Indicators of the spatial distribution of blue shark in the North Pacific

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Introduction

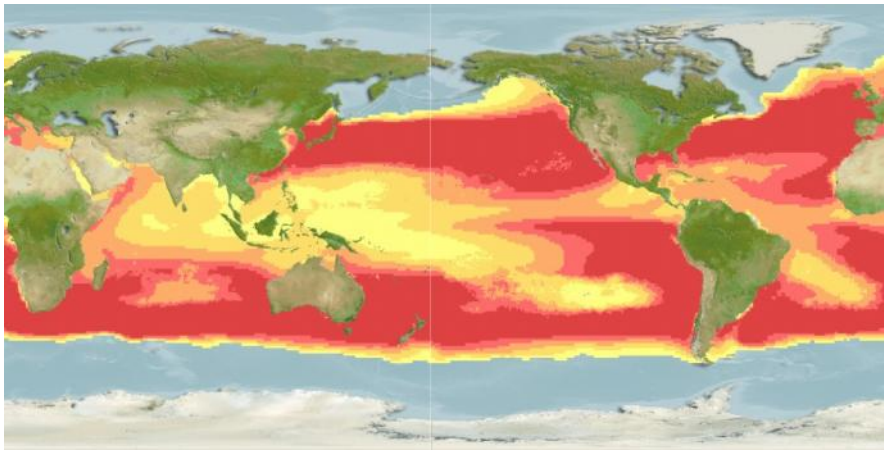
- WCPFC requested SC to provide advice as to whether blue shark in the North Pacific should be designated as a “northern stock”
- Northern stocks are those stocks “which occur mostly in the area north of the 20° north parallel”
- No guidance as to what “mostly” means.
- Current northern stocks are NP albacore, NP swordfish and Pacific Bluefin

Approach

- Compile indicators of BSH spatial distribution using:
  - Life-history information
  - Catch and CPUE data from fisheries and research cruises
  - Tagging data
- Comparison to those species already designated as "northern stocks"

Overall Distribution

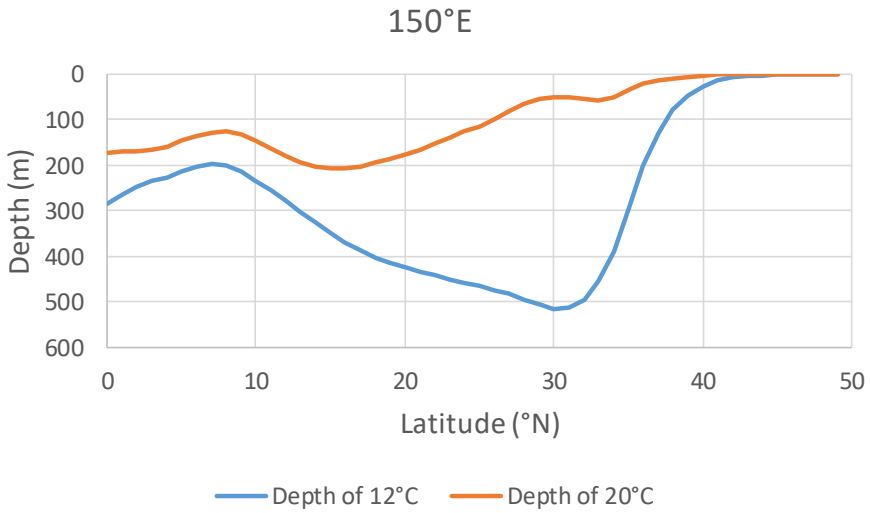
- Overall distribution Equator to at least 57°N

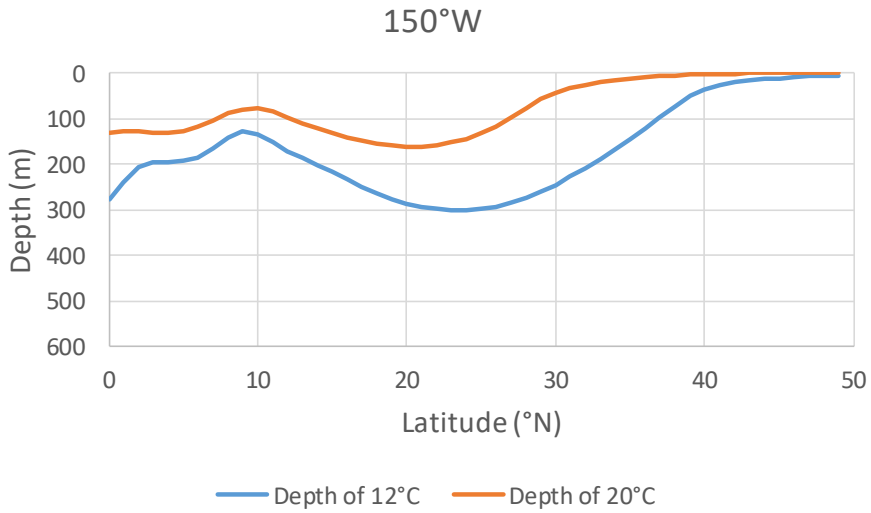


- Occupy waters 10.8 - 29.8° C (electronic tagging) across a wide depth rage

Overall Distribution Limits

- Temperature preference of 12 - 20°C often cited





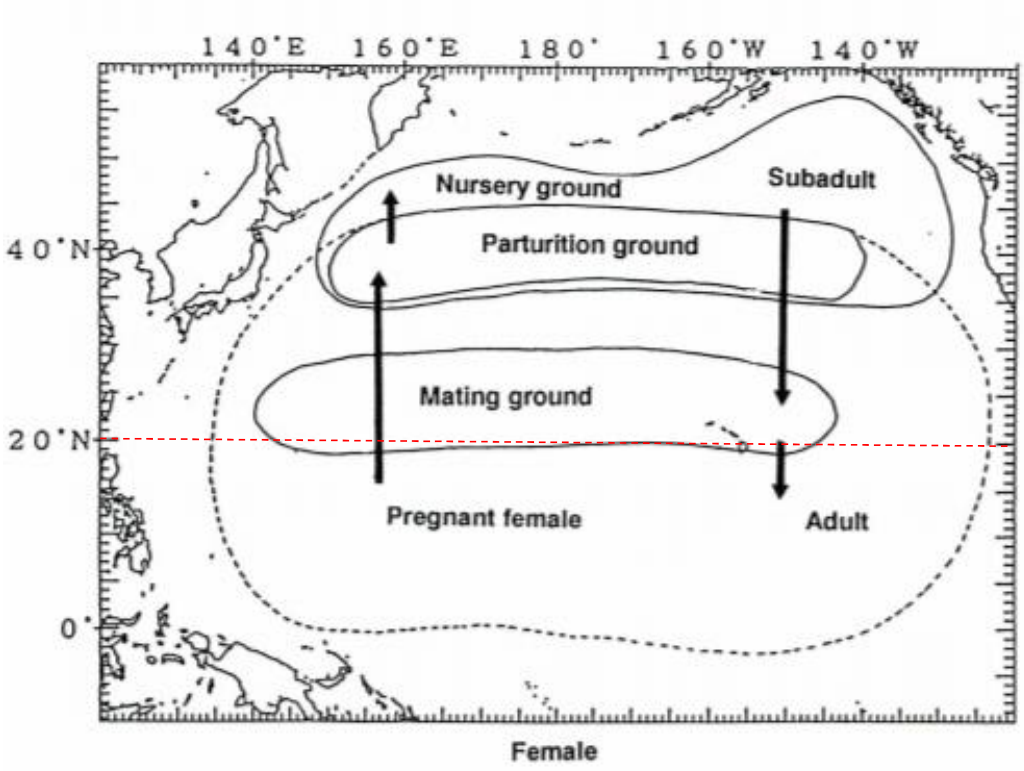
- Depth distribution likely to be determined by DSL

Reproductive Biology

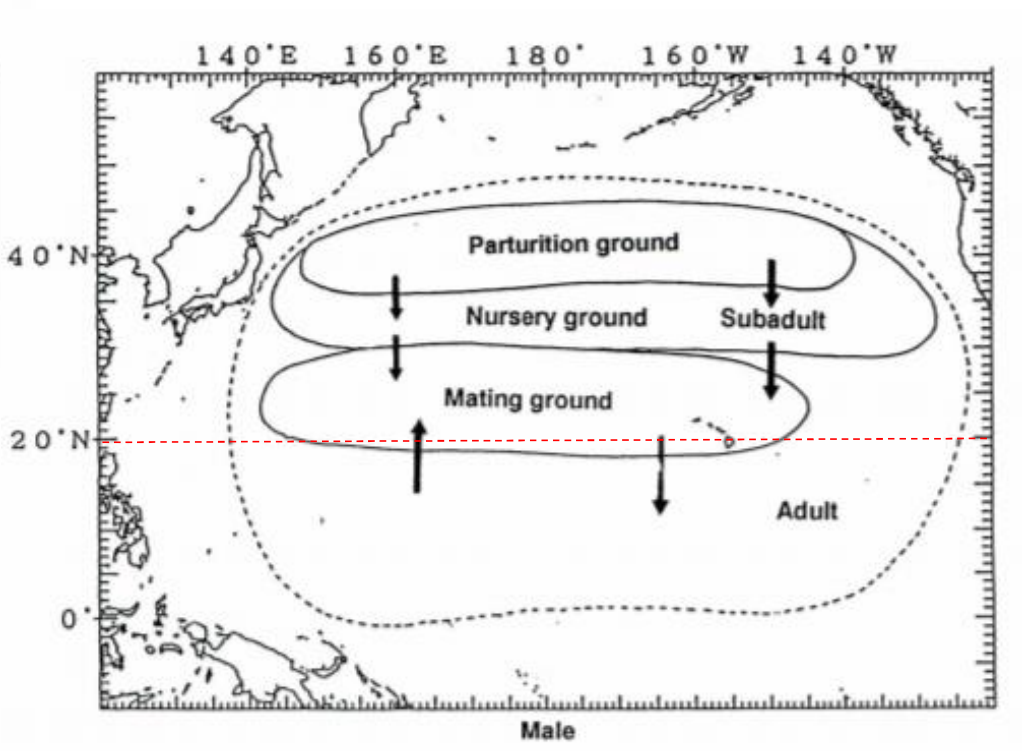
Schematic (Nakano 1994)

Pacific Community
Communauté du Pacifique

Females

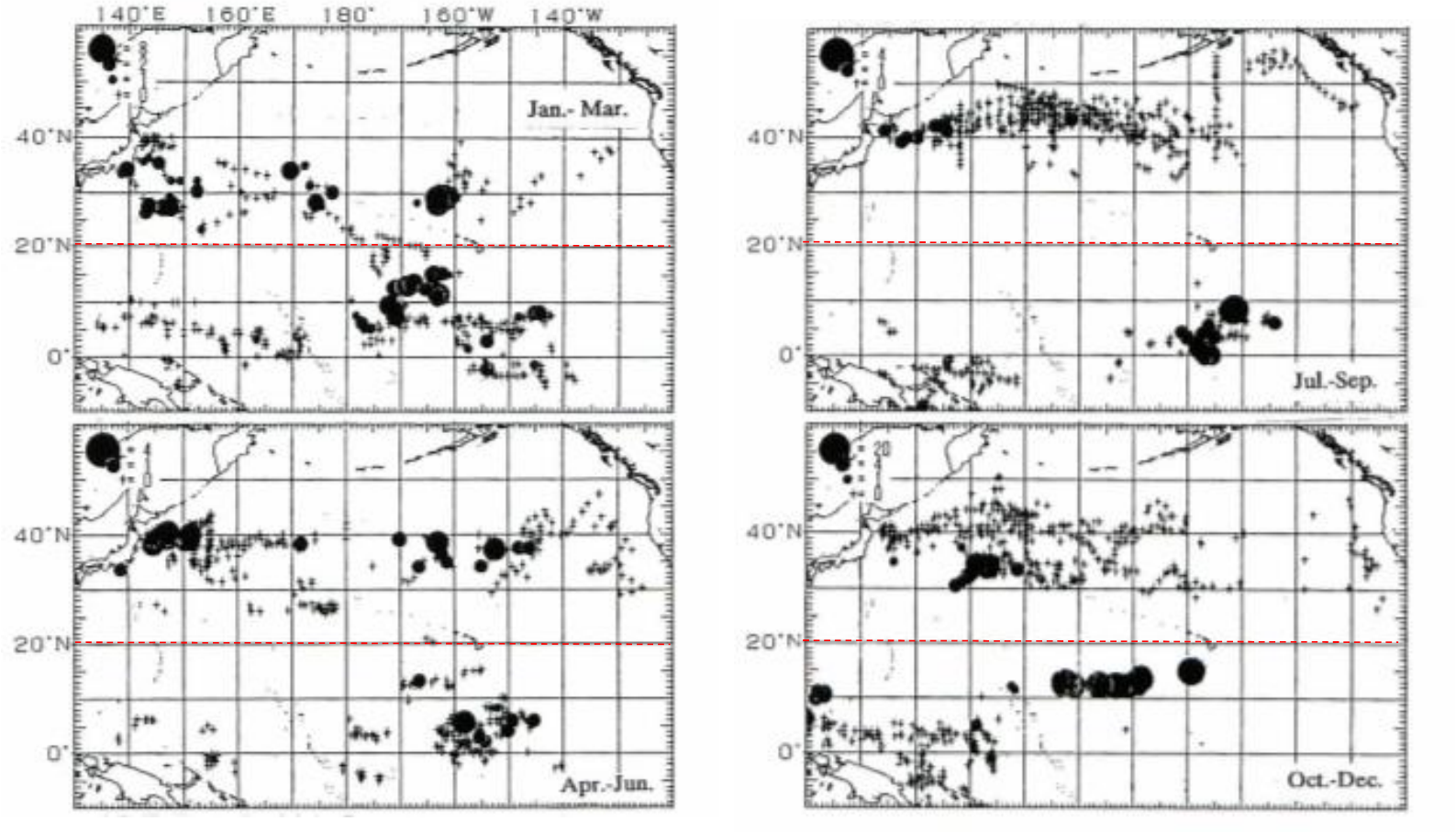


Males



Reproductive Biology

Quarterly distribution of pregnant females (Nakano 1994)



Life History Information

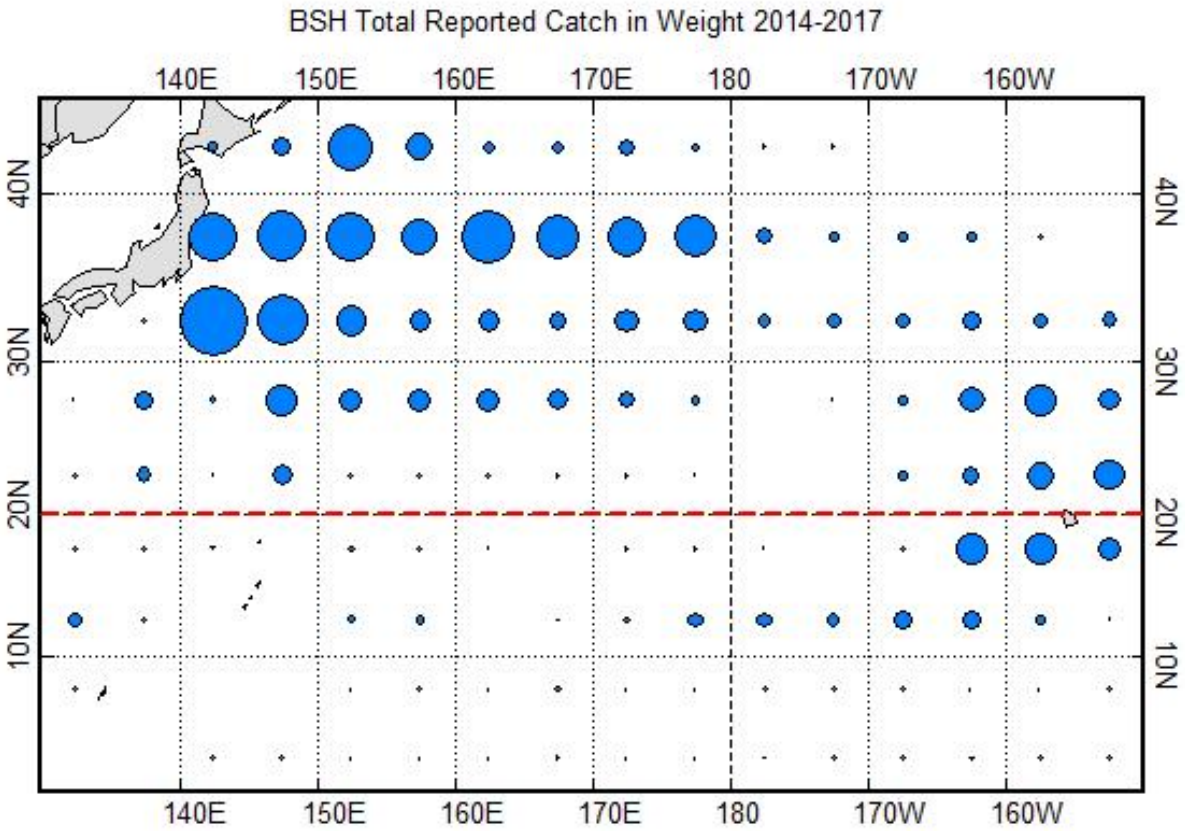
Summary Observations

- Blue shark capable of utilising all areas of the North Pacific
- The area south of 20°N is an important part of the blue shark distribution in the North Pacific, particularly for adults
- The area south of 20°N may be part of the breeding ground, and/or post-breeding area for pregnant females

Catch and CPUE Distributions

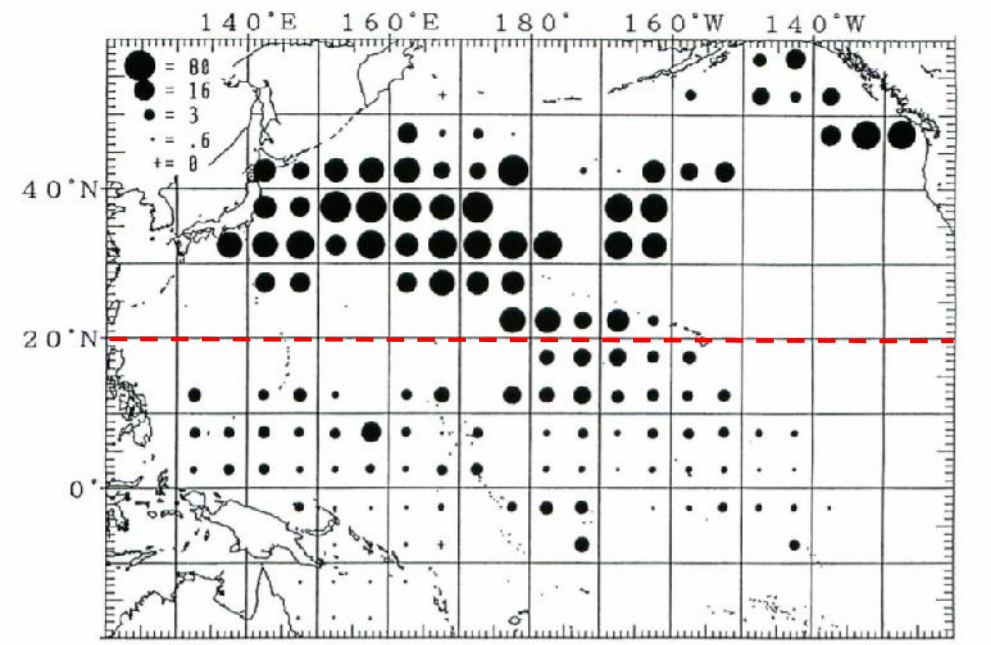
- BSH appear to be more vulnerable to longline gear set shallow and soaking mainly at night, e.g. fisheries targeting swordfish
- These fisheries occur mainly north of 20°N – therefore aggregated catch and CPUE may not provide an unbiased picture of BSH distribution
- Lower BSH catches by deep-set (tuna target) longline soaking mainly during the day.
- Deep-set longline occurs widely both north and south of 20°N

Overall Catch Distribution

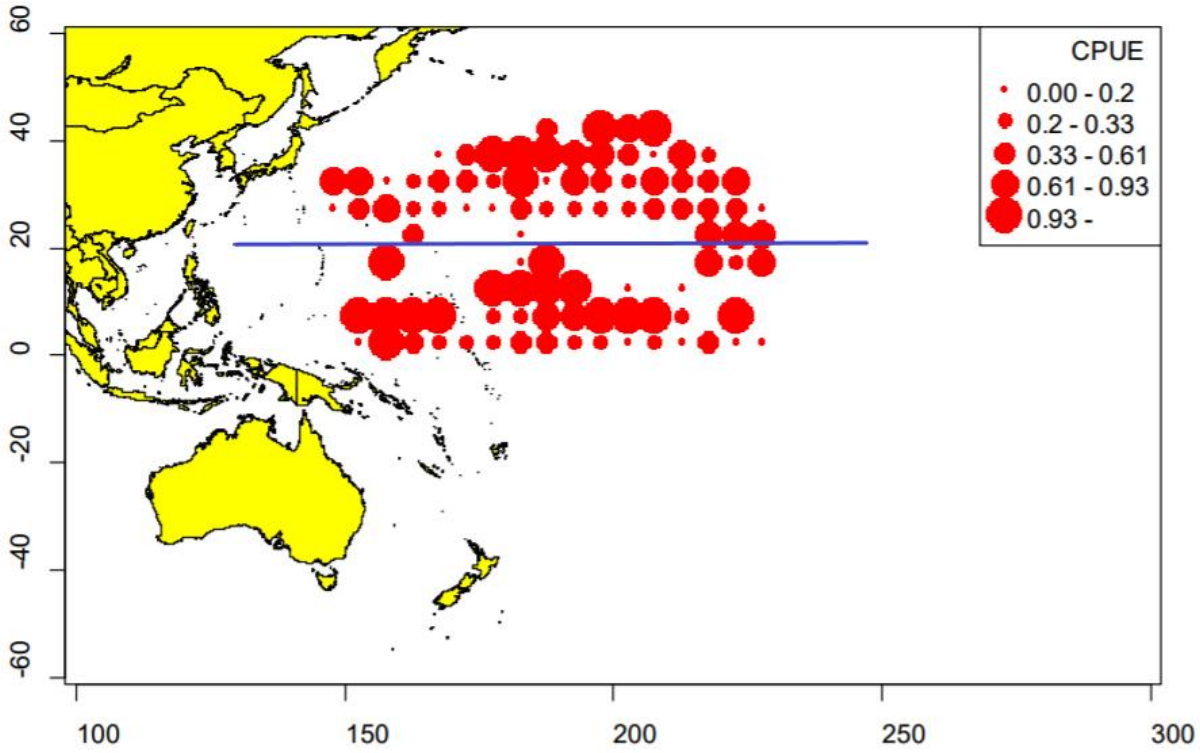


Japan Research Longline

- Targeting both tuna and sharks, but generally using a common shallow gear configuration (5-7 HBF)

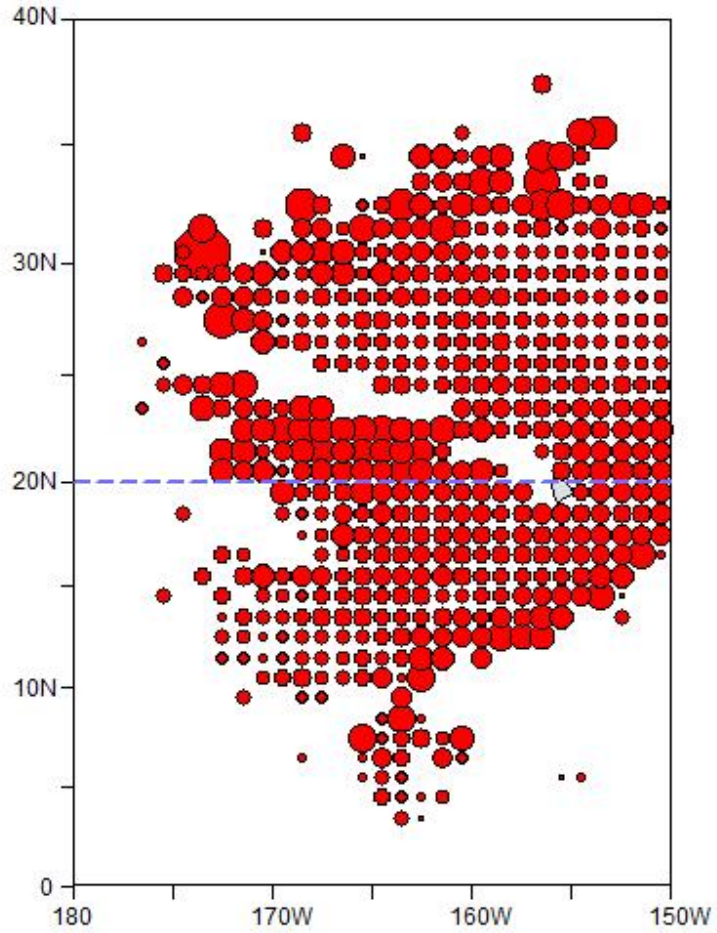


Chinese Taipei Large-Scale Tuna LL CPUE



	Standardised CPUE	
Year	**North of 25îN**	**South of 25îN**
2004	0.0054	0.3017
2005	0.8433	1.1268
2006	0.4906	0.5095
2007	0.4327	0.1602
2008	0.4955	0.3617
2009	0.4102	0.0966
2010		0.5076
2011	0.6813	0.5451
2012	0.0475	0.7262
2013	0.3309	1.0740
2014	0.4346	0.3969
2015	2.3137	0.6001
Average	**0.5896**	**0.5339**

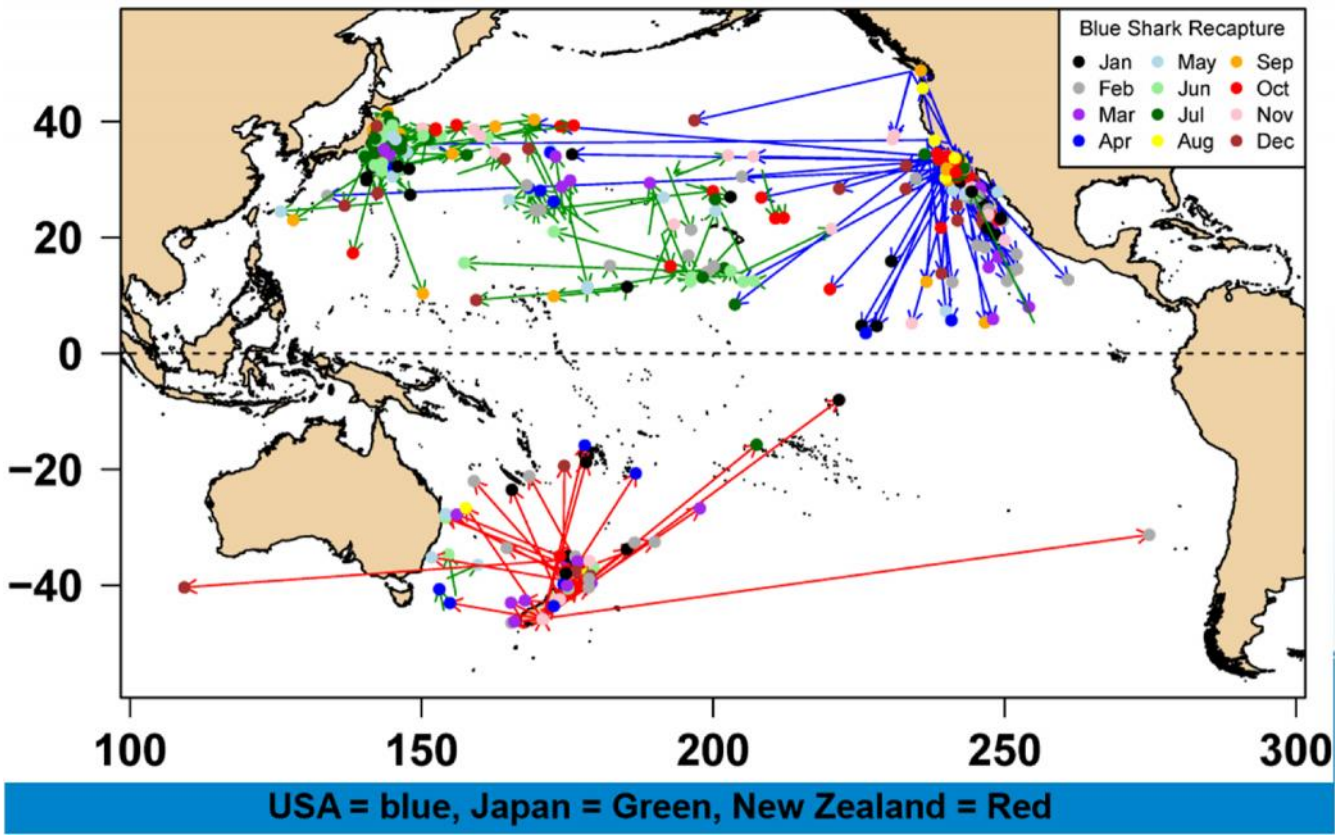
Hawaii Deep-Set Tuna LL CPUE



Year	Standardised CPUE North of 20°N	Standardised CPUE South of 20°N
2000	3.83	3.64
2001	3.76	1.67
2002	3.86	1.54
2003	2.67	2.10
2004	2.50	2.13
2005	1.92	1.98
2006	1.61	1.25
2007	1.73	1.44
2008	1.21	1.15
2009	1.04	1.62
2010	1.14	2.72
2011	1.48	1.45
2012	1.46	1.50
2013	1.75	1.85
2014	1.97	1.78
2015	1.69	1.87
Average	**2.10**	**1.86**

Tagging Data

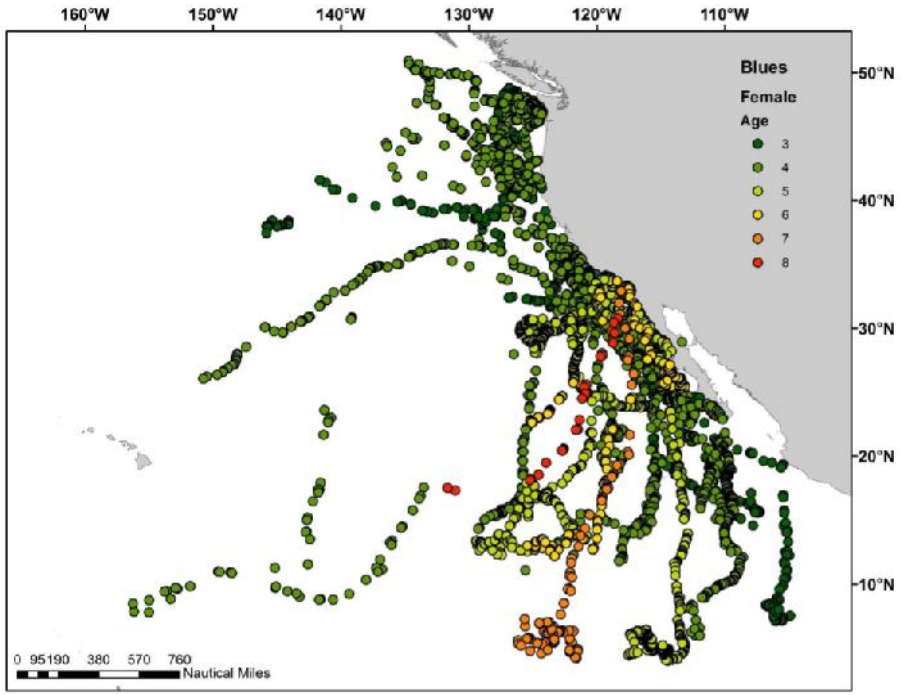
Conventional Tagging (Sippel et al. 2011)



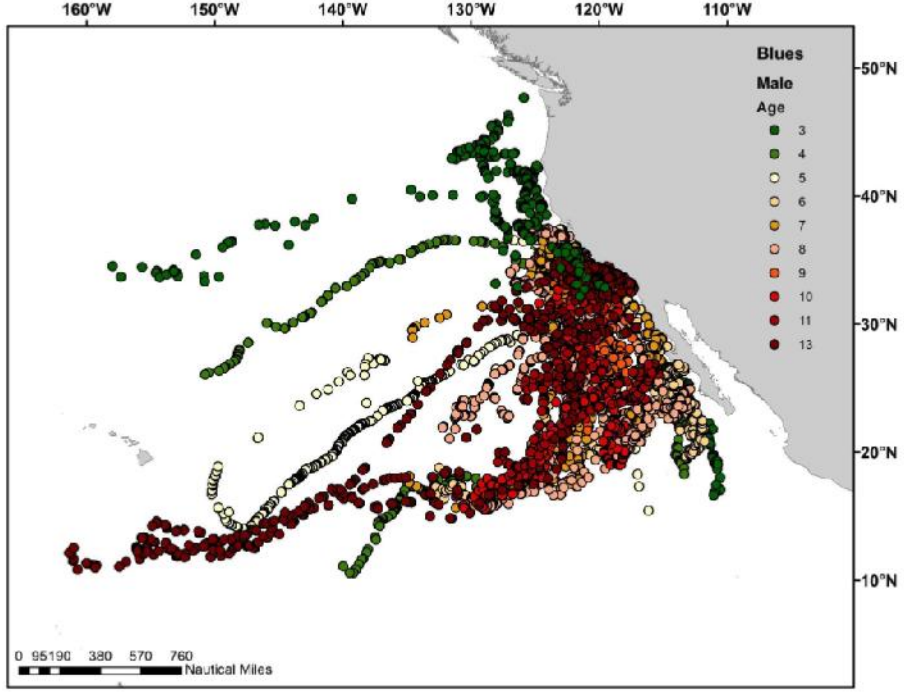
Tagging Data

Electronic Tagging (Heidi Dewar, NOAA SWFSC La Jolla)

Females

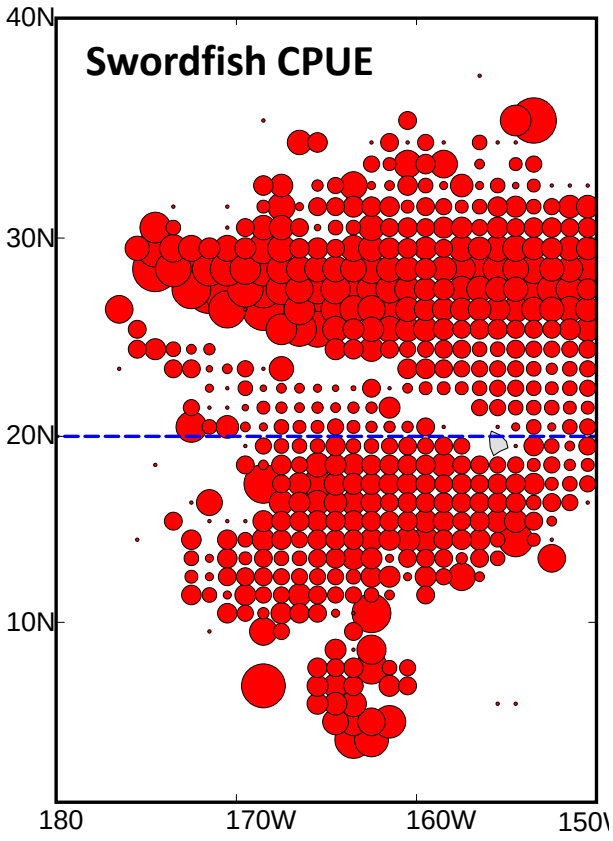


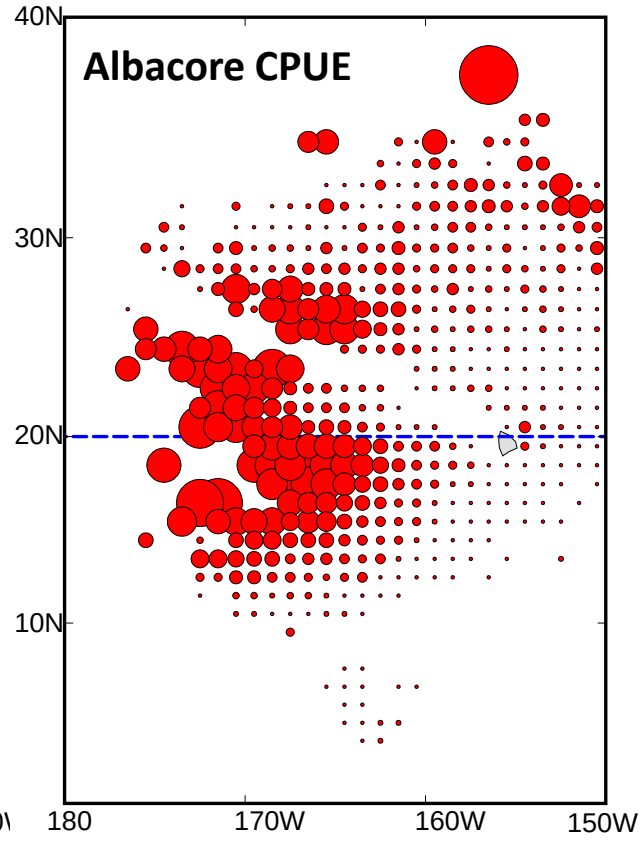
Males



Comparison to Other Northern Stocks

E.g. Hawaii Deep-Set Tuna LL





Nominal CPUE (no per 1,000 hooks)

	North of 20N	South of 20N
Blue shark	1.370	1.380
Swordfish	0.097	0.087
Albacore	0.303	0.477

Conclusions (1)

- BSH may occupy most areas of the North Pacific
- Tropical waters 0-20°N important part of breeding area and post breeding area for females
- CPUE distributions indicate similar CPUE north and south of 20°N for TW and HW deep-set fisheries, higher north of 20°N for Japan research shallow LL

Conclusions (2)

- In the HW deep-set fishery, BSH, SWO and ALB all have significant CPUE distributions south of 20°N
- Commission needs to clarify what is meant by *mostly north of 20îN*

Further Research

Short-medium term

- Further observer-based collection and analysis of BSH catches and biological data
- Spatially structured model for BSH

Longer-term

- Collection and analysis of e-tagging data to estimate spatial patterns of habitat use, particularly in the western Pacific
- Other spatially-explicit models (e.g. SEAPODYM)
- Habitat-based modelling

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