

# Focus questions

## [Data inputs and modelling](#)

### CPUE

**Keynote:** Toshihide Kitakado & Nicholas Ducharme-Barth

**Commenter:** Laura Tremblay-Boyer)

**Does spatially weighted longline CPUE have asymptotic time-invariant selectivity?**

**How can you fill in large contiguous spatial areas of missing CPUE due to fishery expansion and contraction?**

**Is targeting important in tuna longline CPUE standardization and how should it be done?**

**Have there been changes in the longline fishing methods and how can they be incorporated into the standardisation?**

**How should effort creep due to technological advances be included into CPUE standardization?**

**Can and should the third dimension, depth, and the associated environmental conditions be incorporated into the standardisation?**

**How can and should CPUE from different nations be combined?**

**Should covariates and covariate interactions be included in spatio-temporal CPUE standardization given the increased computational demands?**

**CPUE series are sometimes split into separate (consecutive) series when used in stock assessments. When is this appropriate? What could be done instead?**

**What should stock assessors do when information about effort creep in indices is unavailable?**

**What features should be included in simulations used to test a new CPUE analysis method?**

### [Longline size data](#)

**Keynote:** Simon Hoyle & Tom Peatman

**Commenter:** Kaisuke Satoh

**Is it reasonable to drop data from the model if we are unsure about it?**

**Best ways to deal with conflict between the information in different model components? Will we end up with too many scenarios for model weighting?**

**If sizes vary spatially and fishing distribution varies through time, should we always use time-varying selectivity for fisheries?**

**Why do sizes vary spatially: growth, exploitation, or movement?**

**What are the metrics that fish are measured in (length, whole weight, processed weight), by whom (observer, fisherman, port sampler, student), how are they converted to length, and are they raised to the catch and how?**

**Should other nations length composition be included in the stock assessment and should they be represented by a different selectivity?**

**Is multinomial error structure adequate enough for weighting composition data?**

**Are correlated composition residuals mainly due to model misspecification or can they be part of the observed compositions?**

## Purse seine species comp and size data

**Keynote: Tom Peatman & David Kaplan**

**Commenter: Cleridy Lennert-Cody**

**Is there a reliable and efficient way to collect length composition data on board a purse seine vessel?**

## Weight-length, maturity, conversion factors

**Keynote: Jed Macdonald & Simon Nicol**

**Are the weight-length, maturity, and conversion factors reliable for tuna and, if not, which ones need more data.**

**Do Weight-length, maturity, conversion factors change substantially over time?**

**Are accurate weight-length, maturity, and conversion factors needed for providing reliable management advice?**

## Biology and modelling

### Recruitment (Andre Punt / John Hampton)

**Keynote: Andre Punt**

**Commenter: John Hampton**

Is the increase in recruitment estimated as the purse seine fishery on floating objects expanded real or a model artifact?

Should steepness and SigmaR be estimated or pre-specified - if not should there be taxon-specific default ranges?

Should the bias ramp (and maximum bias adjustment) be applied - what are best practices?

Should assessments try to estimate as many rec\_devs as possible

Recruitment independent of stock size, as seen for tuna, implies strong density dependence. What is limiting habitat for larval survival in the pelagic environment?

Are regime shifts in recruitment common for tunas and how should they be addressed in assessments and management?

What are the advantages/disadvantages of assuming recruitment is independent of stock size?

To what extent is the choice of the SRR driven by reference point considerations?

How pervasive are temporal changes in biological parameters (weights, fecundity, maturity, mortality), and do those changes reflect sustained trends or random fluctuations?

What new developments/features for modeling recruitment should be in the "next generation" stock assessment models (and what current issues would these new features help to resolve)?

## Natural mortality

Keynote: Simon Hoyle

Commenter: Kai Lorenzen

What ontogenetic changes in biology and ecology underlie the phase transitions observed in some tuna growth and mortality schedules? Why are these transitions absent in other stocks of the same species?

How do we define  $a_{max}$  (maximum age) and can we implement the concept consistently across different study designs and assessment approaches? Given uncertainty in  $a_{max}$  estimates, are  $a_{max}$ -based M estimators really more precise in practice than growth-based M estimators?

Does M increase for intermediate aged tuna and, if so, why?

Should life-history relationships for M vary taxonomically. i.e. should and can there be a relationship for tuna?

What dimensions of uncertainty in M should be explored in assessments and in MSEs?

How and should temporal trends in M be modelled?

How should factors influencing M other than predation (e.g. condition factor, density dependence and disease) be incorporated in assessments.

If all samplers/observers/survey staff are instructed to take otoliths from the biggest fish they can find, what sample size does this imply and does this sample size matter in estimating M from maximum age?

Given the maximum age relationship is constructed based on M estimates from populations that are lightly exploited, but the relationship is applied to populations that are heavily exploited, does that invalidate the assumptions or does refugia or other phenomena mean that the maximum age will always relate to an unexploited/lightly exploited population?

## Growth

Keynote: Lisa Ailloud

Commenter: Kai Lorenzen

Integrated models can often accommodate incomplete age-length datasets (e.g. missing years, missing length/age strata, low sample sizes). The tendency in tuna assessments, when data are sparse, is to include all data and let the model fill in the gaps. Should we be stricter in filtering the data that enters the assessment and, for example, only include data for the one or two fleets for which we know data is being collected following a strict sampling scheme and for which we have a good understanding of selectivity?

Long-term fishing inevitably affects the age and size structure of a population, including age truncation and lower mean asymptotic length, yet we typically estimate a single growth curve for the length of the assessment period. How important is it that we characterize this change accurately? Given the asymmetries in risk associated with uncertainty in mean asymptotic length (i.e. underestimation is likely to give an overly optimistic outlook on stock status vs. overestimation is likely to give an overly pessimistic outlook on stock status) should we put more effort into trying to estimate historical growth patterns?

New age estimation tools (i.e. epigenetic ageing, near-Infrared spectroscopy) have the potential to revolutionize the ease, cost and speed with which we collect and age fish. Should we make these technologies a priority for tunas and take this as an opportunity to shift our focus towards collecting empirical length/weight at age data to reduce estimation bias in modeling and improve our description of time varying growth?

What ontogenetic changes in biology and ecology underlie the phase transitions observed in some tuna growth schedules?

How might these phase transitions be influenced by global environmental change?

Why do many tuna growth schedules appear very stable in time despite being plastic?

How do we best account for growth plasticity in tuna growth and stock assessment modeling?

Can we use annual rings in otoliths to age tuna?

Is tuna growth sex specific?

How can tagging growth-increment data be included in age-structured stock assessment models?

What types of biological variability in the growth process are the most important to account for?

What sampling biases are the most influential on estimates of length-at-age and need to be accounted for?

Is length-at-age critical only for assessments that use fits to length composition data to estimate scale?

What to do when the growth process varies by spatial regions?

Given that we generally have direct information on the growth process and it may not be critical to the assessment models estimates of dynamics (when not used to inform absolute abundance), should we focus more effort on more difficult and important processes such as natural mortality?

Are empirical approaches a better alternative than trying to estimate the growth process, and, if so, how should missing length-at-age be imputed?

## Model structure

### Identifying stock structure

Keynote: Carolina Minte-Vera & Brad Moore

Commenter: Steve Cadrin

Are there any (other) aspects of tunas and tuna fisheries that require special attention for stock identification?

How can dynamic stock boundaries and spatial strata be monitored and defined in the stock assessment process?

If information from stock identification suggests that stocks straddle tuna RFMO boundaries, what's the process for coordinating stock assessments between RFMOs?

Will Close Kin genetics provide the ultimate answer to stock structure?

Once a "closed" population has been identified, can areas as fleets adequately account for remaining stock-structure (in association with area weighted indices of abundance and associated composition data)?

Can fisheries data (CPUE and composition data) adequately identify stock structure or is other data/information needed?

Does oceanographic or other physical, chemical, or biological structure determine stock boundaries for tunas?

How should stock assessments be used for management advice when stock boundaries don't match management boundaries?

How important is population structure relative to other aspects of population and fishery dynamics (recruitment, natural mortality, growth, selectivity, ...)?

What information is available to identify population structure?

How many of the stocks assessed represent one entire biological population?

How is spatial heterogeneity within stock areas considered?

What are the consequences of violating the unit stock assumption (closed, homogeneous, well mixed)?

## Modeling stock structure

Keynote: Aaron Berger

### Data

What types of novel or unique data could be fit or used to help parametrize spatial models?

Is tagging (marking, genetic, etc.) data needed to estimate movement and what are the relative cost/benefits to incorporating these data?

What are the appropriate diagnostics for tagging data to ensure assumptions are not violated?

What are the pros/cons of using recapture vs. release conditioned tagging models?

### Model

How do we determine the 'optimal' scale for a spatial assessment?

Can we identify thresholds/guidance for when to add spatial complexity?

Which processes should a spatial stock assessment model include at a minimum?

Are there novel ways to leverage existing (or new) data from multiple sources/types to 'build up' evidence for spatial structure within the model fitting procedure?

When can the areas-as-fleets approach adequately deal with spatial structure?

Can complex movement (or other spatial) patterns be accurately modeled? What are the implications of not matching that complexity?

What are the relative merits of current generic assessment platforms that incorporate spatial dynamics compared to using tailor made models?

What are the primary limitations of current spatial assessment platforms and how might these be overcome in future spatial model platforms?

### Diagnostics

What types of diagnostic tools and residual analyses are useful for identifying when spatial processes need to be incorporated into a stock assessment (e.g., based on panmictic assessments)?

Can violation of spatial assumptions or ignorance of spatial structure be identified from commonly observed residual patterns?

### Management

When is spatial management needed?

What is the least complex management procedure that can provide robust management advice (i.e., are spatially explicit models required to address management needs)?

What are the primary factors limiting wider implementation of operational spatially explicit stock assessments and how might these be addressed in the future?

How can we develop biological reference points that adequately account for spatial structure?

Are empirical spatial reference points (e.g., density-based or area-occupied) adequate to address management goals?

Should/could spatial assessment-management frameworks be used as a conduit to operationalizing broader ecosystem goals/objectives?

## Modeling selectivity/fishery structure

Keynote: Mark Maunder

Commenter: Dan Fu

Is there a fishery/index that has asymptotic selectivity (i.e. is it appropriate to use time-invariant asymptotic selectivity for the area CPUE weighted longline composition data)?

Do purse seine length composition data provide information on recruitment variability or selectivity variability?

Why do free swimming school sets catch small and large yellowfin?

What is the mechanism that stops tuna schooling with floating objects and become vulnerable to the longline fishery?

Should the default for fisheries be flexible time varying selectivity?

Is one fishery with a random walk in age-specific selectivity adequate, or do we need to model length-based selectivity in multiple fisheries?

What is the best approach to model temporal variation in length-based selectivity when there are a large number of length bins?

What should be done when length compositions or selectivity's show "weird" shapes (multi-modal, shoulders, long-tails): down weight the data, further divide into fisheries, use splines?

**How can we use what is learned about dome-shaped selectivity in data-rich assessments to inform best shape to use in data-limited assessments?**

**What impedes us from implementing overall selectivity as a relatively stable gear-based size selectivity and a separate process for a highly flexible, time-varying availability in age due to interaction of spatial distribution of stock and fishery?**

**Can informative priors make semi-parametric work in data-weak situations?**

**Is a size based or size-age based model needed for tuna to account for sized based processes such as selectivity?**

## Model diagnostics

**Keynote: Felipe Carvalho**

**Commenter: Jim Ianelli**

**Can model diagnostics detect what is wrong, or just that “something” is wrong?**

**When and how well can quantitative diagnostics stand in for the judgment of an assessment scientist?**

**Is diagnostic performance dependent on how influential recruitment is to the model?**

**Is it worthwhile to develop thresholds for diagnostic tests, given that some diagnostics may simply measure how responsive populations are to fishing?**

**Can data weighting mask and/or improve the reliability of diagnostic performance?**

**How stock specific are any general conclusions, e.g. what is good for a sprat may not be good for a shark.**

## Tag modeling

**Keynote: Dan Goethel & Matt Vincent**

**Commenter: Rich Hillary**

**Can the limited spatial distribution and slow mixing rates of tuna tagging data be addressed inside the stock assessment model or should the data be analyzed outside the model on a finer spatio-temporal scale?**

**Are tag reporting and mortality estimates adequate to allow assessments to rely on tagging data and, if not, how can they be improved?**

**Should recaptured conditioned models be used to address issues with reporting rates and tagging mortality?**



Is Close-Kin Mark-Recapture a solution to the issues with tagging data (mixing, reporting rates, tagging mortality) and what is the cost difference?

## Model weighting

Keynotes: Philipp Neubauer, Max Cardinale, Daithi Stone

Commenter: Nicholas Ducharme-Barth

How do politics ("my model must be included!") affect the interpretation model ensembles?

If we are evaluating against observed data, how do we know the observed data are accurate, or how do we account for inaccuracies?

What is the same/different in the weather forecasting setting?

Is one-step ahead forecasting of observations a reasonable modelling weighting metric, when the observation is not the management quantity of interest?

Is model weighting necessary or is simply only including reasonable models adequate?

How should correlation among models be accounted for in the model weighting?

## Data weighting

Is multinomial error structure adequate enough for weighting composition data?

Are correlated composition residuals mainly due to model misspecification or can they be part of the observed compositions?

Is it more appropriate to model age and length sampling data as proportions-at-age and use a separate index for the total index of abundance or removals (i.e., similar to Stock Synthesis), or should these be combined in a series of indices-at-age (i.e., similar to SAM)?

Are correlated residuals appropriately addressed via "data weighting" or do they require additional model changes (i.e., time-varying parameters)?

How can survey teams efficiently communicate information about sampling imprecision for routine and efficient use by assessment scientists?

How does model-based expansion of sampling data affect the process or interpretation of data weighting?

How should assessment scientists address alternative hypotheses about mechanisms that give rise to poor fit (and associated low weighting) for data?

## Process variation

**Are state-space models the natural framework for fish stock assessment and is increased computation time the only reason to not use them?**

**Can you estimate temporal variation in two processes at the same time and can the model determine which process is varying?**

**Can you estimate the variance parameter of both sampling variation and process variability, and which one accommodates model misspecification?.**

**Are there good alternatives to random effects when observations are missing, when specifying correlations between non-normal observations, and when assigning deviance penalties?**

**Are moving averages the best that can be done to predict weights, maturities, and natural mortalities in short-term forecasts?**