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The precautionary approach to non-native fisheries—The case of striped bass in Texas

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ABSTRACT

Fisheries managers have long relied on non-native fish to improve, sustain, or create recreational fishing opportunities, often without adequate consideration of potentially negative ecological consequences. There is growing advocacy for using the precautionary approach to avoid potentially serious or irreversible harm to the environment in the face of scientific uncertainty. This paper uses striped bass (*Morone saxitilis*) in Texas to examine possible effects that might have resulted had the precautionary approach been applied before stocking began in the 1960s when the species was considered non-native to Texas. The current range of reproducing striped bass populations extends from the North Atlantic Ocean to the U.S.–Mexico border. However, the western extent of the species current range beyond Louisiana is probably the result of stocking begun in 1965 that continues today. The historic range is yet unresolved. The best available information suggests that striped bass are not native to Texas, fish stocking has resulted in beneficial economic impacts, and any negative effects (i.e., harm) are currently unknown. It seems unlikely that application of the precautionary approach would have led to different outcomes in Texas than currently exist. However, the complete striped bass story has yet to be written.

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1. Introduction

The use of non-native fish to restore, increase, or create recreational fisheries has long been integral to fisheries management world-wide. For example, societies were established in Europe in the mid-19th century to further the introduction of "useful and ornamental species" [1,2]. The United States created the U.S. Commission on Fish and Fisheries in 1871 to produce, distribute, and stock fishes throughout the country [3] without any apparent regard for potential negative impacts.

There is growing concern and increasing scientific evidence that at least some introduced species can have largely irreversible, negative ecological impacts once they are established [2,4,5]. The United States and state governments responded in the late 1980s through legislation and regulation that were primarily reactive to the presence of non-native fishes [6–8]. For example, lists of non-native species for which possession is prohibited or regulated ("dirty lists") are relatively common [9]. Species not on the list are less regulated, but may be addressed by a general prohibition against the introduction of any fish into public waters. Antithetical to this approach are "clean lists." Possession of any species not on the list is prohibited unless otherwise allowed.

In Texas, the impacts of a growing aquaculture industry relying, in part, on non-native species resulted in the Fish Farming Act of 1989 [10]. The legislation encouraged the development of fish farming, including the use of non-native species. The Texas Department of Agriculture was given the responsibility for fish farming operations (mostly in private waters), but the Texas Parks and Wildlife Department (TPWD) was responsible for minimizing harmful impacts of non-natives in public waters. Texas is among those states that generate "dirty lists," non-native species for which possession, distribution, and stocking into public waters are restricted. Any species not on the list is not considered invasive or potentially invasive. The "burden of proof" is therefore on the state to demonstrate that any unlisted, non-native species causes or may cause harm before possession is regulated. Texas also prohibits stocking of any species into public waters unless otherwise authorized.

The "clean list" approach (prohibiting any non-native species and allowing possession by exception or "guilty until proven innocent") reflects a "precautionary approach" to managing the potential harmful effects of non-native species. The approach, derived from Principle 15 of the Rio Declaration of the 1992 United Nations Conference on Environment and Development, dictates that prevention of adverse effects through cost-effective measures should not be dependent upon full scientific certainty [11]. There is a growing advocacy for using the precautionary approach to avoid potentially serious or irreversible harm to the

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environment and fisheries in the face of scientific uncertainty [2,4,11,12,13]. However, the use of clean lists is not the norm with respect to non-native species in fisheries management, in part, because of the mis-perception that the approach would prevent any non-native introductions from ever occurring. The precautionary approach does not, by definition, prevent action; it does require an assessment of risk of irreversible harmful effects in light of scientific uncertainty before an introduction of a non-native species occurs.

This paper uses striped bass (*Morone saxitilis*, also known as *Roccus lineatus*, or rockfish) in Texas to examine possible effects that might have occurred had the precautionary approach been applied before stocking began in the 1960s. At that time, the native range was thought to extend from the Atlantic Ocean south to Lake Pontchartrain, Louisiana; the species was considered non-native to Texas. As a result of stocking, reproducing populations now exist in parts of Texas. Addressing the historic natural range of striped is the first step in applying the precautionary approach. If the species is native to Texas, the need for caution in stocking programs may be lessened. If not, the degree of caution depends on the likelihood of the species becoming invasive which, in turn, depends on the specifics (e.g., location, and number and size of fish) of stocking.

2. Native or not?

Whether or not striped bass is a Texas native remains unresolved through 2013. Some researchers conclude that the species is indigenous to Texas [14–16] while others disagree [17]. Evidence supporting native status is primarily self-reported, commercial seafood dealer landings data from the late 19th and early 20th century [14]. However, these data seem to be dismissed without discussion by those supporting non-native status [17,18]. A critical examination is warranted to answer the question, "Is striped bass part of the native Texas ichthyofauna?"

I applied the approach taken by TPWD to determine if a species is native (i.e., it reproduces in Texas and its original occurrence was not the result of human introductions [15]). There is no doubt that striped bass now occur in Texas public waters, and some fish reproduce naturally [18]. However, these fish are likely the result of fishery managers stocking begun in 1965 in Lake Texoma (a reservoir that extends into Texas and Oklahoma) that continues throughout Texas [18]. Therefore, fish present in Texas after 1965 are almost certainly not native to Texas.

Further, Texas was apparently not part of striped bass natural range between 1933 and 1965. No record of striped bass seen or caught during this period was found except one anecdotal, undocumented report by Mr. Earl Griffith. He responded to a 1987 public query by TPWD requesting documentation of historic occurrences of striped bass that he recalled seining numerous "rockfish" at Freeport East Beach in the early 1940s.

Prior to 1933, there is evidence indicating that striped bass might have been native, including reported seafood landings, a drawing of a striped bass, and claims by a well-known university professor. Texas commercial seafood dealers reported about 2500–4000 kg of rockfish annually from 1887 through 1897, and 225 kg were reported in 1932 [19–23]. Professor Charles Reed listed the species as one of the chief commercial species in Texas [24]; no supporting documentation provided. Baughman [25] proclaimed, without providing documentation for his position, that Reed's 1941 contention was "…manifestly an error." Further, Goode [26] suggested that commercially landed fish were actually yellow bass because young striped bass and adult yellow bass are morphologically similar. However, Stevenson [21] included a drawing of striped bass (rockfish) labeled as *Roccus lineatus* (Bloch) to represent the fish landed in Texas. The source of the fish on which the drawing was based is unknown. Indeed, the only *Morone* species reportedly seen by taxonomists in commercial markets in the 1890s was yellow bass in Houston [27]. A well-respected taxonomist, Jordan [28] stated that striped bass did not occur in Texas; that white bass (*Morone chrysops*) and yellow bass did, and were commonly called striped bass. The absence of yellow bass from reported landings is consistent with the conclusion that reported commercially landed striped bass were misidentified, and striped bass did not occur in Texas before 1933.

Even if one assumes that the 1880s commercial landings were accurate, it does not necessarily follow that striped bass are native to Texas. There are several additional criteria that must be met, including: (1) the fish were caught in Texas; (2) they were born, lived, or reproduced in Texas public waters without further regard to abundance or distribution within the state; and (3) the occurrence is not the result of direct or indirect introduction by humans [15]. If commercially landed fish were accurately identified, they were probably naturally produced since I found no striped bass stocking reports in Texas in the 1800s or early 1900s. Therefore, the status of striped bass in Texas depends critically upon the identification of fish reported as striped bass in commercial landings. The evidence seems to weigh against those fish having been identified correctly. As a result, it does not appear as though striped bass are part of Texas' native fish assemblage (at least as early as the late 1800s).

Additional evidence suggesting misidentification comes from an 1878 exchange between a contributor to and the editors of *Forest and Stream* [29]. The letter's author wrote,

> "For some time past we have had in our market a fish which exactly resembles the fish described by St. Clair as the striped bass, and the fishermen here (*in Texas*) call it by that name. The only difference that I can see is that as we have it here it rarely reaches a pound in weight…the fishermen say they are plentiful in San Jacinto (*River*)….I at first thought they might be the young of the *Roccus lineatus*, or sea bass, but I never heard of that fish in Texas."

The editors responded as follows:

> "We have doubt whether our correspondent is exactly right as to the fish being the *Roccus lineatus*. The Fish Commission is not informed that *R. lineatus* ranges in the Mississippi Valley. At the Smithsonian there is a single specimen from the Gulf, taken at Pensacola. This is the only case of its occurring below the St. John's River. Perhaps the fish may be the *R. chrysops*."

Scientific fish collections from the 1880s through the 1950s also tend to support the conclusion that striped bass is not a Texas native. The presence of yellow bass, but not striped bass, in Texas was confirmed as early as 1858 [27]. A review of ecological surveys on the Texas coast reported one 200-mm yellow bass in Galveston Bay, but no striped bass [30]. If striped bass occurred in the sampled areas, it seems reasonable to expect that at least one fish would have been caught and reported in at least one of these studies. A search of U.S. Bureau of Commercial Fisheries (now the National Marine Fisheries Service) and Texas Parks and Wildlife Department (and its predecessors) annual reports, the scientific literature, and museum collections of 29 institutions worldwide (using the internet site http:www.FishNet2.net) produced 14 records of striped bass caught in Texas (none collected before 1974). The same search produced records of yellow bass and white bass caught in Texas as early as 1939. These data lend support to a non-native classification for striped bass.

Fish distributions change through time among drainages, related in part to glacial events in North America [31]. For example, the distributional ranges of several taxa, including some fish species,

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