

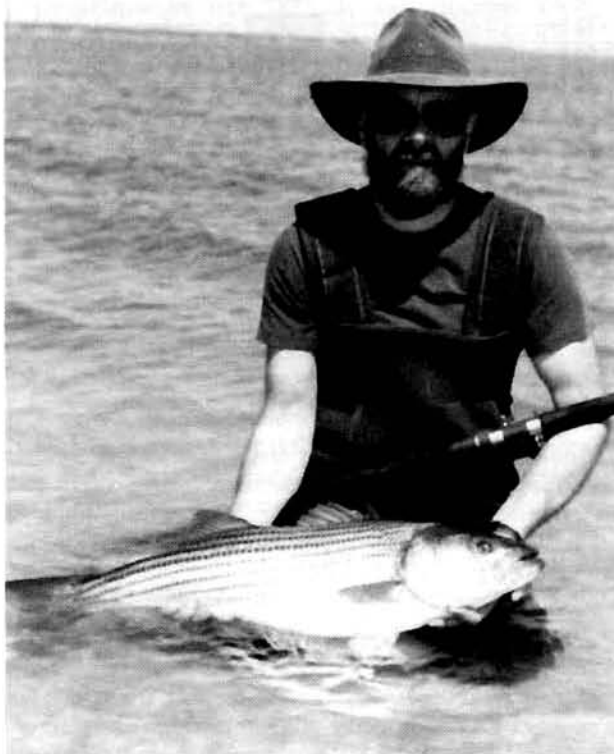
# SEA GRANT

## CORNELL COOPERATIVE EXTENSION

### Guidelines to Increase Survival of Released Sport Fish

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Sea Grant Extension



Angler releasing a striped bass.

Release of live fish by recreational anglers is an everyday occurrence in New York and elsewhere for several reasons. Fisheries management regulations, devised to allow young fish to mature and spawn, frequently require anglers to throw back sublegal-size fish or "shorts." These minimum size regulations are a prime tool for managing inland and Great Lakes populations of walleye, bass, trout, northern pike, and muskellunge. Several marine species are also regulated in this fashion, including winter flounder, striped bass, cod, pollock, fluke, blackfish, and weakfish. Even in populations where natural reproduction is negligible (e.g., salmon in the Great Lakes), minimum size regulations are established to allow a quality "put, grow, and take" sportfishery to develop.

Voluntary catch-and-release practices have been called for by fishery agencies, the outdoor media, fishing clubs, and conservation organizations. Growing numbers of anglers are releasing some portion of their day's catch that might have been legally kept. Perhaps the two best examples of voluntary catch and release programs include those encouraged by organized black bass (largemouth and smallmouth) angler groups, and the practices followed by a

number of recreational shark and striped bass anglers in marine waters.

The purpose of this fact sheet is to suggest some guidelines, practices, and equipment to ensure that released fish are in the best possible condition to survive capture and live to enhance some other angler's outdoor experiences.

#### Why release legal fish?

Given the personal cost of a typical fishing trip, the uncertainties involved in angling success, and the appeal of a fish dinner, why should anglers adopt the practice of catch-and-release? Aside from the legal requirements discussed above, several good reasons exist for releasing a portion of the catch alive. First, catch-and-release offers a way to extend the fishing trip when a reasonable (or legal maximum) number of fish are already in the cooler. If the fishing trip involves a guide or charter service, catch-and-release can prolong unique, enjoyable, and "paid for" recreation.

Second, as anglers gain expertise in a particular fishery or technique, they often develop interest in "limiting their kill" instead of "killing their limit." This change in angler preference and behavior through time has been seen in or suggested by a number of studies conducted in recent years. As fishing technology continues to improve, this evolution in angler behavior may likely continue.

Third, catch-and-release practices can positively influence both the density and structure of fish population. Density is simply the number of fish per mile of stream or volume of water. High fish density does not guarantee fishing success, but most anglers would argue that having more fish in the water is preferable and more tempting.

Perhaps even more important than density, however, is structure—the makeup of a fish population in terms of its age or size classes. For example, in an unexploited, balanced population, one would expect to find many size groups (or age classes) of fish with medium-size fish making up the bulk of the population, along with good numbers of small and large fish (Fig. 1a). In fish populations subject to fishing pressure ("angling effort"), fish of all sizes may get caught, but the intentional removal of large fish significantly alters the population structure (Fig. 1b). The result is an unbalanced population and, in the case of heavy fishing pressure, a less stable population, since it consists of fewer size or age classes, and fewer adult fish available to reproduce.

In many "no-kill" trout fisheries, the management goal is to prevent this shift in population structure by minimizing fishing mortality on the older-year classes of fish. Restoring this shift in population structure is also the goal of many new marine fishery management measures aimed at restoring overfished populations. If widely practiced, voluntary

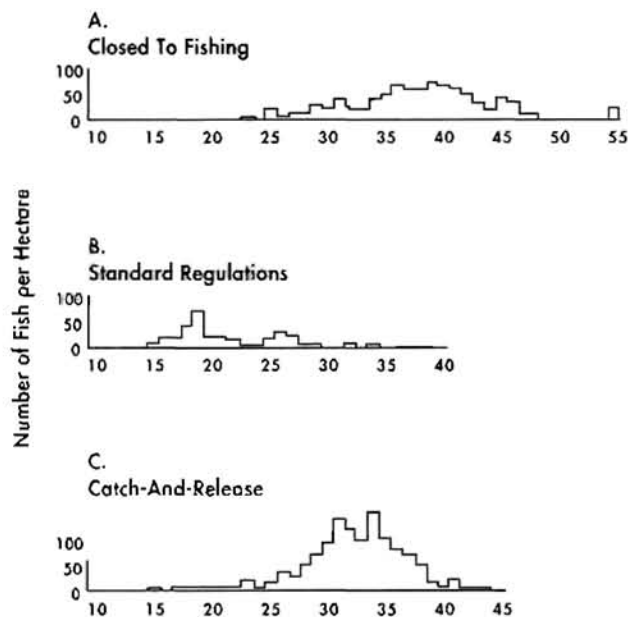


Figure 1. Length-frequency distribution of rainbow trout in three sections of the South Platte River, October 1980. Catch-and-release practices can result in a population structure more like that of unexploited fisheries. [Source: Anderson, R. and R. Nehring, 1984.]

catch-and-release can achieve the same effect (Fig. 1c). Because natural mortality removes most fish before they get to be "lunkers," minimizing fishing mortality helps ensure that bigger fish exist in the population. For catch-and-release fishing to have its beneficial effect on population structure, it is important that released fish survive.

#### Hooking mortality—How serious is it and what are the causes?

Some critics of catch-and-release practices have argued that stress and wounds inflicted upon sport-caught fish are too often lethal. In fact, research on freshwater species indicate that hooking mortality may be as low as 0 or as high as 88 percent, depending on the species in question, season, water temperature, type of terminal tackle used, and other variables. Mortality estimates for bluefish, striped bass, black seabass, scup and weakfish ranged from 0 to 29 percent in a study conducted by the senior author. In any case, tag returns from both coastal and large ocean-roaming (pelagic) species such as tuna, show that survival after catch/tag-and-release is common. For example, tuna caught, tagged and released in the western waters of the Atlantic Ocean have been recaptured off Africa in the eastern Atlantic, and recently a sandbar shark was recaptured 25 years after it was caught, tagged, and released.

Fish that are captured and released may die for a host of reasons, but the two primary causes are *stress* and *wounding*.

In angling stress, the fish's response follows a fairly well understood pattern. As in most animals, vigorous physical exertion causes lactic acid to accumulate in the fish's muscles as a result of fighting the rod and reel. This can lead to blood acidification and a resulting temporary disruption of many metabolic processes. If the animal is able to restore its blood acid (pH) level to pre-stress or normal levels, normal physiological processes return and the fish may live to fight another day. In some cases blood chemistry balance is not restored and the fish may die, perhaps as long as 72 hours after the catch. Since the volume of lactic acid generated is

directly proportional to the length of time of muscular activity, a quick retrieve and capture of a fish would then tend to lessen muscular exertion and metabolic stress. Traditional sporting ethics encourages light tackle to "give the fish a fighting chance." This can lead to long retrieve times as the fish is slowly and carefully played. Research tells us, though, that it may be more sporting to disavow such practices, if successful catch-and-release is the objective.

Research on Atlantic salmon indicates that the volume of lactic acid generated is also proportional to the length of the fish. This phenomenon may explain the significantly lower survival of large striped bass in catch-and-release trials conducted by the senior author (Fig. 2).

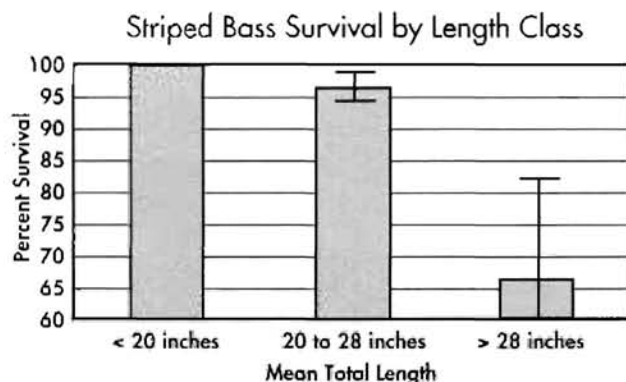


Figure 2. Estimates of striped bass survival in New York's recreational fishery. Results are based on 13 trials involving 118 fish obtained using a variety of angling gear and methods.

Hook wounding is the other major mortality factor, but the evidence is not easily summarized. As one might suspect, injuries caused by fishhooks can range from minor to lethal, depending upon wound location, hook style, size, and number, type of hook plating, presence or absence of a hook barb, use of artificial lure or live bait, and fish species and size. A brief review of the scientific literature on hooking mortality suggests these general conclusions:

- Higher mortalities in sport-caught fish are associated with hook wounds to the gill and stomach areas; intermediate mortality rates occur with wounding of the lower jaw, isthmus, and eye areas; and lowest mortality is related to hooking in the snout, maxillary, corner of mouth, and the cheek (see Fig. 3).

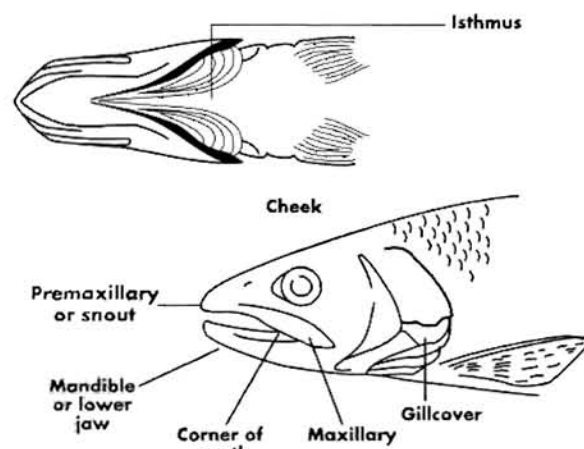


Figure 3. Lowest wounding mortalities of sport-caught fish occur when related to hooking in the snout, maxillary, corner of mouth, and cheek.

- Conventional wisdom and some research indicates that baited hooks are more likely to cause serious injury than artificial lures. This is expected, given that live bait is often taken deeper into the gullet, nearer the gill area. Other investigators have concluded, however, that such mortality variations reflect differences in angling techniques. For example, research on Atlantic salmon produced similar estimates of mortality for fish caught on flies, artificial lures, and worms. In the author's study referred to above, survival rates for striped bass caught on bait were not significantly different than the rates for bass taken with lures.
- The severity of hook wounding is usually lower for barbless than for barbed hooks, largely due to differences in hook injury placement. The use of treble hooks is usually associated with longer handling times and prolonged time out of water. Despite these effects, mortality rates associated with treble hooks are usually (but not always) lower than for the use of single hooks.
- Fish are quite capable of rejecting hooks imbedded in the gullet or stomach region, although such rejection may take as long as 120 days. The type of metal used for the hook coating may influence survival and the length of time required by a fish to reject or expel a hook. The researchers found that although tin/cadmium hooks often broke (probably from galvanic action) and were rejected in less than 60 days, mortality was high, possibly from the toxic effect of these metals. Conversely, no mortality was seen in striped bass carrying stainless steel hooks, despite long retention times—often greater than 120 days.
- Other kinds of physiological stress can lead to higher mortalities in released fish. Fish with air bladders brought to the surface from depths greater than 40 feet may not be able to readily adjust to changing pressures, or the normally higher surface water temperatures (see following). Depressurization can also result in embolism—bubbles that form in blood vessels or body tissues as dissolved gases come out of solution. Also, when a fish is handled or allowed to come in contact with dry surfaces, the protective mucous layers on its skin may be partially removed, presenting an opportunity for bacteria or pathogens to invade the skin.

### Guidance and recommendations

Following is the best available advice on how to address some of the points raised above. These catch-and-release guidelines provide basic information on the release of most small- to medium-size freshwater and marine fish. Species or group specific information for larger fish or special circumstances is also given following the general guidelines.

#### General Catch-and-Release Recommendations for All Species

1. Recognize the trade-offs between single hooks and treble hooks and act accordingly. For example, treble hooks can be used to minimize the severity of hook wounding but are likely to be associated with longer release (i.e., out-of-water) times. With cool water temperatures and small fish, this choice is preferable. If you are targeting large fish during warm weather, single hooks (especially barbless styles) are quicker and easier to remove, especially when dealing with such "toothy" predators as bluefish and northern pike.

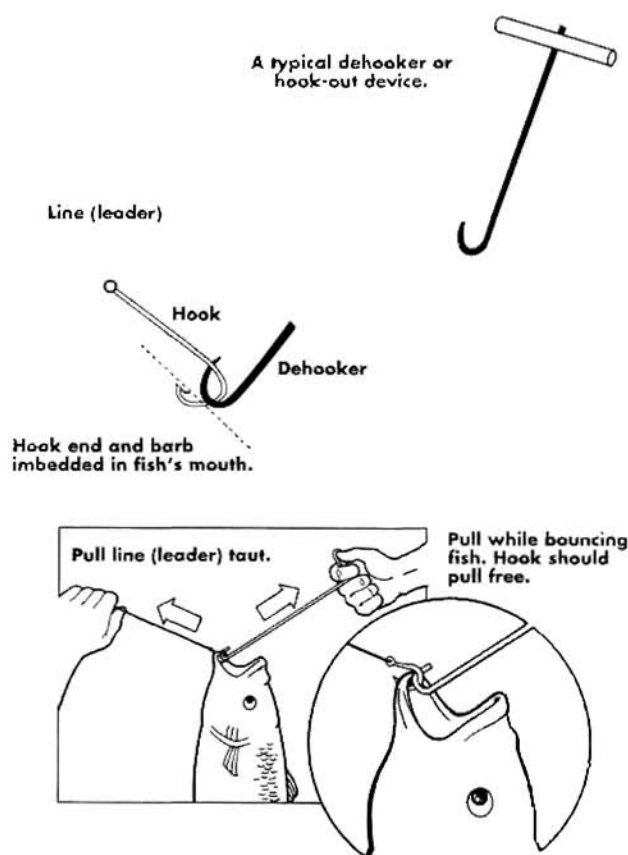


Figure 4. A dehooker can make it easier to pull the hook free with minimal handling.

2. When using live bait, take steps to prevent fish from deeply ingesting the hook. In the case of striped bass, *do* make use of trolled sandworms, or drifted eels. *Avoid* using "clam bellies" and minimize "free spooling" of fish that have struck live baits.
3. Plan your release strategy. Decide whether to keep or release any fish *before* angling or at least before removing the fish from the water. Familiarize yourself with any creel restrictions that are in effect and gather any items that will facilitate the handling and release of fish.
4. When a fish is hooked, use a steady, deliberate retrieve. This can reduce the amount of stress a hooked fish undergoes when pulled up from the depths too quickly or when physically exhausted from an overly slow retrieve.
5. Once the fish surfaces into view, decide (if not done earlier) to either release or keep it.
6. If the fish is not to be tagged, avoid netting the fish or even removing it from the water, if possible. Use needle-nosed pliers to pry the hook from the fish (lures only) while it is still in the water. Fish that can be lifted by the leader can easily be released over the rail using a "dehooker" (see Fig. 4). These devices, whether home-made or purchased, are gaining in popularity in the bluefish fishery (to avoid that species' nasty teeth!) and would be useful for releasing a number of other species. If live bait or a lure is deeply lodged in the fish's gullet, *cut the leader as close to the fish's mouth as possible.*



7. If you are landing and/or tagging the fish, it is important to *minimize* out-of-water time and any contact the fish has with surfaces or objects. Therefore—

- Avoid the use of landing nets if possible and (obviously) gaffs.
- If you must use a landing net, use a “catch-and-release” knotless nylon or neoprene bag rather than knotted twine. Such nets are thought to remove fewer scales and less of the fish’s natural protective mucous (“slime”) layer.
- Keep your hands moistened, or use a wet glove. This also helps to avoid removal of the fish’s mucous layer, and reduces the chance of subsequent infections of the fish’s skin.
- Minimize handling, particularly of the gills and the soft underbelly. Gently prevent the fish from battering itself around the boat deck, beach, jetty, or bank. Experienced fish taggers often place the fish on an old piece of foam cushion and place a wet rag or gloved hand over the fish’s eye. These two actions can do much to subdue even unruly tuna and bluefish.

8. If tagging is planned, be prepared with all materials at hand. Attach only tags as specified by the specific tagging program literature and, if possible, record length or any other requested data.

9. Return fish to the water gently and, if possible, headfirst.

### Specific recommendations

**Marine offshore species:** The National Marine Fisheries Services’ (NMFS) Game Fish Tagging Program advises anglers to simply tow sharks and tuna slowly alongside the boat for tagging and before release. After (or in lieu of) tagging, fish should become revived due to the forced flow of water through the gills created by the towing. Cutting pliers can then be used to cut the leader as close to the hook as possible, and then release of a revived fish can occur.

Tuna and sharks can also be released using a gaff as a dehooker. The technique requires the use of a “V”-notched canoe paddle or similar device to depress the leader. Simultaneously, the gaff is slid back to the hook and lifted vigorously. Recovery of the terminal tackle may minimize hook wounding/retention problems, although no research evidence is yet available.

**Marine demersal species (bottom fish):** In New York’s marine waters, bottom fish typically encountered in the sportfishery can be grouped as: flatfish (fluke and flounder), gadids (cod, haddock, hake, pollack, and cusk), wrasses (blackfish), and sea basses. For releasing flatfish, follow the general recommendations given above.

Members of the three other groups listed here may suffer from depressurization. Blackfish appear to be only slightly affected by this problem and are normally quite capable of submerging to depth immediately after release. Members of the cod family along with black sea bass are quite likely to exhibit air bladder over-inflation if brought up from depths exceeding 40 feet, and may be temporally unable to submerge. Eventually, compensation occurs and most fish are able to descend (if they escape predation by gulls and bluefish). Research observations suggest that black seabass can readily return to depths of 80 feet or more *if they are released quickly* (under 45 seconds), before their swim bladder reaches maximum inflation. In most cases the best advice is simply to release the fish even if it is unable to submerge. If a slow release time has resulted in a hyper-

extended swim bladder, an experienced angler may choose to puncture the bladder (see “A Word about Burping and Puncturing”).

**Warmwater freshwater species:** Warmwater fish may be particularly vulnerable to handling stress because of their elevated oxygen demand and rapid accumulation of toxic metabolic end products in tissues. This stress is compounded by lower oxygen concentrations in warmer waters, which will inevitably prolong the recovery of stressed fish. Often, complete recovery of a stressed fish can take up to a week following release.

One tried-and-true technique that will promote increased survival of stressed warmwater fish is simply a modification of the “ram injection” revival technique described above. First, choose a nearby release site (if possible) over deeper and cooler water to permit a more rapid recovery of the released fish. Release the fish as recommended in the general guidelines section above. If the fish fails to revive and swim away, recover it. Next, grasp the dehooked fish firmly by the peduncle (the narrow stem just forward of the tail) gently cradling the fish under and behind the gill cover with the other hand. Avoid touching the gills or depressing the gill cover. Placing the fish in the water, a steady, deliberate back and forth motion is applied of sufficient force that will alternately open/close the mouth and compress/flare the gill covers. Repeat until the fish shows signs of recovery. In extreme cases, it may be necessary to repeat this procedure for several minutes prior to release. Observe fish after release. A successfully revived fish may remain near the surface momentarily before submerging.

**A word of caution:** Fish in the pike family (muskie, northern, and pickerel) possess special valves just inside the mouth that reduce water backflow from the gills. When applying this technique to pike, the forward stroke can be the more effective step and, consequently extra time may be required to revive these fish.

**Trout and salmon taken from greater water depths:** Great Lakes salmonine (trout and salmon) species are commonly taken at depths having significantly greater water pressures and lower water temperatures than those found on the surface. When brought to the surface on hook and line, these fish can be affected by stress or “shock” brought on by these sudden differences in pressure and temperature. The fish’s survival after release depends upon reducing the amount of time it remains on or near the surface, and getting it back to its preferred, deep-water habitat as soon as possible.

Unfortunately, a fish pulled from deep waters may be unable to swim back down to more comfortable environs due to depressurization and the resulting expansion of its swim bladder. Such a fish may appear bloated and “bug-eyed,” and its stomach—forced forward by the over-inflated swim bladder—may be seen protruding from the mouth. The fish will lie lazily on the surface, unable to “swim down,” and may be subject to injury from continued stress or from predation by gulls and other birds.

To increase the chances of survival in such “surface-shocked” fish, quickly follow the general handling guidelines offered above. Then cradle the fish with one hand around the peduncle (the narrowing in front of the tail) and the other supporting the fish’s side at its pectoral region (just behind the gills). As a last step, vigorously push or heave the fish back into the water *headfirst and straight down* toward the bottom. This technique literally gives the wearied and stressed fish a solid headstart back down to the pressures and temperatures from which it was taken.

## A Word about Burping and Puncturing

Some publicized catch-and-release instructions include advice to burp or puncture fish with over-inflated swim bladders brought on by depressurization. Burping involves kneading or massaging the fish's distended belly and sides in hopes of expelling trapped bladder air through the mouth.

Puncturing entails just that—inserting a sharp instrument through the body wall of the fish. *If correctly done*, puncturing can vent pent-up gas from the bladder through the puncture hole. Burping is difficult, but theoretically possible in those fish whose swim bladder is directly connected to the gut. This type of swim bladder is called physostomus. Important examples of physostomus fish include salmon and trout. Physoclistous swim bladders found in largemouth and smallmouth bass, perch, striped bass, cod, hake, and black sea bass are *not* connected to the gut. For this reason, one should *never* attempt to deflate the swim bladders of these fish by burping.

Few reported studies validate the effectiveness of burping or puncturing in the post-catch survival of released fish, and one study concluded that gas bladder deflation was not an effective tool for enhancing red snapper survival. Either method, *if not carried out with care and skill*, could seriously increase physical stress on the fish because of the additional handling and out-of-water time involved. Moreover, damage to internal organs may occur when either technique is applied with less-than-expert skill.

Puncturing is currently advocated by at least two fishery management agencies under very specific conditions.\* Available release/survival research for the species and situations found in New York waters, however, suggests that these extraordinary resuscitation methods are not normally necessary to achieve good survival after release.

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\*The California Department of Fish and Game Warmwater Fishery Board suggests puncturing the swim bladder of largemouth bass if the fish appears bloated. The research behind this advice was conducted on bass retrieved from deep warmwater habitats—a situation unlikely to be encountered by New York anglers. This guidance remains controversial, given that poor puncturing technique can cause more harm than good. A Florida Sea Grant publication, *Guide to Releasing Fish with Swim Bladder Overexpansion Injuries*, is available to anglers who wish to learn the correct procedure from New York Sea Grant, 3059 Sound Avenue, Riverhead, NY 11901. The National Marine Fisheries Service's Southeast Regional Office similarly advocates the puncturing of swim bladders in various snappers and other reef fishes caught from deep water (typically greater than 60 feet) in the Gulf of Mexico and south Atlantic. A videotape entitled *Pass It On* shows the technique. It is available from: NMFS, 9450 Koger Blvd., St. Petersburg, FL 33702, phone (813)-893-3141.

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