WHITEBAIT OR STOLEPHORID ANCHOVIES

This profile on anchovies is not intended to be a detailed biological review of the species but rather to be an article of general interest on a group which is of economic importance in the South Pacific region and in the neighbouring Indian Ocean.

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Readers of *Time Magazine* (5 July 1993) will recall the article on the vast shoals of small whitebait or stolephorid anchovies along the coast of Western Australia and the large numbers of predatory sharks that these had attracted. Landings of anchovies (Family Engraulidae) during 1990 (FAO 1992) comprised some of the world's largest fisheries, including the Peruvian anchoveta (3,700,000 t), European anchovy (540,000 t), Japanese anchovy (440,000 t) and South African anchovy (200,000 t). Indeed the Peruvian anchoveta yielded annual catches in excess of 10,000,000 t between 1964 and 1971.

The total reported annual harvest of stolephorid anchovies is about 250,000 tonnes, with most of the catch being landed in South-East Asia. The largest catches of anchovies are landed by Indonesia and the Philippines, which both catch more than 100,000 t/year at present.

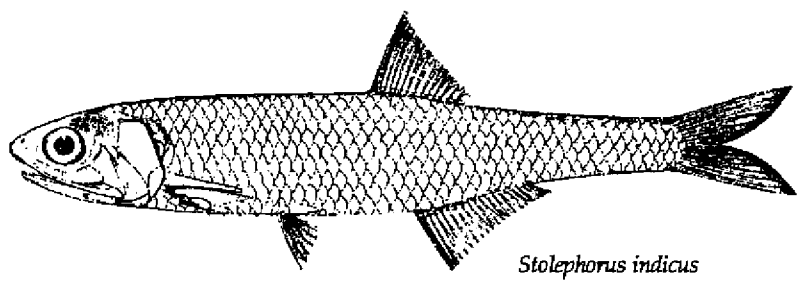
In Asia and the Middle East stolephorid anchovies are consumed fresh, dried and as fermented products. Fermentation of anchovies is particularly common throughout South-East Asia and fermented pastes and sauces are common to most countries of the region, e.g. *patis* in the Philippines, *nam-pla* in Thailand and *nuoc-mam* in Vietnam. Ruddle (1986) provides a useful summary of the fish fermentation industries in South-East Asia.

The stolephorid anchovies are found throughout much of the Indian and Pacific Oceans and extend north to Japan, south to South Africa and as far east as Tahiti. All species live in the nearshore neritic zone except *Encrasicholina punctifer* or buccaneer anchovy, which is oceanic and may be found at considerable distances from the coastal margin. Apart from *E. punctifer*, stolephorid anchovies are found along coastal shelves and lagoons where primary production is high and where there is some freshwater influence from rivers and runoff. Stolephorid anchovies are absent from atolls, apart from *E. punctifer*, which may be found in the ocean outside the lagoon.

Originally it was thought that the stolephorid anchovies were contained in the single genus *Stolephorus*. However, Nelson (1983) split the genus into *Stolephorus* and *Encrasicholina*. There are a number of different morphological characteristics that separate the two genera but effectively the *Encrasicholina* are the five smallest species. They include *Encrasicholina devisi, E. heteroloba, E. oligobranchus, E. punctifer and E. purpurea.* There are 19 further species in the genus *Stolephorus*, bringing the total to 24 species. The species *E. heteroloba, E. devisi, E. punctifer* and *Stolephorus indicus* are the most common and most widespread of the stolephorid anchovies. Other species, such as *E. purpurea, E. oligobranchus, S. brachycephalus, S. multibranchus* and *S. ronquilloi* are endemic or have very limited distributions The most up-to-date and informative guide to the species of the two genera and their distributions is the second volume of the FAO species catalogue on clupeoid fishes (Whitehead et al. 1988). The distribution of stolephorid and other anchovies in the South Pacific region is summarised by Lewis, Smith & Ellway (1983)

By contrast with Asia, there has been limited traditional use of stolephorid anchovies in the South Pacific region. Rapson (1955) reported seasonal catches of stolephorid anchovies in southern Papua New Guinea, and similar subsistence fisheries are found elsewhere in the Pacific (A.D. Lewis, Fisheries Programme, pers. comm.). However, these species are a good source of live bait for Okinawan style pole-and-line tuna fishing.

Fisheries for live bait, based mainly on stolephorid ancho-



Stolephorus indicus

vies, were established in New Caledonia, Papua New Guinea, Palau and Solomon Islands to support domestic pole-and-line tuna fisheries (Dalzell & Lewis 1989). Of this group of countries, only Solomon Islands has maintained pole-and-line fishing. Bait catches, which comprise about 73 per cent stolephorid anchovies, presently amount to 2,500 t/year (Nichols & Rawlinson 1990).

Stolephorid anchovies are also caught in the live-bait fishery in Fiji but they account for only 10 per cent of the total catch (Lewis et al. 1983). The Hawaiian anchovy (*E. purpurea*) is also caught for live bait to support a small pole-and-line fishery in Hawaii that supplies fresh tuna for domestic markets.

Capture of live bait for pole-and-line fishing is conducted at night by attracting schools of fish to underwater lamps and then catching them with a dip net. Variations of this technique are used to catch stolephorid anchovies in South-East Asia. In some locations, the dip net is not mounted on a boat but on a bamboo platform set on stilts in the shallows. In Indonesia, such structures are known as *bagans*. They are a common sight along the north Java coast.

Other methods for capture include small meshed trawls, beach seines, small gillnets and fish corrals. Fish corrals guide the anchovy schools through a series of chambers to a terminal chamber where they are caught using a dip net. They are a common sight around the coast of the Philippines, particularly in shallow shelf areas of the Visayan Islands such as between the islands of Negros and Panay.

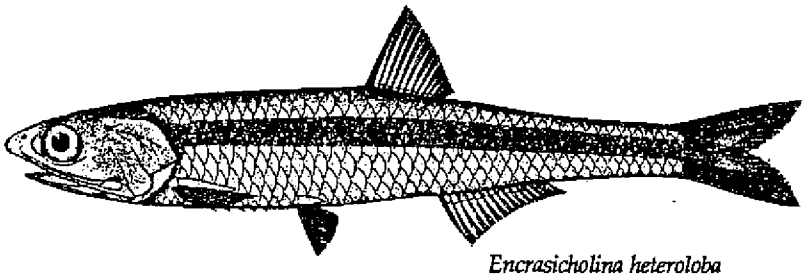
Several studies have been conducted on stolephorid anchovy stocks in India, South-East Asia, the South Pacific islands and Hawaii. Stolephorid anchovies can be characterised as small (maximum size usually 7–12 cm), rapidly growing fishes that have short life-spans, typically between one and two years, and high mortality rates. The largest species of this group, *Stolephorus indicus*, may reach 18 cm and have a life-span of three years but this is exceptional. With smaller species such as *E. purpurea* and *E. heteroloba*, the turnover of the population is very rapid and there may be two to three generations within the population in one year.

Stolephorid anchovies are planktivores, feeding mainly on copepods and other crustaceans (Milton et al. 1990). Spawning occurs throughout the year, particularly near the equator, but may demonstrate seasonal peaks allied to major climate changes such as the monsoons, which in turn are also periods of peaks in planktonic production (Dalzell 1987).

Climate, particularly wind and rainfall, appears to have marked influence on stolephorid anchovy populations. The Singaporean biologist Ah Kow Tham noted this for *Stolephorus* populations during his landmark studies of the interactions of climate and physiochemical factors on the fishery yields of the Singapore Straits in the late 1940s (Tham 1953). Tham modelled the catch rates of stolephorid anchovies in *kelong* traps in Singapore Straits and related this, among other things, to rainfall, salinity, wind strength and zooplankton biomass. Recruitment of *E. heteroloba* in Palau has been shown to be related in part to rainfall (Muller 1976) as have catch rates (and recruitment) of stolephorid anchovies in Papua New Guinea (Dalzell 1984).

From a fisheries perspective the short life-spans and high mortalities of stolephorid anchovy populations means that they can be fished very heavily and their biomass markedly reduced, but that the population will recover in a short time, usually in a period of a few weeks to a few months. In the Hawaiian bait fishery in Pearl Harbour, as much as 80 per cent of the biomass of *E. purpurea* might be captured per month by commercial fishermen (Somerton 1989). In Papua New Guinea, stolephorid anchovy catches over a year were equal to three to four times the standing stock (Dalzell 1990). Standing stocks could be reduced from several hundred tonnes to a few tonnes in the space of a year, but recover the following year despite continued fishing.

The main use of stolephorid anchovies in the South Pacific has been for live bait, and nearly all the present production is from Solomon Islands. Most of the high islands in the Pacific also have stolephorid anchovy resources that are, for the most part, not being exploited. The



Encrasicholina heteroloba

size of the stolephorid resources around high islands is related to shelf and lagoon area. The greatest resources of these anchovies are therefore to found in the large island archipelagos of Melanesia. Further, the evidence from bait fishing suggests that sustainable yields of the order of 0.4 to 0.6 t/km^2/yr are possible from stolephorid anchovy populations (Dalzell & Lewis 1989).

What are the prospects for stolephorid fisheries in the South Pacific region? Although there is a high demand for stolephorid anchovies in South and South-East Asia, production of these fishes continues to rise. Further, these fishes do not command high prices in Asia, so there is no potential for exports of stolephorid anchovies. Indeed the reverse is true and in some countries of the South Pacific dried anchovies from Asia can be found in stores and supermarkets. Small domestic fisheries for fresh and dried anchovies may offer some economic potential, as in Fiji (Anon. 1992).

Persons interested in the biology and ecology of stolephorid anchovies can consult the publications listed below. The most recent work on Pacific stolephorid anchovies has been conducted by the Australian Centre for International Agricultural Research (ACIAR)/Commonwealth Scientific and Industrial Research Organisation (CSIRO) Baitfish Biology Project led by Dr Steve Blaber of CSIRO. This project has looked in detail at the biology of baitfish, including stolephorid species in Solomon Islands (see contributions in Blaber & Copland 1990), Kiribati (Rawlinson et al. 1992) and Fiji (contributions in press).

Amongst the studies carried out by Dr Blaber and his team was an investigation of the importance of stolephorid anchovies and other baitfish as forage for reef and lagoon fishes. This is an important issue in the South Pacific, where commercial and subsistence fishermen are concerned about the influence of baitfisheries on the productivity of reef and lagoon fisheries.

The ACIAR/CSIRO project has also produced biological studies on a variety of other related clupeoid fishes, including the gold spot herring, sardines and sprats. Persons interested in other aspects of stolephorid anchovy fisheries such as processing and marketing are recommended to consult the recent study of this topic by the Bay of Bengal Programme (Bostock et al. 1992), which was featured in *Fisheries Newsletter* #65.

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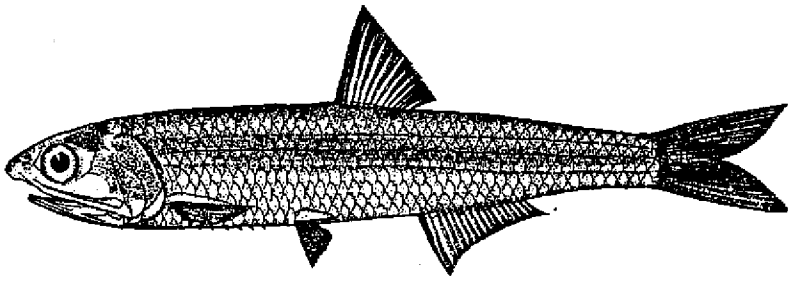

Encrasicholina devisi

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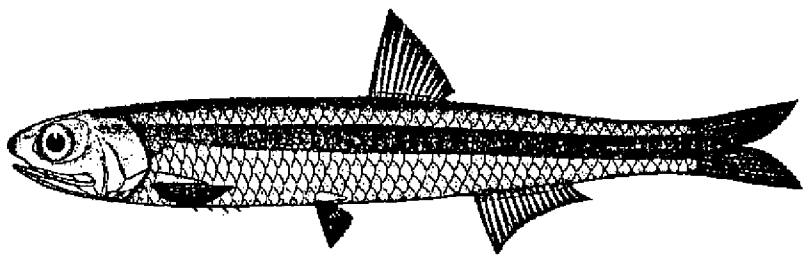

Encrasicholina punctifer