PRELIMINARY EFFORTS TO ESTIMATE DIMENSIONS AND WEIGHTS OF HOOKED BLUE MARLIN USING VIDEO IMAGES OF FISH AT THE BOAT

Jon A. Lucy[1] and James E. Kirkley[1]

SUMMARY

A project, in progress, is intended to provide recreational fishermen and charter captains with a reliable technique to estimate head-trunk dimensions of billfish at the boat prior to release. Derived from video tape images of the fish, such dimensions may prove to provideacceptable estimates of billfish weight. If proven workable, the technique could help reduce problems with inaccurate size estimates of billfish made by fishermen when tagging or recapturing tagged fish, thereby assisting tagging programs. More work is required to determine the successful application of the experimental technique.

RESUME

Un projet, qui est actuellement en cours, vise à fournir aux pêcheurs sportifs et aux patrons de bateaux affrétés une technique fiable pour estimer les dimensions de la tête et du tronc des istiophoridés à bord du bateau avant de le relâcher. Ces dimensions, calculées à partir d'images magnétoscopiques du poisson, peuvent s'avérer constituer une estimation acceptable du poids des istiophoridés. Si elle s'avère réalisable, cette technique pourrait aider à réduire les problèmes concernant les estimations peu exactes des istiophoridés effectuées par les pêcheurs lorsqu'ils marquent des poissons ou les recapturent marqués, ce qui serait utile aux programmes de marquage. Il faut poursuivre les travaux pour définir comment appliquer avec succès cette technique expérimentale.

RESUMEN

Está en marcha un proyecto destinado a los pescadores de las pesquerías de recreo y a los patrones de los barcos en sistema "charter", facilitándoles una técnica fiable para estimar las dimensiones de cabeza y tronco de los marlines, en el barco, antes de devolverlos al agua. Basándose en imágenes de video de los peces, estas dimensiones podrían proporcionar estimaciones aceptables del peso de los marlines. Si esta técnica resulta aplicable, ayudaría a reducir el problema de estimación inexacta de la talla de los marlines, por parte de los pescadores, en el curso de las operaciones de marcado o recaptura de peces marcados, contribuyendo a los programas de marcado. Es necesario seguir investigando el empleo de esta técnica experimental.

1. INTRODUCTION

This project is designed to take advantage of offshore fishermen's frequent use of video cameras to record billfish catches. In addition, billfish held at the boat by the leader often turn or rest on their side, if relatively "played out". The objective of this experimental field project is to develop a technique for use by recreational fishermen and charter captains to improve accuracy of size estimates for released billfish using video tape images of the fish immediately adjacent to the boat.

[1] School of Marine Science, Virginia Institute of Marine Science, College of William and Mary, Gloucester Point, VA 23062 USA

Improving size estimates of released blue marlin (*Makaira nigricans),* white marlin *(Tetrapturus albidus)* and sailfish *(Istiophorus platypterus)* would benefit tag and release programs. Recent analysis of tag return files of the Cooperative Game Fish Tagging Program (U.S. National Marine Fisheries Service) revealed that returns on marlin having size information available at release and recapture resulted in "negative growth" in length for 43.9% of blue marlin, 42.3% of white marlin and 31.2% of sailfish (Bayley and Prince 1992).

2. METHODS

Dimensions of billfish for estimating size are determined using a standard video camera recorder and image calibration device, the latter run down the leader as fish are brought to the boat. Simple-to-construct calibration devices have been field tested by investigators and fishermen. Video images of hooked marlin at the boat with the image calibration device on the leader are examined relative to consistency of position and clarity of both the fish and the device.

PC-based software has been developed to digitize appropriate head-depth and trunk-length dimensions (Fig. 1) from single video tape frames which best capture the lateral (side) view of a hooked fish when alongside the boat. The indicated dimensions and lower jaw fork length also have been taken as "straight-line" measurements from killed blue marlin at tournaments and from taxidermist production molds of marlin. Mathematical models relating these body dimensions to actual fish weight are being examined to determine the best model for predicting marlin weight from those lateral view body dimensions captured in video images of hooked fish.

3. RESULTS AND DISCUSSION

With support from the Virginia Sea Grant College Program (program development funds mini-grant), field experiments were initiated to test calibration devices for running down leaders. Polyvinyl chloride (PVC) pipe squares were constructed from 22 mm outside diameter standard PVC pipe using 90 degree corner pieces. The squares, measuring 15 cm on a side (outside dimensions) were sealed with epoxy adhesive compound to make them airtight. When clipped onto a fishing line leader using heavy monofilament line (22.7 kg class line approximately 30-40 cm long) and a spring snap clamp, the calibration device's buoyancy helped reduce entanglement problems. The calibration device used on the leader was similar to that used as a calibration tool for digitizing body dimensions of dead sailfish from video images of the fish (Ehrhardt 1990). In the field, problems sometimes occurred regarding the on-leader calibration device's orientation to the video camera when marlin were being released at the boat. The device was ultimately replaced by a 10.2 cm diameter styrofoam ball (hard exterior finish) which was readily available at "hobby" retail stores.

Tournament weigh-in data were obtained on 42 Pacific blue marlin (PBM) with cooperation of the 1990 Hawaiian International Billfish Tournament (HIBT). On-boat experience during the tournament documented successful use of a hand-held video camera to capture side-view, head-trunk images of blue marlin on leaders. Accuracy of digitized fish dimensions from video images was significantly affected when camera position, or fish behavior, prohibited filming relatively straight down on, or "perpendicular" to, the fish (Lucy et al. 1991).

Cooperative efforts in 1991 by fellow researchers and HIBT tournament organizers provided body dimension and weight data on 32 PBM (HIBT) and 74 Atlantic blue marlin(ABM) from two Caribbean tournaments. An additional 35 data sets were taken from taxidermist molds of blue marlin and combined with the tournament data, primarily to expand the database regarding larger fish (Fig. 2).

Fitting a linear regression model to the combined 1990-1991 data ($n = 190$; adjusted $R^2 = 0.95$) and plotting actual versus estimated weights against belly length (Fig. 3) indicated good tracking of predicted fish weights with observed weights (Lucy 1992). A linear regression model for marlin up to 100 kg ($n = 108$; adjusted $R^2 = 0.81$), produces a wider than desired forecast interval (approximately

33 kg). Similarly, a linear regression model based upon marlin weighing 101-600 kg. (n = 82; adjusted R^2 = 0.88), produces an even broader forecast interval (approximately 150 kg).

Filming from the stern corner of the flying bridge has proven adequate on larger boats while filming at the gunnel works reasonably well on smaller boats. In both cases anglers may have to be reminded not to obscure the fish with their bodies. The person controlling the leader sometimes has to be made aware of the cameraman's need for a lateral view of the fish, preferably with its head flush with the water's surface. The fish also has to be far enough away from the boat's side (usually about 50-75 cm) not to have it obscured by the gunnel. A fish controlled by the bill can be adequately filmed, given the referenced positioning conditions. In a few instances appropriate video frames of fish have been obtained without the benefit of any artificial positioning of the fish. Adequate video images of hooked billfish have been obtained by fishermen from which researchers were able to obtain desired head-trunk body dimension estimates. In these cases investigators were not on board the boat, only providing the simplest instructions for necessary orientation of the camera and fish.

Cooperative efforts with a VIMS researcher and indirect support from the Billfish Foundation, Inc., have provided additional dimension-weight data sets from small numbers of PBX, ABA, and white marlin. Additional analysis of the expanded data set is underway, and efforts will continue to expand the data base. This will ultimately allow for determination of various size ranges of marlin for which weight predictions can be optimized, thus determining the limitations beyond which the technique proves useful.

Additional fishermen need to be incorporated into the project to confirm that fish handling and hand-held video camera techniques provide consistent marlin dimension data under normal fishing scenarios. We must expand the data base and demonstrate that mathematical models based upon the dimensions and known weights of marlin produce acceptable forecast intervals around predicted weights. Finally, estimated marlin weights derived by the combined techniques must be validated in fishing situations whereby fish are available for weighing at dockside.

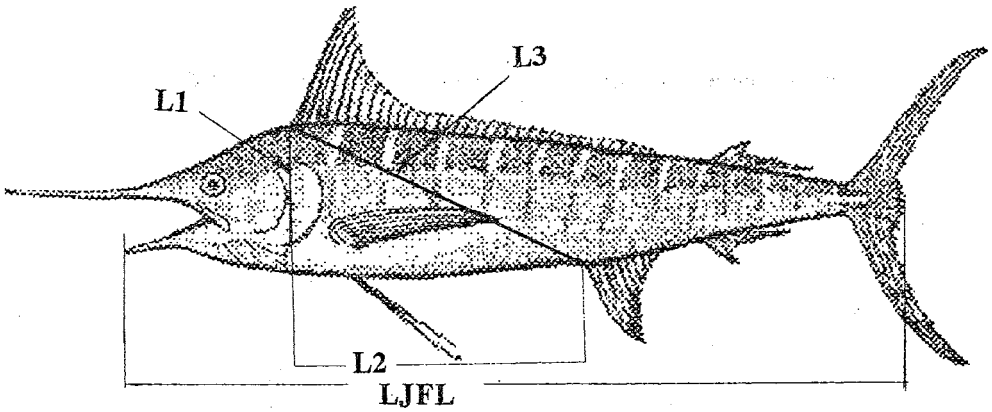
4. LITERATURE CITED

BAYLEY, R. E. and E. D. PRINCE, 1992. A review of tag and release and recapture files for Istiophoridae from the Southeast Fisheries Center's Cooperative Game Fish Tagging Program, 1954 to 1992 (June). ICCAT Working Document, SCRS/92/60, 14 pp.

EHRHARDT, N., 1990. The potential of using allometric growth characters for resolving routine size and age estimations of billfishes. in Proc. of the Second International Billfish Symp., R. Stroud (ed.), Mar. Recreational Fisheries 13, National Coalition for Marine Conservation, Inc., Savannah, GA: 277-285.

LUCY, J. A., 1992. Practical considerations and expanded data base for estimating weights of blue marlin from video images of fish brought to the boat for release. (Abstract). In Proc. of the 43rd Annual Tuna Conf. A Coan and A. Jackson (eds.), NMFS Southwest Fisheries Science Center, La Jolla, CA: 33.

LUCY, J. A., J. POSENAU and K. KILEY, 1991. Video as a potential tool to estimate dimensions and weights of hooked marlin at the boat in the recreational fishery. (Abstract). In Proc. of the 42nd Annual Tuna Conf., D. Margulies and J. Wexler (eds.), I-ATTC, La Jolla, CA: 24.



L1 - Origin of first dorsal fin to posterior edge of branchiostegal membrane
L2 - Branchiostegal membrane to origin of first anal fin.
L3 - Origin of first dorsal fin to origin of first anal fin.
LJFL - Tip of lower jaw to "fork" of tal (caudal fin).

Figure 1. Dimensions taken dockside from marlin; L1, L2, and L3 represent dimensions sought from video images of live fish at the boat.

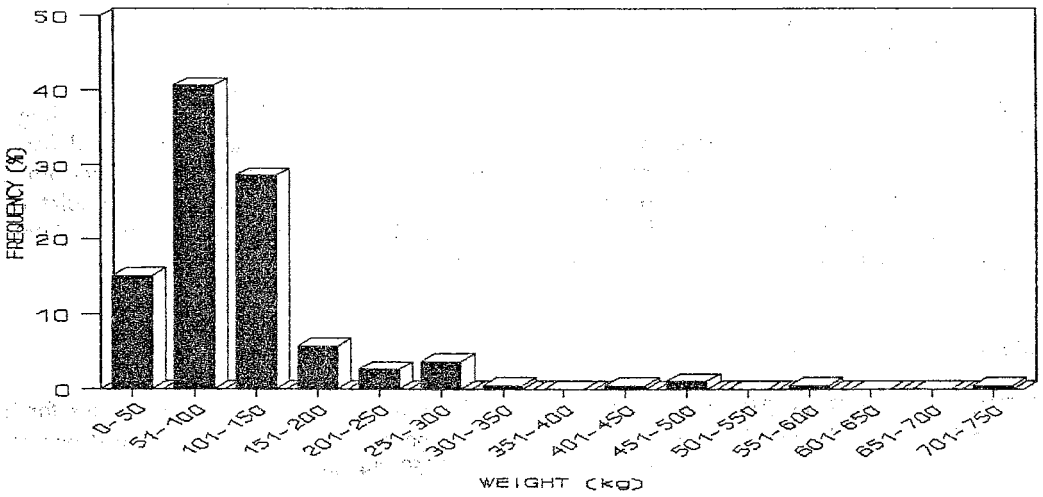


Figure 2. Weights of measured blue marlin (N=190).

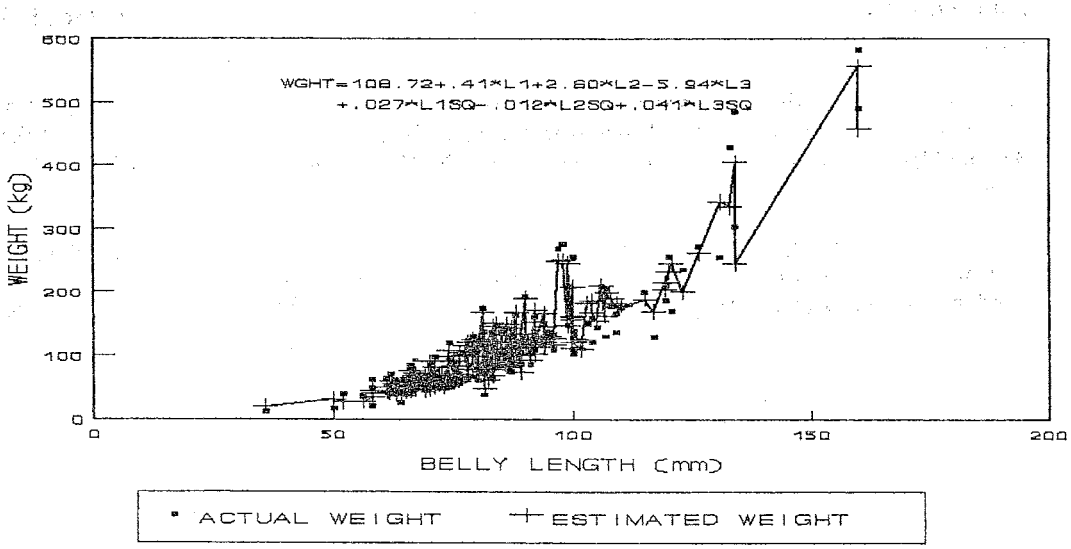


Figure 3. Actual and estimated weights (kg) of blue marlin versus belly (L2) length (mm) (N=190).