

## 和平島馬尾藻生態初步調查

### I. 馬尾藻之分布成長及與環境因素之關係

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Preliminary survey on *Sargassum* of Ho-Pin-Tao

I. Growth, distribution of *Sargassum* and their relationship to environmental factors.

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An ecological survey of *Sargassum* along the rocky shore of Ho-Pin-Tao was conducted. Three species, i.e. *S. duplicatum*, *S. cristaefolium* and *S. hemiphyllum* were found there, with the former two presenting over 95% of dominance. All of them began their recolonization at nearly the same season (November-December), but the latter seemed to initiate its rapid growth 3 months earlier (January) than the former did. It was due to its rapid growth in height, the latter was doomed to be damaged during an oil-pollution accident, which was considered to have detrimental effect on floating organism, especially the benthic algae with its photosynthetic and respiratory part suspending on surface water. On the contrary, *S. duplicatum*, and *S. cristaefolium*, though revealed its rapid growth later in April, were able to avoid being killed during the accident.

The vertical distribution of *S. duplicatum* and *S. cristaefolium* mainly located between high-tide and low-tide level, and with gradually decreasing in number of per square centimeter below this zonation. *S. hemiphyllum* was found at 0-50cm above low tide level.

Interspecific competition among *Sargassum* was very obvious. Growing into belt-like zone at a depth of -10-50cm from low-tide level, the top part of *S. duplicatum* and *S. cristaefolium* revealed a coverage of almost full percent while the lower part (hold-fast), usually competing with calcareous algae: *Corallina pilulifera* and *Amphiroa zonata* for colonization, only revealed a few percent of coverage.

Environmental factors have been related to the growth of *Sargassum*. The optimal temperature for *S. hemiphyllum* was 18°C, while that of *S. duplicatum* and *S. cristaefolium* was around 20°C. Other factors, such as pH, dissolved oxygen and salinity, though showed monthly variation, could not be recognized as the responsible causes.

前言

馬尾藻為極具經濟價值之海藻，其藻體除可供提煉褐藻膠 (Alginin) 外，其殘渣富含鈉鉀碘等無機鹽，可利用為無機肥料，增進農作物之生產。最近美國夏威夷正計劃進行海耕 (Marine agronomy)，大量生產此類速生之褐藻以供上述用途之原料，並且研究以其藻體發酵分解生產甲烷，故此馬尾藻之用途可謂與日俱增。有關馬尾藻生態之研究在本省方面僅有江及周 (1977) 之報告，其內容主要是包括本省南部產馬尾藻 *S. cristaefolium* 之分布及生態，至於其在北部之情形僅有 Taniguti (1971) 及陳 (1977) 之報告，但進一步之資料則不得而知，根據 Tsuda (1971) 之報告，馬尾藻之分布及季節性因地理環境不同而不同，因此乃着手進行本研究，俾能由於此研究有利其將來之開發及利用。

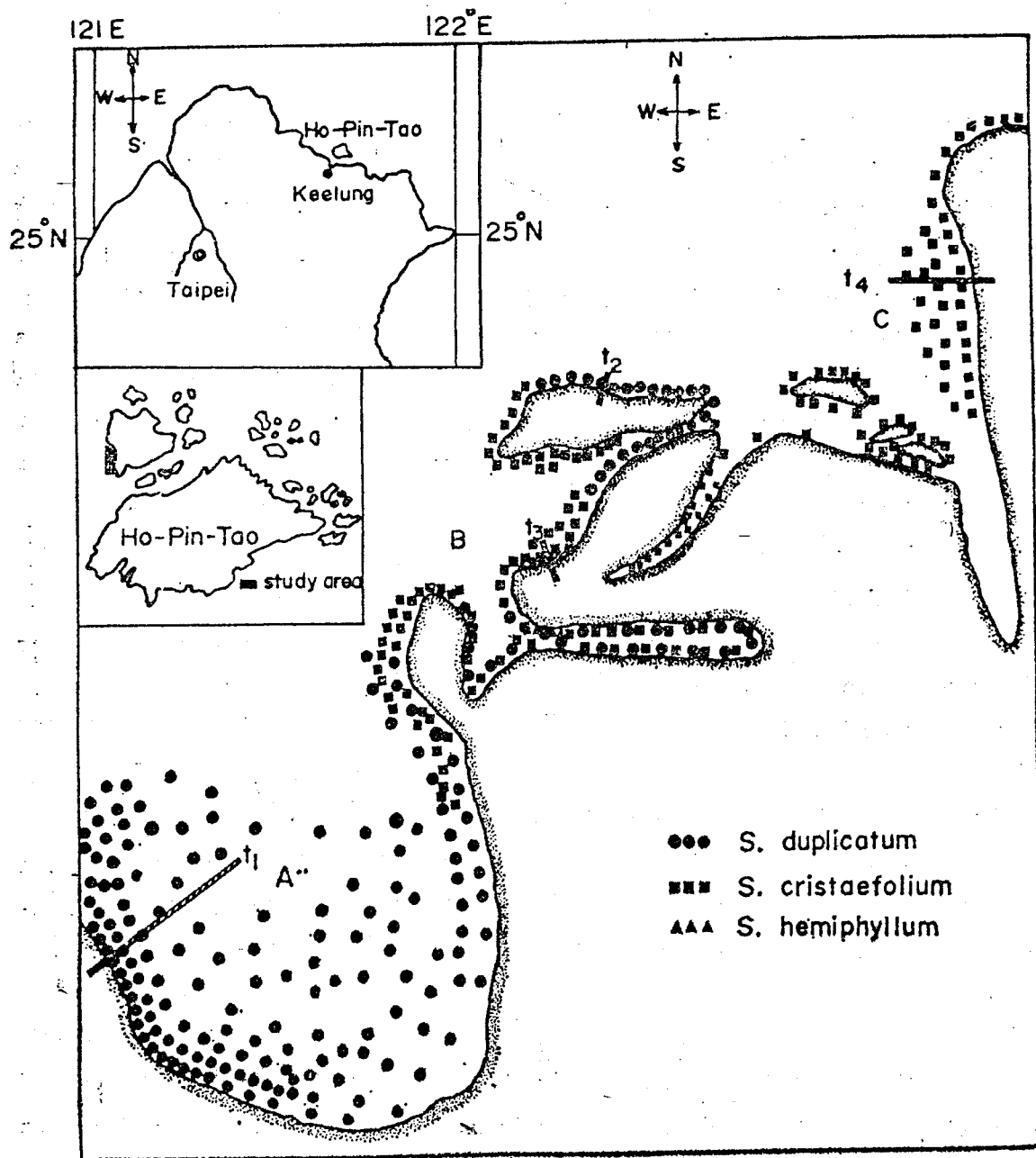


Fig. 1 Location of the study area (included are the four transects: t<sup>1</sup>-t<sup>4</sup>; and the horizontal distribution of sargassum species.)

## 調查方法

本試驗調查地點是選擇本省北部之和平島沿海一帶（見圖一），該地點之地形在陳（1977）之報告已有描述。調查方法係在該處設定幾個調查帶（Transect），按月前往觀察測定。測定方法係以方形測量法（Square method）估測海藻在各帶之分布深度及密度，以藻體體高測定其生長。此外並測定水溫、pH值、溶氧及鹽度等環境因素之月變化。

## 結果與討論

馬尾藻之分布：

調查區內馬尾藻計有三種：*S. duplicatum*、*S. cristaefolium*及*S. hemiphyllum*，前二者為主要種類，其所佔比例（見圖一）在95%以上。*S. duplicatum*之水平分布很廣，主要在內灣浪衝擊力較小之處（圖一之A處），*S. cristaefolium*則分布在正面迎浪之處（圖一之B及C處），由此可見*S. cristaefolium*比較*S. duplicatum*能經得起海浪之衝擊，至於*S. hemiphyllum*則僅出現於圖一之B處內一小範圍。

在垂直分布方面*S. duplicatum*一般分布在高潮線附近至低潮線下2~3公尺，其分布之型式視沿岸之地形而異（圖二），如屬平緩之海底，則高潮線下四公尺附近仍可見其零星之分布；如屬陡直之峭壁，則其分布僅於低潮線上30公分處，以下則不見分布。平緩海底之分布低潮線下有隨深度而密度漸減之趨勢，陡直之岩岸則無此現象，形成一明顯之分布帶（Zone）與其下之石灰藻截然劃分。*S. hemiphyllum*之分布僅在低潮線上20~30cm附近，其上不見分布。*S. cristaefolium*之分布在高潮線附近至低潮線下一公尺左右。其分布於陡直岩岸者型式與*S. duplicatum*相似。

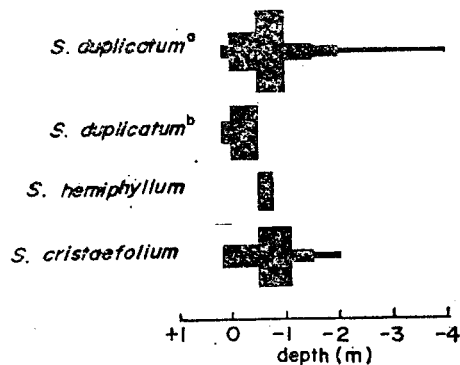


Fig. 2 Vertical distribution of sargassum species showing their relative abundance (individuals/50cm<sup>2</sup>) in four transects.  
a: vertical distribution along sea bottom of smooth slope.  
b: vertical distribution along sea bottom of steep slope.  
o: average high-tide level

馬尾藻之生長與環境之關係：

## 1. 馬尾藻羣落內之競爭現象

馬尾藻羣落內之競爭可分為二種：一是馬尾藻與其他藻類間之競爭，一是馬尾藻羣落內之競爭。就前者而言，與馬尾藻互相爭取着生位置的其他藻類甚多，其中最主要的種類為*Corallina pilulifera*及*Amphiroa zonata*等，此二種紅色石灰藻根據陳（1977）之調查結果，其生長始於每年入秋後水溫開始下降時，蓋此時適逢本省北部雨季來臨，鹽度下降，*Corallina*等迅速蔓延整個藻

床。其分布甚廣，由高潮線附近以至低潮線下一公尺左右皆有，成爲最優勢之種類，整個藻床百分之七十以上皆爲其所覆蓋，對於其他藻類之着生自然構成競爭與妨礙，而馬尾藻之生長期始於每年入冬之初，因彼時藻床泰半爲*Corallina*等所覆蓋，乃構成馬尾藻生長之障礙。

由圖二可知 *S. duplicatum* 及 *S. cristaefolium* 之分布主要在低潮線附近至其上50~70公分處最多，其分布密度多達每五十平方公分一百株以上，然而馬尾藻間之競爭主要在葉體上部之空間，因其分枝衆多，而將上部空間幾乎遮蔽，至於其地下部，亦即附着器，由於每個附着器所據之面積很小（直徑約三公分左右），即使在最密之處亦不致造成過密和競爭之現象。

## 2. 馬尾藻之生長與油污染之爲害

由圖三知 *S. hemiphyllum* 之生長始於十一月間，由開始不久其生長即呈現很快，一月份左右體高達20公分附近；二月份達30公分以上，其後由於油污染之影響藻體全部死亡，不見其生長至最高高度。受到油污染之藻類其藻體皆爲污油覆蓋，推想而知因此導致各種生理作用，特別是光合作用及呼吸作用遭受阻碍而告停頓，乃致死亡。*S. duplicatum* 及 *S. cristaefolium* 之生長亦始於同期間，其生長在前四個月間比較緩慢，及至四、五月後生長快速增加，三月以前平均體高爲10公分左右，三月以後平均體高達40公分左右，且其生長可繼續至體高一公尺以上。北部馬尾藻 *S. duplicatum* 之快速生長較南部爲晚，此可能係因爲水溫較低之關係，蓋南部水溫在一月份即已超過20°C（江及周，1977）。

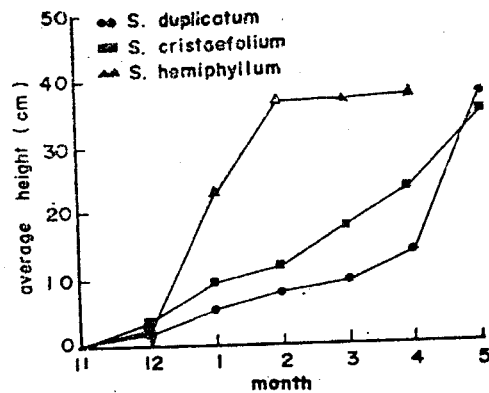


Fig. 3 Average growth in height of the three species of *Sargassum* during investigating period (Nov. 1976-May 1977).

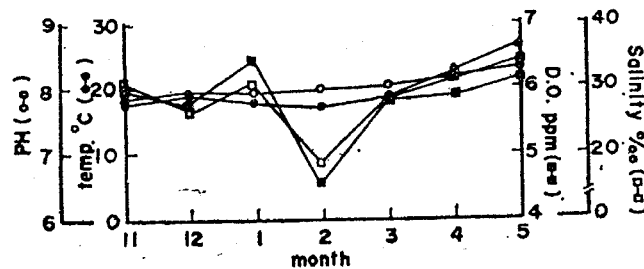


Fig. 4 Monthly fluctuation of environmental factors through a period of seven-months' investigation (Nov. 1976-May 1977).

### 3. 馬尾藻生長與環境因素之關係

調查期間環境因素之月變化示於圖四。水溫在十二月間平均為 19.5°C，一月及二月間為 18.5°C，三月以後開始有回升現象，由三月之 20°C 一直升至五月之 27°C，此與馬尾藻之生長相互對照結果，可知 *S. hemiphyllum* 之最適溫度應在 18°C 左右，而 *S. duplicatum* 及 *S. cristaefolium* 生長最佳溫度為 20°C 以上。溶解氧的變化一般在 5ppm 以上，但二月間有顯著下降之現象，推測可能係受油污覆蓋之影響，使得海水表面與空氣之交互作用及藻類之光合作用遽減。pH 值之變化係介於 7.9~8.2 間，此變化範圍不大，仍然在藻類生長適宜範圍之內，故不構成影響藻類生長之重要因素。鹽度變化範圍很大，由十二月之 26.4‰ 至一月之 31.2‰，二月急降為 19.4‰，三月以後即回升至約 30‰，由此可以推測三種馬尾藻之適合鹽度並不相同。

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