Survival of Released Red Snapper Progress Report

April 1985

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OBJECTIVES

1. To determine the relationship of the depth of capture to survival of released reef fish.
2. To determine if predation is a significant source of mortality to released reef fish.

BACKGROUND:

The establishment of a minimum size limit for red snapper is a management scheme being considered by the Gulf of Mexico and South Atlantic Fishery Management Councils. A size limit would be selected to allow attainment of greater yield per recruit than that resulting from the unregulated fishery. However, practical problems associated with size limits may prevent the attainment of theoretical increases in Y/R or may even decrease it. Red snapper, caught to depths of 65m or more, experience many atmospheres (1 to 10) of pressure change during ascent and the gases in airbladders and other tissues expand many-fold. These expanded gases could prevent fish from returning to the bottom or cause lethal internal damage. In that case establishment of a minimum size limit would not protect yield; it would cause unnecessary lost harvest. Predation may also be a significant source of mortality of released red snapper. Temporarily disoriented fish released far above their normal habitat might be easy prey for such predators as sharks, barracuda, and amberjacks. To estimate the extent of survival of released red snapper, we conducted holding experiments to measure the percent of fish taken that survive release, and SCUBA divers attempted to observe the interaction of released fish and predators.

METHODS:

At first, the relationship of the depth of capture to survival of released fish was tested in the laboratory. Fish captured from various depths (18 to 122m) were transported to the laboratory by-way-of a temporary holding tank aboard our R/V Onslow Bay. They were held at surface conditions (1 atmosphere) in tanks with flow-through seawater. The fish were observed over a period of 3 weeks and mortality was recorded.

Later, to remove the reduced pressure and transportation effects of holding fish in the laboratory at one atmosphere, which could cause substantial biases, we held fish in situ at their initial capture depth for periods of up to 3 weeks. Reef fish were caught by traps and hook and line, brought to the surface, put in cages, and returned to the bottom. Long term (2-3 weeks) observations of the condition of the fish were made by SCUBA divers. The cages were relocated with the aid of Loran-C and surface buoys.

In situ studies on red snapper, Lutjanus campechanus, were made in geographical locations where numerous small red snapper could be caught. Studies were conducted during 2 weeks in July 1981 and 3 weeks in March 1983 off northest Florida, and 2 weeks in June 1984 from a gas production platform off central Texas.

The interaction of released reef fish with predators was observed in situ by SCUBA divers on two occasions (August 1981 and June 1984). Divers were stationed throughout the water column to a depth of 30m in the vicinity of fishing vessels. They recorded encounters of released fish with wild sharks, barracuda, and amberjacks.

PROGRESS:

One Atmosphere Experiments

From December 12, 1979 to November 11, 1982 we made observations in the laboratory on 494 fish (Table 1) caught by hook and line or traps on 30 collection trips. Large scale mortality in holding tanks, probably resulting from handling, temperature shock, and foul water (September 1983 Progress Report), led to changes in procedures in FY83 and 84.

In Situ Trap and Cage Experiments

Results of trap and cage experiments off Beaufort, NC were inconclusive because bad weather prevented frequent monitoring of experiments and caused loss of experiments. However, results were more interpretable in two sets of experiments focused specifically on red snapper (Table 2). In a set of experiments (14 fish in individual cages) conducted off Daytona Beach, FL in March 1983, 79% (0.79 ± 0.24 at $\alpha = 0.05$) of red snapper less than 400mm long (a likely size limit) survived at least 10 days in cages at 22m. In another set of experiments (37 cages with 1 fish each, plus 2 cages with 2 fish each) on red snapper at 30m off Galveston, Texas in June 1984, 89% (0.89 ± 0.09 at $\alpha = 0.05$) of 44 fish survived to the end of the experiments (12 to 13 days). Three fish were hooked in the gills or deep in the throat. These were not placed in cages but were counted in the experiments as killed by fishing. Water temperature ranged from 24°C to 26°C.

To determine if released snapper could return to the bottom, we released thirty at the surface. All readily and quickly swam down.

In Situ Predation Observations

Diver observations of released hook and line caught fish in 20-30m were made during the week of August 24-28, 1981 off Daytona, Florida. Ten (18.5%) of 54 released fish (45 vermilion and 6 red snapper, 2. gray trigger fish and 1 gag) observed on their way to the bottom, were taken by predators, primiarly greater amberjack and barracuda. Seven fish (4 vermilion and 2 red snapper, and 1 red porgy) caught by hook and line were returned to the bottom in cages; three (2 vermilion and 1 red snapper) were dead within 43 hours. One death (red snapper) was possibly caused by an octopus in the cage.

Three released red snapper were observed between 2 and 25m off Galveston, Texas during June 1984. No predation was seen. Very few predators large enough to capture a sub-legal snapper lived around Tenneco Platform Galveston 393-A where most of our work took place.

Attempted observations of predation at Tenneco platform Brazos 17 in 45m of water failed because it was virtually impossible to bring snapper to the surface without an attack by large amberjacks. I have no information on the extent of such intense predation in the Gulf of Mexico.

Autopsies

In the laboratory we took radiographs of dead fish, conducted underwater necropsies similar to that used in cases of air embolisms in human patients, and attempted to find emboli through histological examinations. Radiographs demonstrated the presence of ruptured swim bladders and of gas in the pericardial space. Underwater necropsy revealed gas in the abdominal cavity, intestine, heart, eye, musculature, and under the skin that apparently came from ruptured swim bladders. Evidence of healed ruptured swim bladders was noted in black sea bass that survived the holding experiment. Emboli could not be determined from histological examinations. Embolisms, apparently, are not fatal in some fish as they would be in humans who become saturated with gases and then surface from depths greater than 18m.

RELEASED RED SNAPPER SURVIVAL STUDY

The Beaufort Laboratory released red snapper from a gas platform off Sabine Pass and a headboat off Galveston, Texas, from May 16 to June 2, 1985. The objectives of the study were to 1) determine the relationship of the depth at capture to survival and 2) determine if predation is a significant source of mortality. Small red snapper were reported as plentiful around the deep water (52 m) platforms, but our team caught only four red snapper in four full days of fishing. Although diver visibility was good (15-25 m), no red snapper were seen on two dives at the platform. Two small red snapper placed in cages and returned to 34 m survived to the end of the experiment. One red snapper released at the surface began to swim toward the bottom within 5 seconds. The fourth red snapper was too badly injured during capture to be released, presumably attacked by an amberjack on the way to the surface. Planned research on predation with cooperation of the Reel-Fun Inc. headboat, Ranger V, was hampered by bad weather, strong currents, and poor diver visibility. None of the three released red snapper were attacked by predators as they returned to the bottom, although three sharks and several greater amberjack were observed by the divers. (Parker, 919-728- 3595).

Table 1. Survival of Released Reef Fish - One Atmosphere Experiments (12/11/79-11/2/82).

Species	Maximum size. TL in inches (mm)	Number	Experiments	Capture Depth Range(m)	% Survival 24 hr	1 wk	2 wk	3 wk	Comments
Black Sea Bass	9.0 (233)	44	6	18-37	75	70	70	70	
Red Porgy[1]	14.5 (369)	158	23	23-122 (23)	63	56	30	21	Heater failure
Red Porgy[2]	14.5 (369)	77	11	23-37	62			22	
Red Porgy[3]	14.5 (369)	21	7	53-122 (53)	67			19	
Vermilion snapper	13.0 (324)	133	16	21-73	48	19	5	4	Foul water
Red snapper	16.0 (407)	61	8	21-34	26	5	5	5	Foul water

Table 2. Survival of Released Reef Fish - In Situ Cage Experiments (May 1983 - June 1984)

Species	Maximum Size. TL in inches (mm)	Number	Capture Depth (m)	% Survival 24 hr	1 wk	2 wk	3 wk	Comments
Black Sea Bass[1]	9.0 (233)	39	27-30	41-90	3-77	0-77	0-77	lost cages
Red Porgy[1]	14.5 (369)	22	27-30	5-77	0			checked 6 days later-badly decayed
Gag[1]	25.5 (649)	11	27-30	9-73	0-45	0		checked 6 and 13 days later-badly decayed
Red Snapper	16.0 (407)	14	24	86-100	79			observed from 10-13 days off Daytona 79% survival
Red Snapper[2]	16.0 (407)	19	30	89	89			
Red Snapper[3]	16.0 (407)	25	30	88	88			

[1] Observed off Beaufort, NC; could have been killed by predacious isopods

[2] Observed for 13 days off Galveston - 89% survival

[3] Observed for 12 days off Galveston - 88% survival