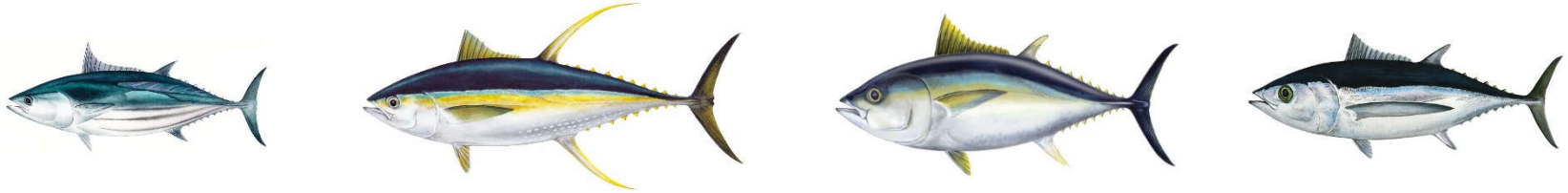
Stock structure in fisheries management



Brad Moore

Identifying the Spatial Structure of Pacific Tuna Stocks workshop

9-12th October 2018

UNIVERSITY of TASMANIA | IMAS INSTITUTE FOR MARINE & ANTARCTIC STUDIES

What is a stock?

Fish stock ≠ Population

Population: A group of individuals that belong in the same species and live in the same area

Fish stock: Unit defined by management, but generally implies a degree of reproductive isolation

What is a stock?

Multiple definitions, depending on management:

Marr 1957 – a population or portion of a population, of which all members are characterised by similarities which are not heritable, but are induced by the environment. May include members of several different subpopulations

Ihssen 1981 – an intraspecific group of randomly mating individuals with temporal or spatial integrity

Welch et al. 2015 – post-juvenile populations of fish that remain discrete and non-mixing (i.e. independent) and therefore comprise a functional management unit

Begg and Waldman 1999 – a semi-discrete group of fish with some definable attribute of interest to fisheries managers

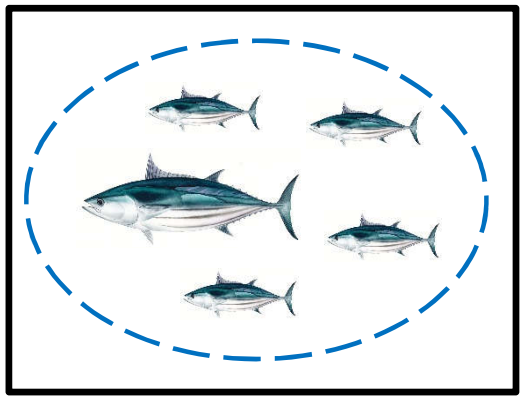
stock = group of fish that share same demographics
stock = group of fish that share same otolith chemistry
stock = genetically discrete group

What is a stock?

Stock = self-replenishing population, that will maintain itself over time in the absence of other stocks

Assessment models assume group of individuals being assessed (a unit stock) form a discrete entity, with its own origin, demographics, and fate

Assessment boundary = Stock boundary



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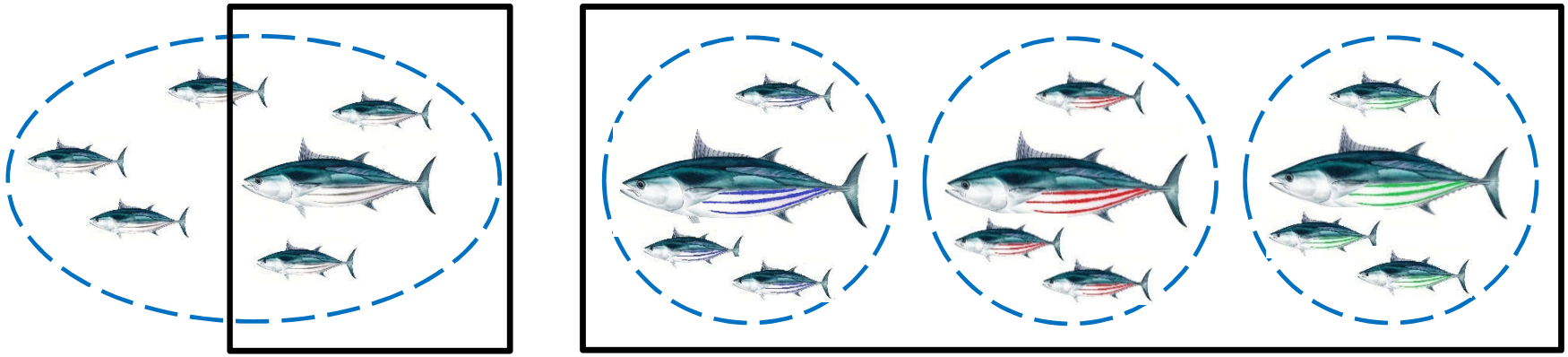
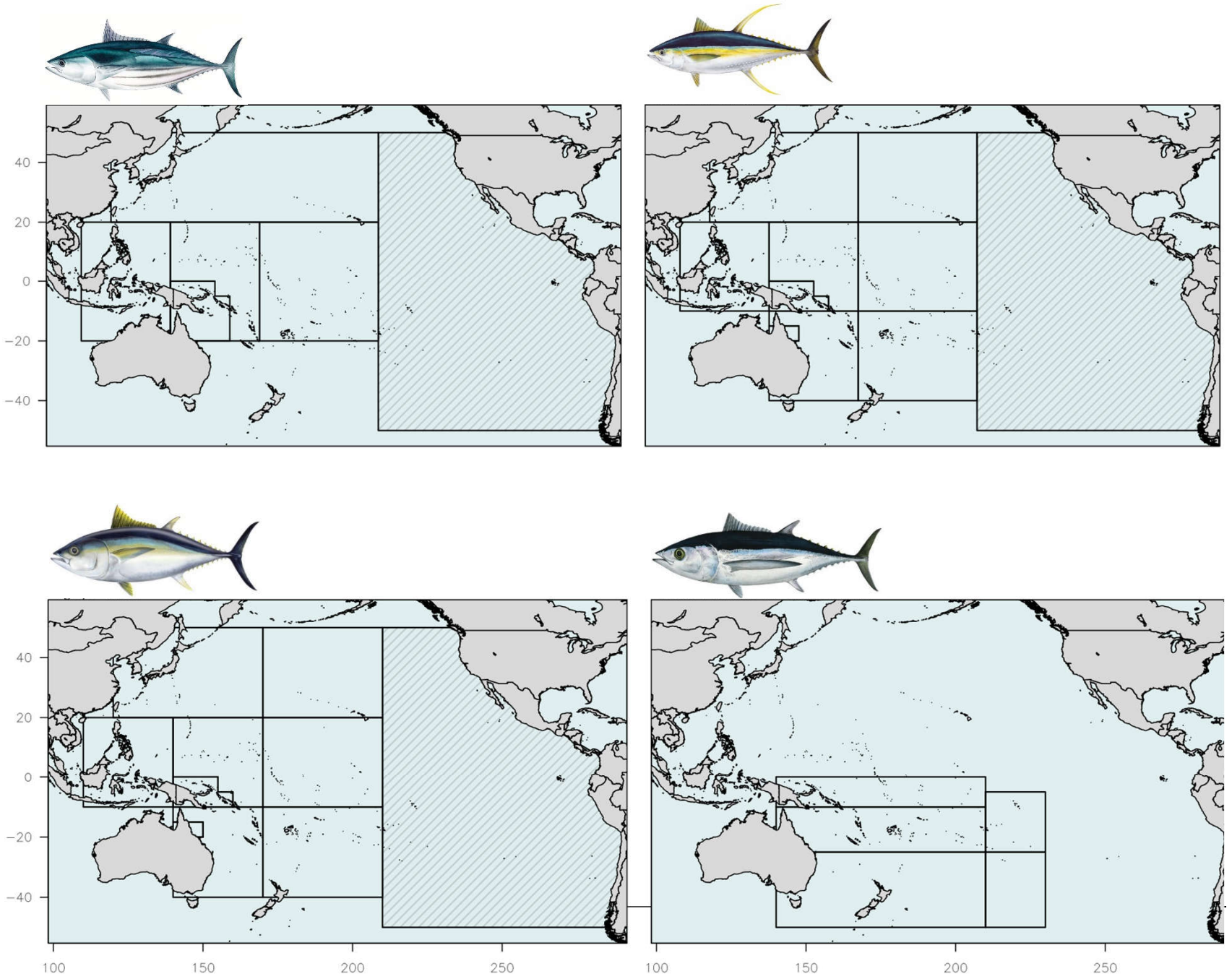
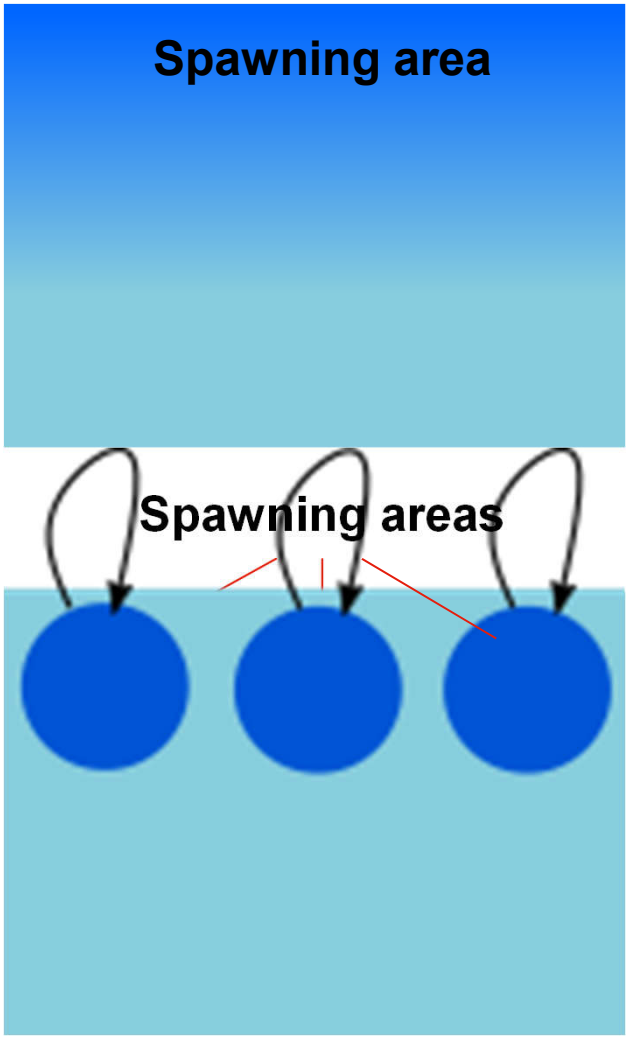


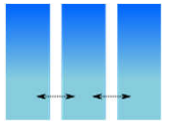
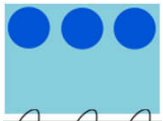
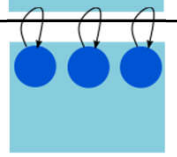
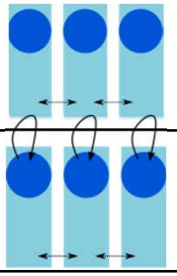

40
20
0
−20
−40
100
150
200
250

What might moderate stock structure of tuna in the Pacific?

1. Spawning behaviour
   - Is spawning opportunistic or discrete?
   - Each of SKY, YFT, BET and ALB considered to spawn in waters > 24°C
2. Movement and mixing
   - Considered highly migratory - ?
3. Degree of spawning site fidelity
   - Do individuals use same/natal spawning grounds
4. Environment

Products result in vastly different stock structure scenarios, with different assessment/management implications



	Spawning behavior	Post-larval mobility	Natal homing	Stock structure scenario	Assessment concerns
Tools	- Gonad development - Larval distribution	- Tags (all types) - Molecular markers - Otolith chemistry - Parasites	- Electronic tags - Molecular markers - Chemical markers - Parasites		
	Opportunistic (i.e. spawn in waters over 24°C)	High	--		Limited; must ensure assessment boundary contains the full stock
		Low	--		Higher; risk of overfishing less productive stock under single stock assessment, unless spatially-explicit assessment allows for different biological parameters across regions
	Discrete (i.e. use discrete spawning sites)	High	No		Limited; adult mixing should ensure productivity is the same across stocks
			Yes		Higher; risk of overfishing less productive stock, but cannot be individual assessments due to mixing of adults
		Low	No		Higher; risk of overfishing less productive stock under single stock assessment, unless spatially-explicit assessment allows for different biological parameters across regions
			Yes		

This workshop

- How should we define a stock for assessment?
- What are they underlying mechanisms by which observed spatial patterns occur
- What sort of hypotheses can we actually test? What is scaleable?
- How does it fit into the stock assessment framework?
- Would we be doing management any differently?