Pauly, D. 1994. An approach for minimizing the costs of obtaining the growth curves required for fish stock assessments in the Caribbean, p. 49-52. *In* Final Report of the Large Pelagics, Reef and Deep Slope Fishes Assessment Subproject Specification Workshop, 18-26 January 1994, CARICOM Fisheries Resource Assessment and Management Program, St. Vincent and the Grenadines.

CARICOM FISHERIES RESOURCE ASSESSMENT AND MANAGEMENT PROGRAM

LARGE PELAGICS, REEF AND DEEP SLOPE FISHES ASSESSMENT SUBPROJECT SPECIFICATION WORKSHOP

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BASSETERRE, St. KITTS/NEVIS

FINAL REPORT

CARICOM Fisheries Resource Assessment
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Tyrell Street, St. Vincent and the Grenadines
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INVITATIONAL PAPER

An Approach for Minimizing the Costs of Obtaining the Growth Curves Required for Fish Stock Assessments in the Caribbean[4]

Age and growth studies in the Caribbean and elsewhere in the tropics are usually conducted to estimate the parameters (L_∞, K, t_0) of the von Bertalanffy Growth Function (VBGF), as required by various analytical stock assessment models (Beverton and Holt's yield per recruit model and its variants, Jones' length cohort analysis and its variants, etc.)

Usually, a single set of growth parameters per (single-species) stock (or population) is considered sufficient, because:

- growth parameters appear to vary among years far less than fishing mortality, the parameter of interest for most fisheries investigations; and

- the scarcity of data and personnel in the region would in any case make periodic re-estimation of growth parameters impossible.

Growth parameters estimates exist and are documented in FishBase (Pauly and Froese 1991) for many species (>100) in the greater Caribbean area, and particularly for most of the fish species considered of prime importance in the CARICOM area (Table 4).

Hence it was suggested that the most effective approach for accelerating fish stock assessments in the area would be to:

1) find a way to make VBGF parameters estimates pertaining to a given site or stock or a number of sites or stocks) apply to the site or stock one is interested in (henceforthwith "critical site" or "critical stock");

2) estimate age and growth from hard parts (e.g., otoliths) only in important species that have never been studied in terms of growth (i.e., for which no size-at-age data are available from which growth parameters could be straighforward and reliably estimated.)

Item (2) is obvious, and should in any case become part of the terms of the reference of the CFRAMP-sponsored Fish Aging Laboratory which may be set up at the IMA, Trinidad and Tobago.

Item (1) was the topic of this paper

[4] Summary of a lecture presented by Daniel Pauly (ICLARM) at the CARICOM Fisheries Resources Assessment and Management Program-Subproject Specification Workshop, St. Kitts, January 18-26, 1994.

Evidence was presented which shows that for fish, there exists a strong inverse relationshiop between the parameters K and L_∞ of the VBGF, expressed by the relationship

$$Ø' = \log_{10}K + 2\log_{10}L_\infty \qquad ...1)$$

with Ø' showing very little variability among stocks of the same prices. In addition, data were presented showing that Ø' is normally distributed within a species.

Hence, it was shown that given an estimate of Ø' from any stock of a given species, and an estimate of L_∞ for a critical stock of the same species, the value of K in the critical stock could be estimated from

$$\log K_{crit} = -2\log L_{\infty crit} \qquad ...2)$$

Moreover, when several L_∞, K pairs are available from various stock, the mean or median Ø'(Õ') could be calculated, and K_{crit} estimated by inserting Ø' into equation (2)[5] .

This estimate of K_{crit} would not only be compatible with the estimate of L_∞ for the stock concerned, but also embody all the aging work that went into the value of Ø', often a considerable accumulation of material and intellectual inputs.

Estimating L_∞ for a critical stock was shown to be straightforward, being done either:

- from length-frequency data, using the Wetherall method as incorporated in the complete ELEFAN or FiSAT, its successor (to be launched in early 1994 by FAO and ICLARM);
- from a series of locally sampled maximum sizes, using extreme value theory (also incorporated as an easy-to-use routine of FiSAT); or
- a single value of maximum size, from a report, a taxonomic account, or field observations.

The paper indicated the availability of growth parameter estimates for a large number of species for the CARICOM area. Hence, the approach was proposed to use these growth parameters estimates to obtain critical values of K, given critical estimates of L_∞. In this way, fish stock assessments in the region would be considerably accelerated.

The software programs required for this approach (FishBase, FiSAT, AUXIM) are available, or soon would be available to all researchers in the CARICOM area.

[5] A new software program called AUXIM has recently been developed at ICLARM which facilities estimation of Ø' and the identification of outliers; this program is available from the author.

The author indicated his readiness to make this approach known to researchers in the area, either through one, or several presentations in the region, or through a short course that could be arranged, by CFRAMP for the purpose.

Reference

Pauly, D. and R. Froese. 1991. FishBase: Assembling Information of fish. NAGA, the ICLARM Quarterly, October 1991: 10-11.

Table 4. Some species of interest of CARICOM countries and the numbers of corresponding growth curves available through FishBase (Pauly and Froese, 1991).

Reef and Slope		**Growth Curves**
queen snapper	*Etelis oculatus*	0
red hind	*Epinehelus guttatus*	1-LF; 1-OS
mutton snapper	*Lutjanus analis*	6-OS
silk snapper	*Lutjanus vivanus*	1
stoplight parrotfish	*Sparisoma viride*	0
mahogany snapper	*Lutjanus mahogani*	0
longjaw squirrelfish	*Holocentrus ascensionis*	1-TR
yellow snapper	*Ocyurus chrysurus*	1-LF: 4-OS; 2-OR
rock hind	*Epinephelus adscensionis*	0
queen triggerfish	*Balistes vetula*	1-LF; 1-TR; 1-OS; 1
doctorfish	*Acanthurus chirurgus*	1-TR
white grunt	*Epinephelus plumieri*	2-LF; 1-OS; 1
coney	*Epinephelus fulvus*	1-LF
ocean surgeon	*Acanthurus bahianus*	1-TR
blackfin snapper	*Lutjanus buccanella*	2-LF; 1
Nassau grouper	*Ephinephelus striatus*	2-TR; 1-OS; 1
margate	*Haemulon album*	1-LF; 1-OS
French	*Haemulon flavolinealum*	0
redtail parrotfish	*Sparisoma chrysopterum*	1-TR
hogfish	*Lachnolaimus maximums*	0
striped grunt	*Haemulon striatum*	0
tomtate grunt	*Haemulon aurolineatum*	1-OS
porkfish	*Anisotremus virginicus*	0
striped parrotfish	*Scarus iserti*	0
dog snapper	*Lutjanus jocu*	0
black grouper	*Mycteroperca bonaci*	1-OS
porgy	*Calamus penna*	0
yellowmouth grouper	*Mycteroperca interstitialis*	0
smallmouth grunt	*Haemulon chrysargyreum*	0
blue parrotfish	*Scarus vetula*	1-TR
red grouper	*Epinephelus morio*	1-OS
black grunt	*Haemulon bonariense*	1-OS
redspotted goatfish	*Pseudupeneus maculatus*	2-OS
angelfish	*Pomacanthus paru*	1-TR

Reef and Slope		**Growth Curves**
smooth trunkfish	*Lactophrys triqueter*	0
tiger grouper	*Mycteroperca tigris*	0
saucereye porgy	*Calamus calamus*	0
Large Pelagics		
wahoo	*Acanthocybium solandri*	1-LF
blackfin tuna	*Thunnus atlanticus*	2
crevalle jack	*Coranx hippos*	0
cero mackerel	*Scomberomorus regalis*	1-LF
albacore	*Thunnus alalunga*	5-OS; 2-TR; 1-OR; 10
Serra mackerel	*Scomberomorus brasiliensis*	1-LF
marlin	*Makaira nigricans*	1-OS; 1
Atlantic bonito	*Sarda sarda*	6
little tuna	*Euthynus alletteratus*	4
tiger shark	*Galeocerdo cuvieri*	3-OR
scalloped hammerhead	*Sphyrna lewini*	1-OR
blacktip shark	*Carcharhinus limbatus*	4-OR
Coastal Pelagics		
ballyhoo	*Hemiraphus brasiliensis*	1
skipjack tuna	*Katsuwonus pelamis*	10-LF; 4-OS; 2-TR; 32
scad	*Selar crumenophthalmus*	7-LF; 5-OS
scaled sardine	*Harengula jaguana*	0
round scad	*Decapterus punctatus*	1-LR; 1-OR
yellow jack	*Caranx bartholomaei*	0
jack	*Caranx ruber*	1-LF; 1-OR
rainbow runner	*Elegatis bipinnulata*	1-LF
great barracuda	*Sphyraena barracuda*	3
bar jack	*Caranx ruber*	0
sprat	*Harengula humeralis*	0
nurse shark	*Ginglymostoma cirratum*	0
black jack	*Caranx lugubris*	1-OS; 1
amberjack	*Seriola dumerili*	1
thread herring	*Opisthonema oglinum*	0
horse-eye jack	*Caranx latus*	0
"anchovy"	*Sardinella brasiliensis*	0

Numbers without codes are entries where the data type is blank

Growth curves based on: LF - length frequency
OS - otholith/scale data
OR - other annual rings
TR - tagging recapture data