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Integrated Statistical Models of Tuna Movement in Relation to Fish Attractors

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Abstract

Integrated statistical models combine theoretical models of biological processes with statistical models of the observational errors in measuring the dependent variables in the process model. Three classes of integrated statistical models will be are presented — compartment models, advection-diffusion-reaction models, and state space Kalman filter models. The data requirements, expected output and possible interpretations of each class of model will be presented with examples of application for the analysis of tuna tagging data. The applicability of these models to the study of the movement of pelagic fish in relation to deep water rigs is discussed.

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Selected references to animal movement and statistical modeling of tag recapture data

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Taxonomy of Tag Recapture Models

Model	Basic Data	Output	Auxiliary Data	Auxiliary Output	References
Simple Tag Aggrition	Release & recapture time series	Total mortality (half-life)	Fishing Effort	catchability fishing mortality natural mortality harvest ratio	Kleiber et al 1987 Holland et al 1999
			Catch	standing stock throughput fishing mortality harvest ratio	Kleiber et al 1987
Compartment Model	Release & recapture time series at arbitrary "sites"	Total mortality Exchange rates	Fishing Effort	catchability fishing mortality natural mortality harvest ratio	Sibert, 1984 Sibert et al 2000
Advection-diffusion	Release & recapture time series at geographic locations	Total mortality Directed and random movement	Fishing Effort	catchability fishing mortality natural mortality harvest ratio	Kleiber & Hampton 1994 Sibert et al 1999
Random Walk Kalman filter	Time series of geographic positions (ie tracks)	Directed and random movement	Tempera-ture Depth	habitat use behavior	Sibert & Fournier 2001

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