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Review

A review of the biology, stock structure, fisheries and status of wahoo (*Acanthocybium solandri*), with reference to the Pacific Ocean

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ABSTRACT

The wahoo, *Acanthocybium solandri* (Cuvier), is a high trophic level predator in tropical and sub-tropical marine pelagic waters worldwide. Wahoo are primarily caught as a retained incidental catch in purse seine and pelagic longline fisheries that target tuna and swordfish. The global commercial catch of wahoo has increased in the Pacific Ocean from 130 t in 1993 to a peak in recent years of 1339 t in 2006. Wahoo are also a highly prized sportfish in recreational fisheries, and although catches are poorly understood, they may be higher than the commercial catch in some regions. Despite their commercial and recreational importance, little quantitative information exists on their biology and stock structure, particularly in the Pacific Ocean. This dearth of information may have significant consequences for stock assessments and management. Suggested research priorities for wahoo in the Pacific Ocean are to: (1) investigate their biology in the region, particularly age, growth and reproductive parameters, which are essential for stock assessment; (2) use holistic methods to determine stock structure on a timescale appropriate for assessment and management; (3) conduct quantitative diet analyses that may contribute to ecosystem models, and (4) quantify catch from recreational fisheries to include in estimates of total mortality.

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1. Introduction

In response to the protein demands of an increasing worldwide human population, catch of wild marine species has increased from 16.7 million t in 1950 to approximately 80 million t in the late 1980s through to 2009 (FAO, 2010). Pelagic fish species account for almost half (approximately 37.5 million t) of the global marine catch. While the catch of many smaller pelagic species (e.g., herrings and sardines) has decreased in recent years, the catch of large pelagic species (e.g., tunas and billfishes) continue to increase to almost double that of the 1950s (FAO, 2010). Approximately 70% of the global catch of large pelagic species occurs in the Pacific Ocean (FAO, 2011), where large-scale commercial pelagic longline and purse seine fisheries combine with small island nation subsistence fisheries and recreational sport fisheries to exert a considerable amount of fishing pressure on these species. Catches of tunas and billfishes are the highest in the western and central Pacific Ocean, where more than 50% of the total marine catch consists of these pelagic species (FAO, 2010).

Increasing fishing pressure on these pelagic species and poor management in the Pacific Ocean has inevitably led to the overdepletion of some species (e.g., southern bluefin tuna, *Thunnus maccoyii*). As access to populations of traditional target species become either restricted by government legislation or unprofitable to target, fishers often shift effort toward other species that may have been either traditionally discarded or occasionally retained for sale at lower market prices. The paucity of reliable life history data for these byproduct species may lead to further unsustainable fishing, and ultimately to "fishing down food webs" (Pauly et al., 1998).

The wahoo, *Acanthocybium solandri* (Cuvier, 1832), is one such species that has typically been regarded as a byproduct of many commercial fisheries, and has experienced substantial increases in catch in recent years. It is important to many subsistence fisheries and is also a highly prized recreational sportfish. Despite its increasing global importance, there is a dearth of information concerning the basic biology and stock structure of wahoo, particularly in the Pacific Ocean. This review will present fishery statistics for wahoo, summarize current literature on their biology, stock structure and status and suggest future research direction, with specific reference to wahoo in the Pacific Ocean.

2. Taxonomy, behavior and distribution

The wahoo is a monotypic species belonging to the family Scombridae (Collette and Nauen, 1983). Some conjecture is apparent in the genetic and morphological literature concerning the evolutionary lineage of the species, with suggestions that wahoo may either be more closely related to the istiophorid billfishes or represent an evolutionary link between the istiophorids and the scombrids (Johnson, 1986). Recent genetic evidence, however, supports their assignment to the family Scombridae, being closely related to the Spanish mackerels, *Scomberomorus* spp. (Orrell et al., 2006).

As outlined by Collette and Nauen (1983), wahoo have an elongate, fusiform body consisting of a bluish-green back and silver sides inter-dispersed with 24–30 cobalt vertical bars and covered with small scales. Distinguishing features include a long snout (extending approximately half of the head length) with a mouth containing finely serrate teeth, an absence of gill rakers and the presence of a swim bladder. They have clearly distinguished first and second dorsal fins consisting of 23–27 spines and 12–16 rays, respectively, as well as 8 or 9 finlets. They also have a single lateral line, which curves downward posterior to the insertion of the first dorsal fin.

Wahoo are distributed globally throughout tropical and subtropical areas of the Pacific, Atlantic and Indian Oceans, including the Caribbean and Mediterranean Seas (Briggs, 1960; Collette and Nauen, 1983). Wahoo are epipelagic and oceanic, preferring sea-surface temperatures between 20 and 30 °C, with key habitats including temperature and current gradients, deep ocean ridges, shallow coastal reefs, and in the vicinity of floating debris and artificial fish aggregating devices (FADs) (Collette and Nauen, 1983; Taquet et al., 2007; Theisen, 2007). They nearly exclusively occupy epipelagic waters in the upper mixed layer above the thermocline, in depths of less than 20 m. Although wahoo do not show any discernable diel shifts in dive behavior, they do make brief excursions down to approximately 250 m (Sepulveda et al., 2011; Theisen, 2007).

3. Fisheries

3.1. Commercial fisheries

Wahoo are exploited by commercial fisheries worldwide. They are primarily retained as an incidental catch in purse seine, pelagic longline and trolling fisheries that target tuna (Scombridae), broadbill swordfish (Xiphiidae) and dolphinfish (Coryphaenidae). Historically, the majority of global commercial catches of wahoo originated from the Atlantic Ocean, but in recent years, an increasing proportion of the catch has come from fisheries in the Pacific Ocean (Fig. 1). The main nations that contribute to the global commercial catch of wahoo are the Republic of Cape Verde (Atlantic Ocean), the United States (Atlantic and Pacific Oceans) and the combined Pacific Island nations, particularly Fiji and Samoa (FAO, 2011). Increases in the commercial catch of wahoo have been most dramatic in the western and central Pacific Ocean, rising from an annual mean (±S.E.) catch of 41.5 (±5.7) t pre-1997 to 442 (±58) t in the last 14 years (Fig. 2). Kiribati contributed to the majority of historical wahoo catch in the western and central Pacific Ocean; although Fiji, Samoa and the Cook Islands have been the major contributors in recent years (Fig. 2) (SPC, 2011).

The large peaks in global catches in 1971, 1978 and 1981 were due to reported catches from Taiwan being 5087, 1639 and 1655 t, respectively (Fig. 1). This may represent either peaks in local market demand or variable abundance of wahoo in these areas. However, since reported annual catches outside of these years was zero, these peaks may be an artifact of inconsistent reporting (i.e., catches

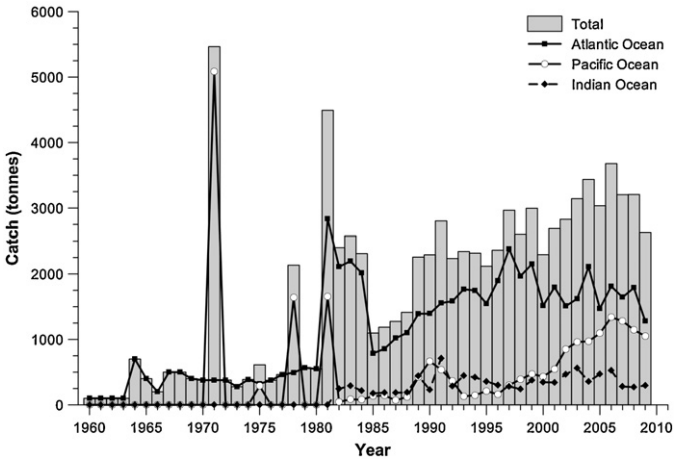

Fig. 1. Annual catch of wahoo pooled globally (gray bars) and for each ocean basin (lines) for the years 1960–2009 (FAO, 2011).