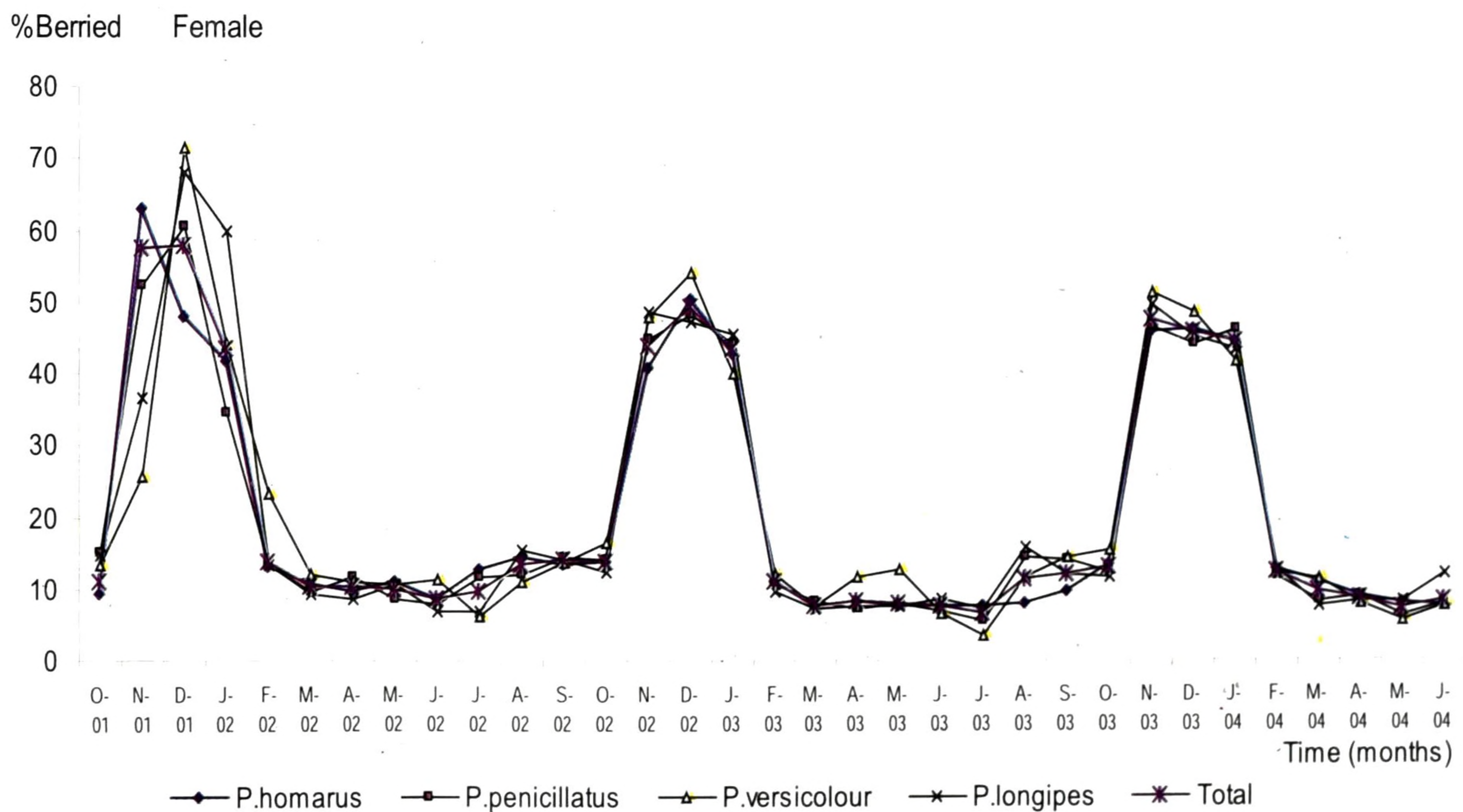


Fig. 4. Relationship between the proportion of berried females caught and the season.

The fitted regression line for the relationship between carapace length and total length of female and male lobsters of each species intersected at different carapace lengths. Traverse point of this regression relationship were considered as the size where lobsters begin to mature (size at onset of maturity, Krouse, 1972 and Fielding and Mann, 1998). *P. versicolour* showed the greatest carapace length 6 cm (Fig. 6) at which two lines intersected, followed in descending order, by *P. penicillatus*: 5.2 cm (Fig. 7), *P. homarus*: 4 cm (Fig. 5) and *P. longipes*: 3.4 cm (Fig. 8).

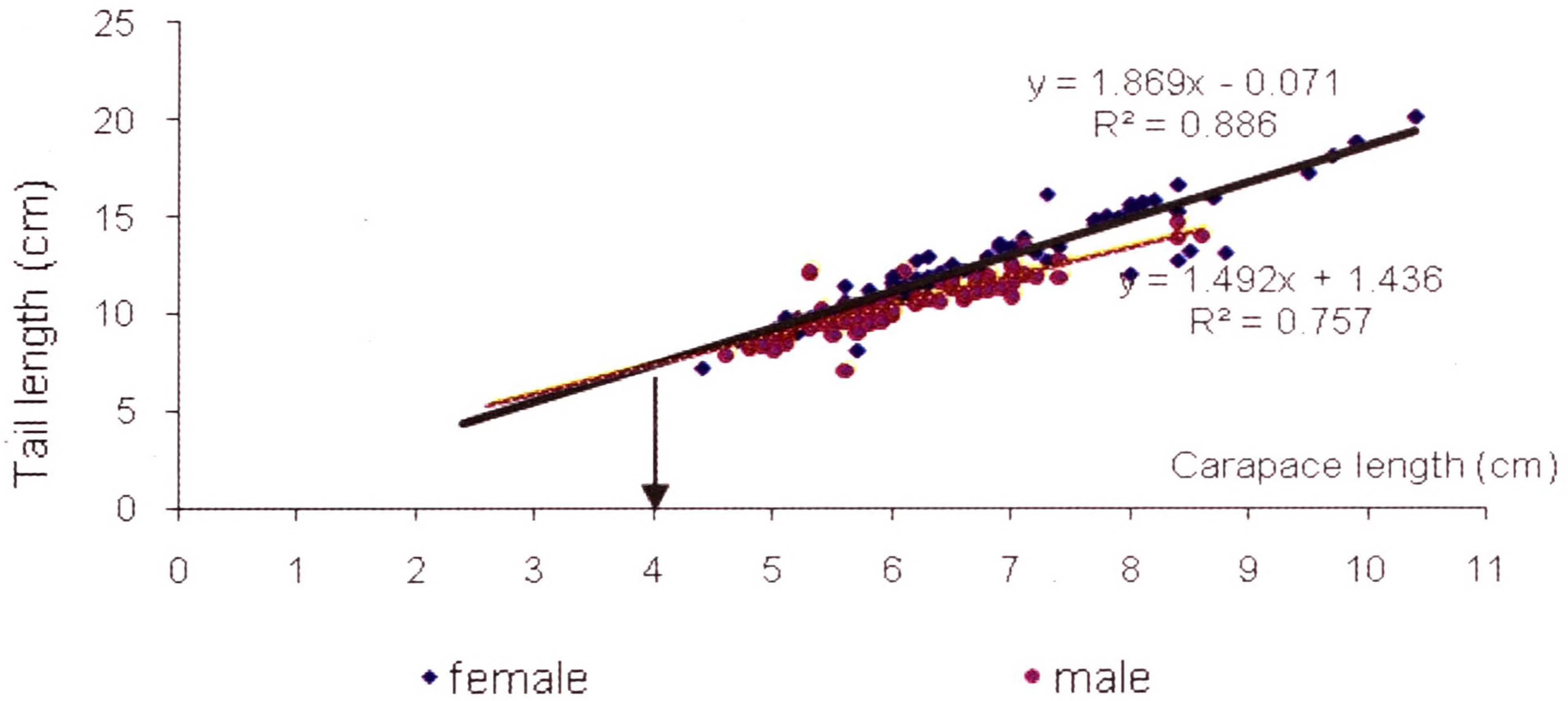


Fig. 5. Carapace length Vs tail length in *P. homarus*.

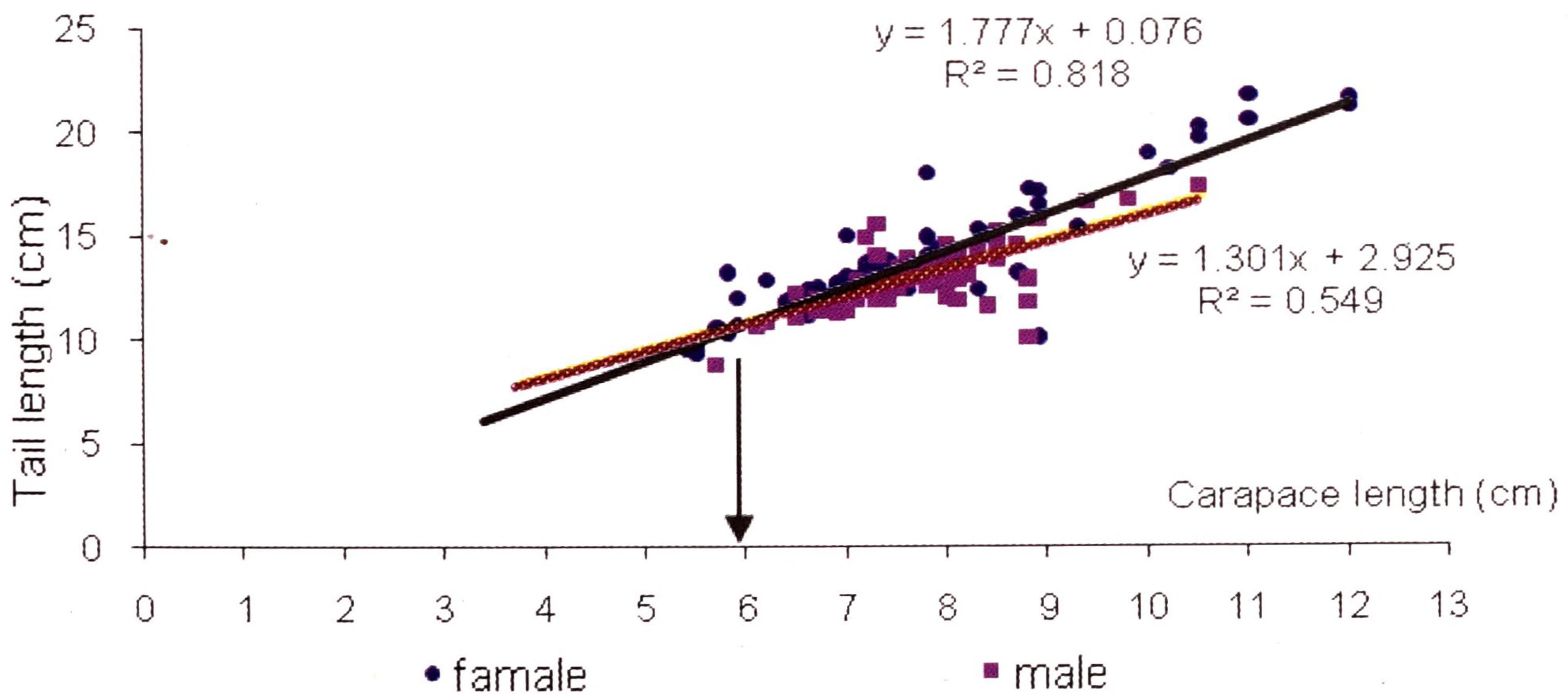


Fig. 6. Carapace length Vs tail length in *P. versicolour*.

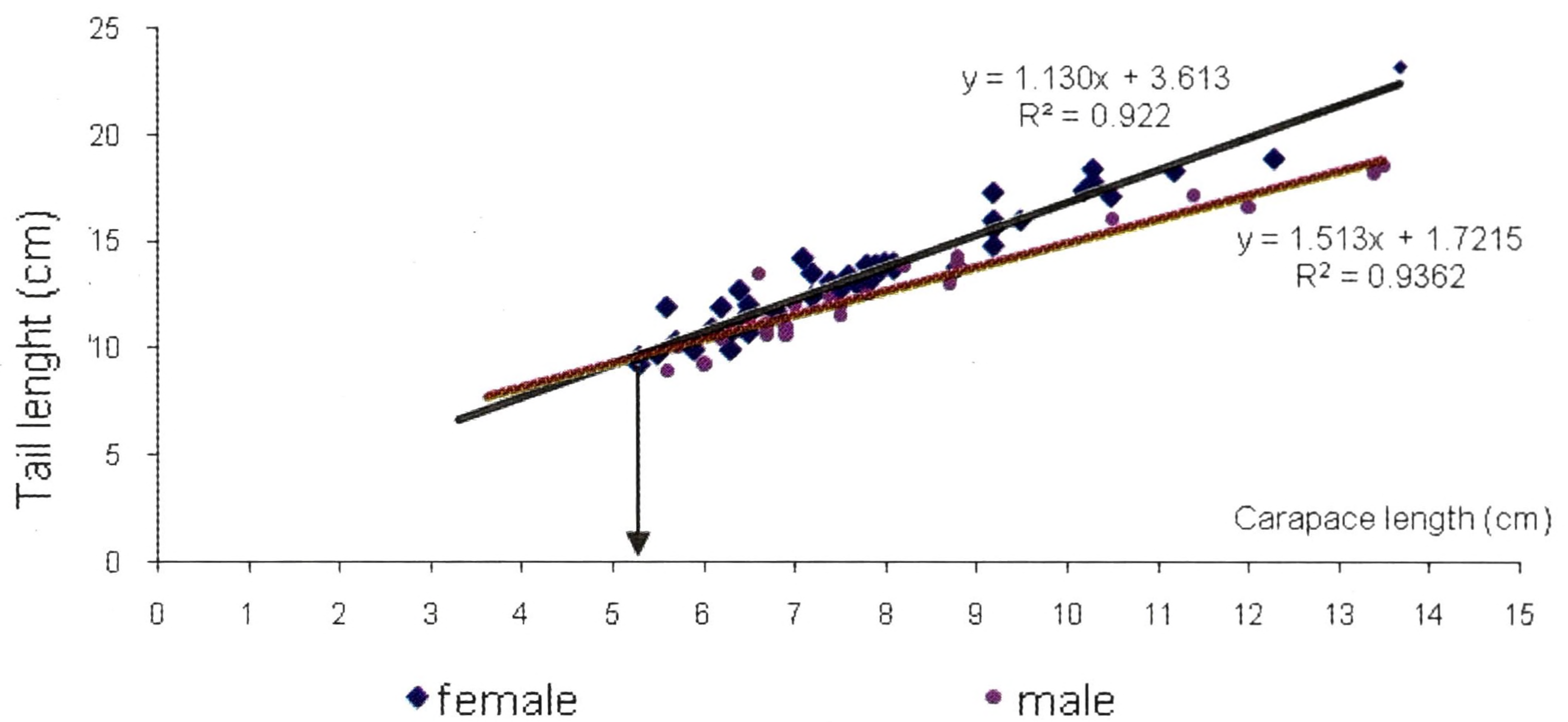


Fig. 7. Carapace length Vs tail length in *P. penicillatus*.

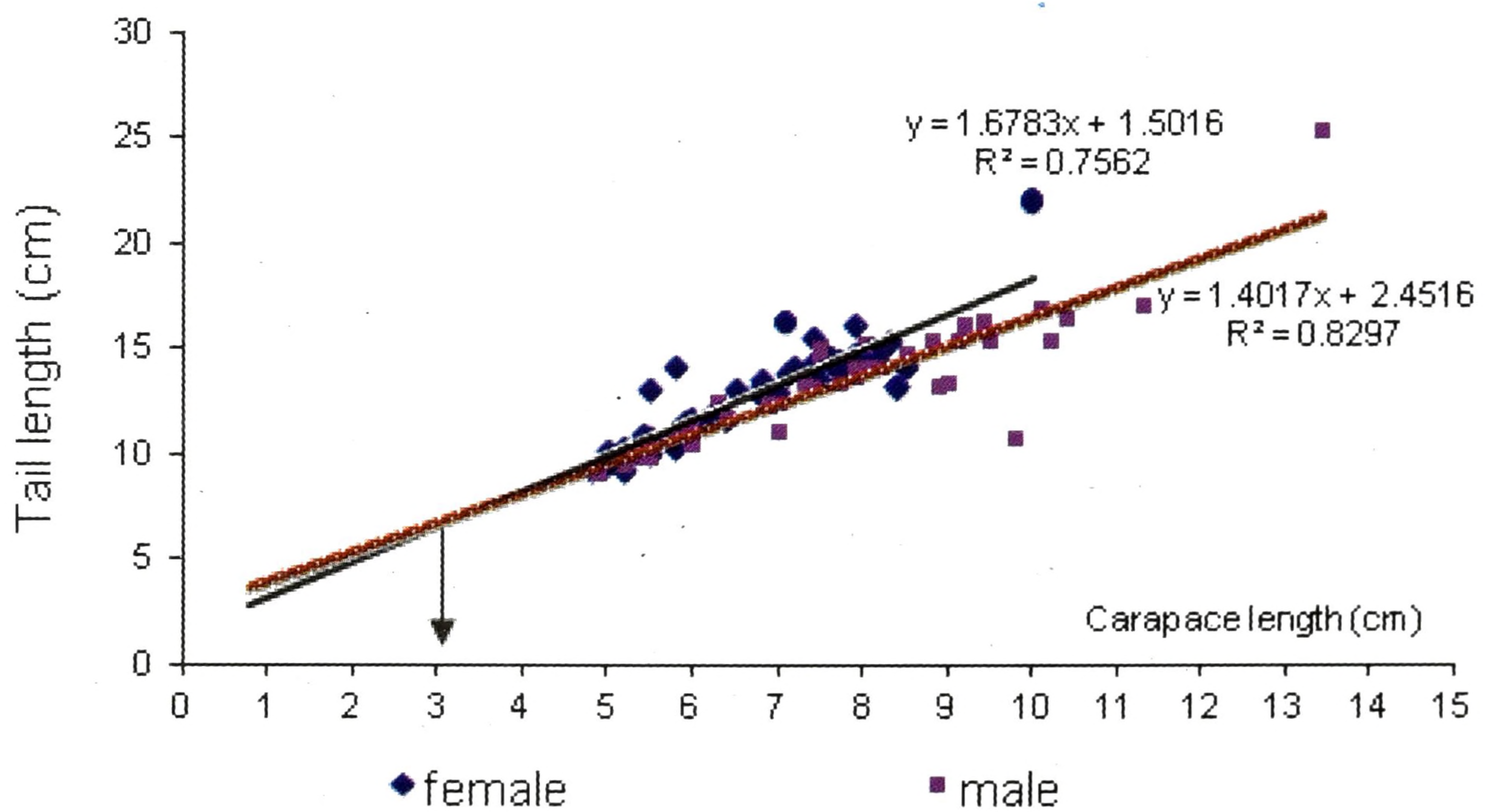


Fig. 8. Carapace length Vs tail length in *P. longipes*.

Although Jayakody (1991), reported a significant decline in annual spiny lobster production and Catch Per Unit Effort (CPUE) in the southern region of Sri Lanka, the average CPUE in the study area remained constant at 0.75 kg boat⁻¹day⁻¹ during the present study period from 2002 to 2004.

A significant drop in average catches was also not observed. Aruldpragasam (2000) reported a decline in average annual catch rates from 3.3 kg boat⁻¹ day⁻¹ in 1986 to 1.24 kg boat⁻¹ day⁻¹ in 1991, in the same study area. These declining rates in both catch and CPUE may be due to the increase in fishing intensity. Moreover, recently introduced highly efficient fishing gear types such as bottom set gill nets, scuba diving and blast fishing (Rajasuriya *et al.*, 1995) may have contributed to a decline in annual lobster production. Indeed, available reports (Anon, 2000) indicate that several species are now being over harvested and Aruldpragasam (2000) highlighted an urgent need of immediate management measures for the spiny lobster fishery industry. High value and easy marketability of lobsters together with the relatively simple harvesting technologies, live storage potential and durability attract fishermen to lobster fishing, thus creating a high fishing intensity. The higher CPUE values observed in monsoonal months may be due to the turbid nature of sea which makes lobsters more vulnerable to entangling. This aspect has to be seriously considered when deciding on the “closed” months.

Low legal compliance of lobster fishermen and company owners in the southern coast is shown by the increasing trend in the presence of a high proportion of undersized individuals in total landings (below 6cm CL and below 200 g in weight) and a decreasing trend in average individual weight. A high proportion of undersized lobsters at the onset of the fishing season (August) with the cessation of monsoonal period indicate the entry of young individuals into the fishing area. Exploitation of undersized individuals from the inshore nursery areas may, therefore, have an adverse impact on the fishery in the long term.

In this fishery, a sufficient number of mature females should be present in the population to replenish the breeding. During the south-west monsoon the strongest currents are recorded off the southern coast (Samaranayake, 2003) thus limiting the fishing operation up to some extent during this period. Lobster fishing can be seen, however, even during the southeast monsoon due to the introduction of motorized boats (Jayakody, 1991). The present study revealed that the currently chosen closed months do not appear to be appropriate in achieving the intended purpose. In order to protect the breeding adults, management should consider revision of the closed season taking into account the periods of peak reproductive activity.

One weakness observed in the present regulations is having two separate months within the lobster season in which the fishing is banned. The majority of fishermen now catch lobsters in the last two weeks of each banned month and keep them alive in cages in shallow waters. As a result, the effective period of prohibition is reduced to one month instead of two months. A single closed period spanning two months would be more effective than having two separate closed months.

Between two peak breeding seasons, the November to October shows higher occurrence of berried females (Anon, 2000). Considering the proportions in the catch of berried females, undersized lobsters and CPUE in monsoonal months, it appears more appropriate to declare both September and October as the closed season, rather than the two separate closed months as is currently implemented.

According to Jayakody (1986), *Panulirus homarus* contributes 70-80% to the total production. After 1986 no analysis of species composition has been carried out in the Southern coast lobster fishery. The present study found, however, that only 45% is contributed by *P. homarus* with other species contributing a significant proportion (Table 1). This declining trend of *P. homarus* in the catches could be a result of either over exploitation or increased production in other species. The increased proportion of non-dominant species further highlights the importance of having safe legal limit to prevent over exploitation.

For the *P. homarus* stock in southern Sri Lankan waters, mean size at sexual maturity has been estimated as 55-59 mm CL by De Bruin (1962) while Jayakody (1989) estimated the size at ovi-position as 59.5 mm CL and the size at the onset of maturity as 38mm CL for the same stock. Since no other studies have been conducted in the same waters for other species, implementing the legal limit of 6 cm CL for lobsters other than *P. ornatus* could be considered a precautionary approach. Present study found that the size at onset of maturity of *P. homarus* (40 mm CL) is not significantly different from the results of previous studies (Jayakody, 1989), but that *P. versicolor* and *P. penicillatus* showed higher values than the dominant species. The legal limit enforced for the dominant species may not, therefore, be appropriate for the other two species; indeed, it is likely that the current legal limit does not permit those two species to reach 50% maturity level. It follows that in order to ensure the sustainability of these non-dominant species, the existing legal limit should be increased from 6 cm following further studies to determine a safe legal limit for them.

Since the spiny lobster fishery in Sri Lanka has open access, it can be expected that any restrictions imposed will be resisted by fishermen. During this study it became evident, however, that fishermen are beginning to realize that the lobster fishery - on which they depend on for their livelihood - is gradually becoming depleted, and that implementation of regulatory measures would benefit them in the long run. This study has also shown that some of the regulations need to be revised and updated in order to ensure the sustainability of the industry. These changes should be made in the "closed period" (September and October) as well as the existing legal limit from 6 cm of CL for the non-dominant lobster species.

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