



Diurnal and nocturnal catchability of Kuwait's commercial shrimps

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Trachysalambria curvirostris

Solenocera crassicornis

ABSTRACT

In descending order of importance, the shrimps *Penaeus semisulcatus* De Haan, 1844; *Metapenaeus affinis* (H. Milne-Edwards, 1837); and *Parapenaeopsis stylifera* (H. Milne-Edwards, 1837) account for over 95% of Kuwait's commercial landings. Throughout its range, *P. semisulcatus* is nocturnal, but Kuwait trawlers are active 24 h a day during season. Historically, all scientific shrimp surveys in Kuwait have been conducted during daylight because of regional security concerns. In order to more accurately assess shrimp stocks using survey data, comparative trawl tows were conducted during day and night from March 1999 through December 2000. Monthly catches from one to four different stations were standardized to catches (kg and no.) per net hour at 3.3 knots. Catch rates of eight shrimp species (*P. semisulcatus*, *M. affinis*, *P. stylifera*, *Metapenaeus stebbingi* Nobili, 1904, *Metapenaeopsis stridulans* (Alcock, 1905), *Megodris granulatus* (Haswell, 1879), *Trachysalambria curvirostris* (Stimpson, 1860), and *Solenocera crassicornis* (H. Milne-Edwards, 1837) and fish by-catch were analyzed using generalized linear models and tested for significant differences for timing (day vs. night), month, year, region, time × month, time × year, time × region, month × year, month × region, and year × region. Of the 80 comparisons (8 species × 10 variables) for mass and numbers, significant differences were similar for all but 15 comparisons. Significantly higher catch rates (kg or no. net h⁻¹@3.3 knots) during night than during day were found for *P. semisulcatus* (3.705 vs. 3.198 kg), *M. affinis* (1.420 vs. 1.077 kg; 135 vs. 95 no.), *M. stridulans* (0.420 vs. 0.050 kg; 143 vs. 14 no.), *M. granulatus* (0.437 vs. 0.018 kg; 125 vs. 8 no.), *T. curvirostris* (0.082 vs. <0.001 kg; 21 vs. 0 no.), *S. crassicornis* (0.007 vs. 0.003 kg; 1.4 vs. 0.8 no.). Significant differences also occurred between years for *P. stylifera* (2000 > 1999), *M. granulatus* (1999 > 2000), and *S. crassicornis* (2000 > 1999). Monthly and regional differences occurred for five or six of the eight species, depending on mass or no., reflecting recruitment patterns, fishing season, and distance from the Shatt Al-Arab. These differences are believed to be influenced by a combination of water turbidity and predation pressure. With the damming of the Tigris and Euphrates Rivers in Turkey, the silt load as well as water volume discharges of the Shatt Al-Arab will decrease. Consequently, future studies of shrimps' diel behavior may find changes from the results presented here.

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1. Introduction

With the adoption of the otter trawl as a primary gear to capture shrimp in the early part of the 20th century, fishermen soon realized that the timing of trawl tows influenced catch rates. Depending on location and species, certain shrimps were more catchable during daylight while others were more catchable at night. Most shrimp fishermen time their trawling activities to maximize economic return, that is, at night for nocturnal species and during the day for diurnal species.

Commercial shrimping in the Arabian (Persian) Gulf started in the late 1950s with the introduction of the otter trawl and Gulf-of-Mexico-style trawlers (Kristjonsson, 1968). Trawling was conducted both day and night, and during the mid 1960s, catch rates were among the highest in the world (Kristjonsson, 1968). All Gulf countries maintain resident shrimping fleets, except the United Arab Emirates where trawling is forbidden. In the past 25 years, Arabian Gulf landings have ranged from a low of 3,921 tons in 1979 to a high of 19,712 tons in 1989 (Bishop, 2002). The Green Tiger Prawn, *Penaeus semisulcatus*, is the Gulf's most important shrimp species (Van Zalinge, 1984) and throughout its range, this species is nocturnal (Kutty and Murugoopathy, 1968; Moller and Jones, 1975; Branford, 1980; Dall et al., 1990).

Because of heavy exploitation of shrimp stocks and the need to coordinate management of adjacent fisheries, countries of the

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western Arabian Gulf initiated in 1999 a coordinated 2-year study of regional stocks. The primary objectives of this study were to identify unit stocks and to determine their possible interactions using survey data (Bishop et al., 2001). With *P. semisulcatus* being the dominant species, sampling was to be conducted at night in Saudi Arabia and Bahrain when their commercial fleets are active. For Kuwait, where the shrimp fleets trawl around the clock, sampling was conducted during the day in order to maintain a continuum with previously collected data. To make the survey data compatible between countries, comparative trawl tows were conducted during day and night in Kuwait. The purpose of these paired samplings was to quantitatively estimate the pattern of nocturnal vertical movement of Kuwait's major prawn species. The comparative results and analysis of the day trawls with those conducted at night are reported here.

2. Materials and methods

Kuwait's shrimping grounds from Kuwait Bay south to the border with Saudi Arabia were partitioned into three nautical-mile

squares, each identified using an alphanumeric system (Fig. 1). Based on shrimp species distributions and geographical considerations, the three nautical-mile squares were grouped into three areas: Northern (Kuwait Bay), Middle and Southern areas. The relative size of these three areas is 1:3:5, respectively, and trawl stations were randomly selected within each area accordingly. For monthly sampling, we used a 31.5-m commercial shrimp trawler, powered by a 541-kW (725 hp) engine, towing two 28.8 m (96 ft.) foot-rope length flat trawls constructed of 30 mm stretched mesh of No. 60 twine. Because of by-catch volume in Kuwait Bay, tow time was limited to 15 min, but tows outside Kuwait Bay lasted 30 min. Sampling was completed within three consecutive days in the initial 10 days of the calendar month from March 1999 though December 2000. Catch comparisons were carried out by sampling paired (day vs. night) trawl stations. Each month during the survey period, one to four of the day-time surveyed stations were randomly selected and the same three-nautical mile grids trawled again at a random starting position at night in two or more hours after the sunset. It is not believed that the daytime trawl had any noticeable effect on the night-time catch as their positions were not exactly same.

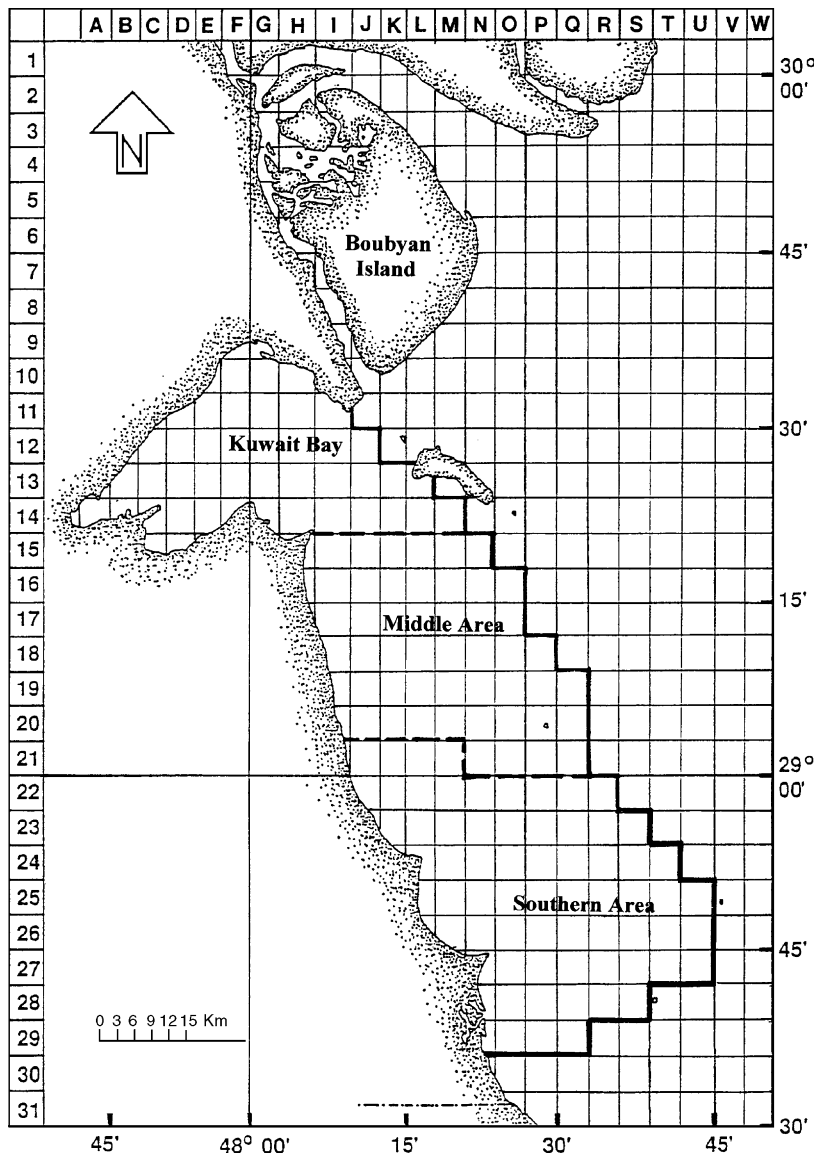


Fig. 1. Trawling grounds off Kuwait's coast showing three-nautical mile grids divided into three areas, Kuwait Bay, the Middle Area, and the Southern Area.

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