Following the review of the document by the three peer reviewers, all comments were accepted with the exception of the comments below. The reason those comments were not incorporated is explained beneath each comment.

Frank Parauka, Sturgeon Biologist, US Fish and Wildlife Service

Mr. Parauka noted that Wisconsin electrofishes for lake sturgeon and that Gulf states and the FWS periodically capture Gulf sturgeon during electrofishing surveys. It is possible that electrofishing for sturgeon could be a useful tool in areas where nets cannot be deployed.

> NMFS acknowledges that sturgeon can be collected by electrofishing. However this document is intended to establish "consistent and safe sampling methods when conducting research on sturgeon." Electrofishing is less safe and less effective than alternative methods of collecting sturgeon and therefore is not recommended by NMFS. Legally, when states are conducting electrofishing for other species and may encounter a listed species during their activities, they are required to engage either the Fish and Wildlife Service or NMFS to obtain an Incidental Take Permit under section 10(a)(1)(B) of the Endangered Species Act (ESA), unless such taking has been exempted by a rule under section 4(d) of the ESA.

Doug Peterson, Professor and Sturgeon Researcher, University of Georgia

In response to NMFS' temperature and dissolved oxygen guidelines for capturing sturgeon, Dr. Peterson noted that his empirical catch data over the past 8 years shows that southern fish are capable of tolerating oxygen levels down to 2.5 mg/l and temperatures up to 30°C.

> This observation is based on capture data, while the referenced material in the protocol document is based on LC50 studies. An LC50 of 3.3 mg/L does not mean that every fish will die, but that the probability of mortality is .5, which is too much risk when working with threatened, endangered, and candidate species. Dr. Peterson has caught very few fish at such low oxygen concentrations. NMFS believes the risk of adding the stress of capture to the stress of low dissolved oxygen presents an unnecessary risk to the species. Additionally, the information gained by targeting sturgeon under adverse conditions is not worth the risk presented by sampling under those conditions.

Also in response to the temperature and dissolved oxygen maxima established for capturing sturgeon, Dr. Peterson stated that strict adherence to the proposed minimum sampling levels would eliminate about 75% of the sturgeon he captures each year.

> This is a recommended upper temperature but sampling limitations are further defined by the percent oxygen saturation in the water. When oxygen conditions are at levels that will allow for safe sampling of sturgeon at higher temperatures, then sampling may not be affected. However, NMFS believes that research on threatened

and endangered species should not result in a risk of mortality to the individuals. For those reasons, these are recommendations and not mandatory limitations.

In response to the sentence, "NMFS therefore recommends using external tags to identify the presence of a PIT tag, if necessary, but researchers should not remove scutes from sturgeon for any reason," Dr. Peterson suggested that all responsible sturgeon researchers should be using PIT tags and PIT tag readers in the field.

While this is very true, there were other factors that went into our decision for allowing external identification tags. The primary issue is that a government agency cannot require public researchers to use equipment from one company over another company. NMFS would encourage all researchers of a particular sturgeon species to get together and agree on a standardized PIT tag, tag frequency, and tag reader so external tags are not necessary. Some readers are unable to read other tags and some researchers are using PIT tags transmitting at different frequencies. It was, therefore, NMFS decision that there was a chance that even with a PIT tag reader, a PIT tag may not be detected. The secondary issue was that some researchers were concerned about the retention of PIT tags and wanted to use external identifier tags as a backup mark.

In response to the discussion of tissue samples being taken from the pelvic fin, Dr. Peterson noted they can be take from other fins as well.

While it is true that a genetic sample can be obtained from any fin, and NMFS had historically recommended sampling the dorsal fin, several researchers proposed sampling the pelvic fin because the rays are soft and the easiest fins to clip. NMFS agrees with those researchers and believes that the pelvic fin is the least harmful fin to remove a clip from.

When discussing the placement of PIT tags in small juvenile sturgeon, Dr. Peterson stated they place their PIT tags behind the 4th dorsal scute for the precise reason identified in the document.

This is an excellent example of the flexibility provided by these protocols. Dr. Peterson conducts extensive research on sturgeon in their second and third years. In many cases, these are small fish with limited muscle near the base of the dorsal fin. In Dr. Peterson's research, NMFS would recommend PIT tagging at the widest dorsal position. However, when Dr. Peterson captures a sturgeon, NMFS would recommend scanning the entire body in case another researcher has placed a PIT tag at the base of the dorsal fin. When Dr. Peterson captures larger sturgeon with sufficient muscle to place a PIT tag in the recommended location near the dorsal fin, NMFS would recommend he place the tag there.

In response to the sentence in the anesthetic section, "Because of the risks associated with this type of anesthetization, NMFS recommends conducting this type of anesthesia in a

laboratory and using a heart rate monitor to prevent overdose," Dr. Peterson stated that experience is the most important factor to using anesthetic safely.

> For all researchers conducting sturgeon research, NMFS recommendation will not change. But as has been acknowledged in other sections of the protocol document, there are exceptions to this recommendation who may be able to work outside of these recommendations if the appropriate management agency agrees that the researcher can meet the stated objectives of "consistent and safe sampling methods." However, NMFS does not agree that all sturgeon researchers should conduct procedures that carry high risk to sturgeon individuals and believes the current recommendation is most appropriate for the majority of sturgeon researchers to meet the intentions of the document.

In response to the sentence, "In this study, wild fish experienced 9% mortality but hatchery-reared sturgeon experienced 90% mortality," Dr. Peterson stated that the tags were not responsible for the mortality because there had been no mortality during the three weeks the fish were monitored in captivity prior to being released.

> While NMFS agrees that the tagging method in a sterile hatchery environment has improved to avoid mortalities, the evidence still suggests that this tagging method, coupled with natural environmental conditions leads to mortality at a considerably higher rate than either internal tagging or external tagging.

In response to the paragraph in the tagging section about internal/external tagging, Dr. Peterson stated, "The key to this method is to drill a small (1/8 inch) exit hole thru a ventral scute, then thread the antenna thru the body wall so that it exits thru the hole in the scute. A large catheter needle does the job nicely. With this method, there is no chaffing against soft tissue, which was the problem in these other studies. This is actually a VERY good method, so I would not dismiss this for some situations."

> NMFS did not dismiss the concept of internal external tags. We discussed the pros and cons of the procedure, acknowledging that there was research that showed high levels of mortality and more recent research that showed low levels of mortality or no mortality. However, NMFS did not recommend using IE tagging because the risks associated with it are still not proven to be completely safe and the intention of this document is to provide "consistent and safe sampling methods."

In the recommendations for endoscopic sexual identification, Dr. Peterson asked why NMFS was not recommending standard laparoscopy through the ventral wall because it is so much better than borescopy.

> NMFS agrees with this statement and that sentiment is written in the section on endoscopy. However, NMFS decided not to recommend any methods of endoscopy and instead would prefer safer sexual identification methods in the field. NMFS also recognizes that those methods may be cost prohibitive or still in development, so

> while laparoscopy is not recommended, it is still an option for researchers to use until a safer, more reliable method is developed.

In response to NMFS statement of length of sturgeon being an unreliable predictor of age, Dr. Peterson stated that it was possible to use the length of juvenile fish to estimate their ages.

> Clugston *et al.* 1990 show that growth rates are highly variable among individuals from the same year class. Dr. Post also provided evidence of anomalous growth rates for some shortnose sturgeon individuals in a sampled population. NMFS does agree with Dr. Peterson though, that many juvenile Atlantic sturgeon display consistent growth rates making it possible to track cohorts until they leave the freshwater system and begin the saltwater phase of their juvenile development. The incidence of anomalous growth would be so infrequent that number of fish estimated in a cohort would be unaffected.

In response to the sentence, "Because of increased error in reading fin spines of older fish and evidence of abnormal regrowth, NMFS does not recommend taking fin spine samples from mature Gulf, shortnose, Atlantic, or green sturgeon," Dr. Peterson stated that despite some problems associated with aging adult sturgeon, some fin spine sampling is necessary to evaluate the age structure of adult stocks. It should not be a standard procedure, but to evaluate whether the population is recovering, this is a valuable analysis until something better is discovered.

> NMFS agrees with this comment. There is a need to understand the age structure of sturgeon populations to understand survival at various ages, mortality rates, recovery progression, and possibly identify threats to the population. However, as the sturgeon ages, the age estimates provided by fin spine sampling are increasingly inaccurate. Also, in recent studies monitoring recaptures of previously aged mature sturgeon, the fin spines had not healed properly in mature fish. For these two reasons, NMFS does not recommend taking age estimates from mature individuals in the population and questions the benefits provided by highly variable data that may be adversely affecting these sturgeon. NMFS would prefer to consider mature fish as a group because age estimates may have up to five or six years of variability between the estimation and the actual age.