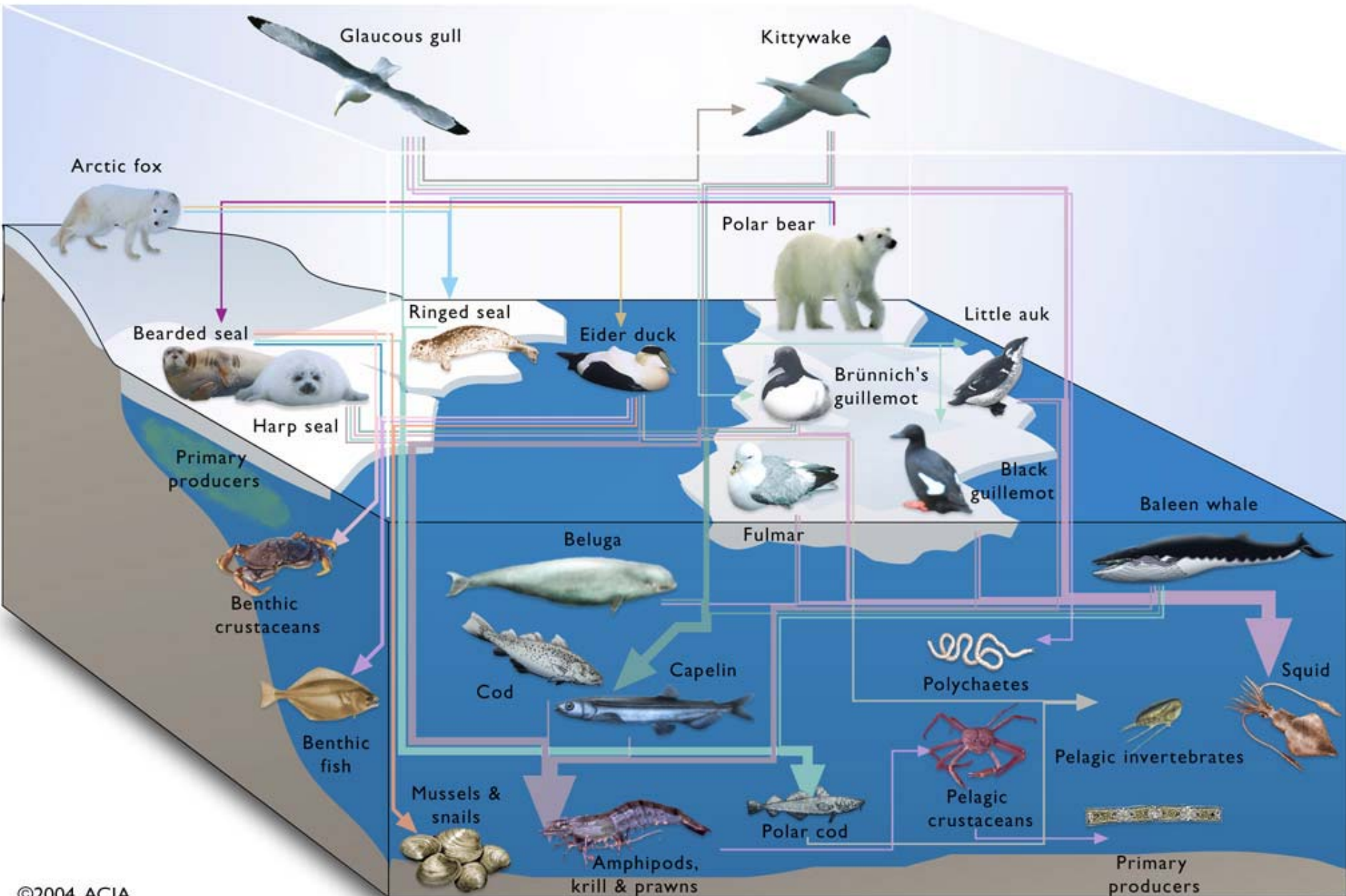


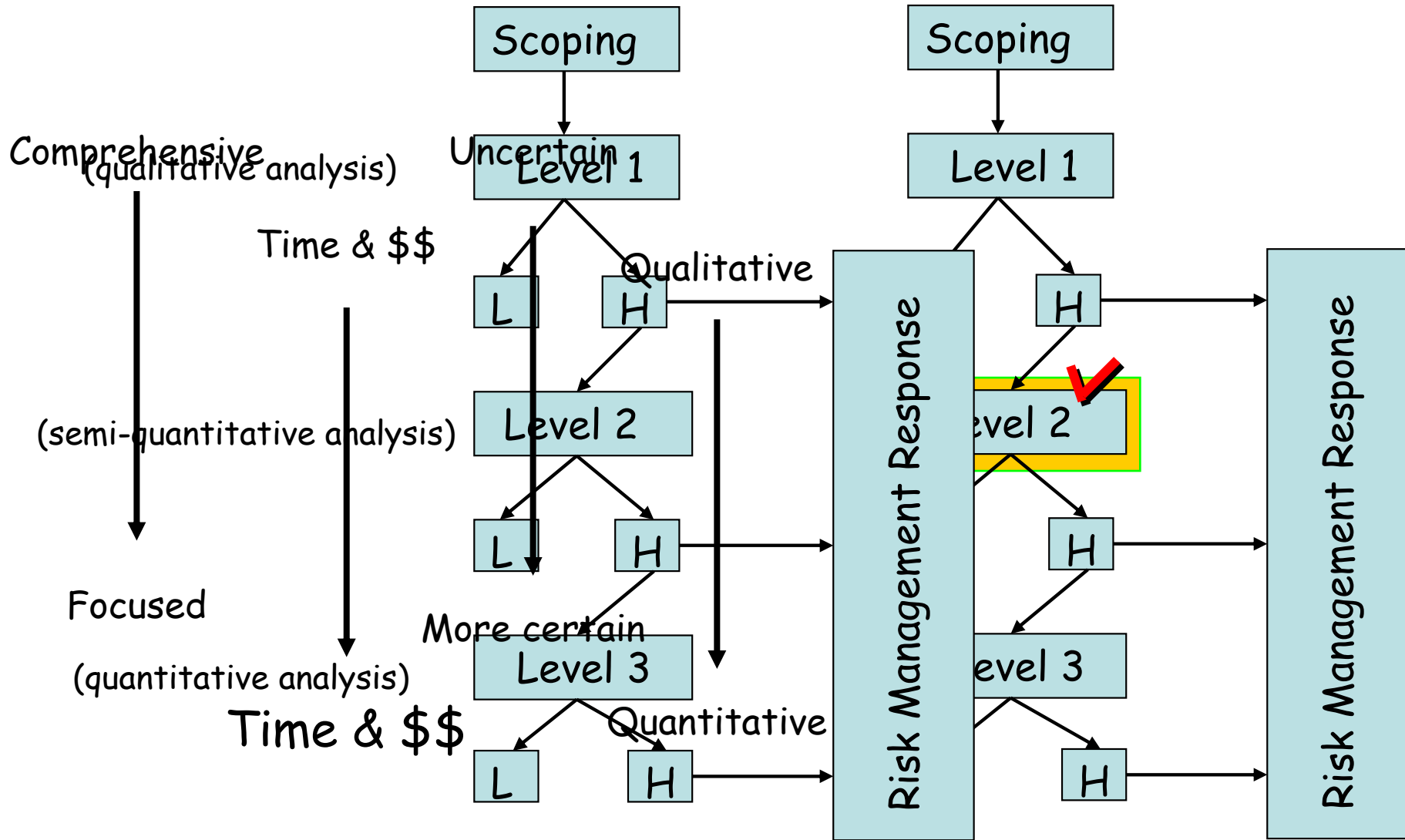
An ecological risk assessment for the effect of the Korean tuna longline fishery in the Western and Central Pacific Ocean

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Ecological risk assessment



(Smith et al, 2007)

Level 2: PSA

(Productivity and Susceptibility Analysis)

$$\frac{dB}{dt} = rB\left(1 - \frac{B}{K}\right) - qEB$$

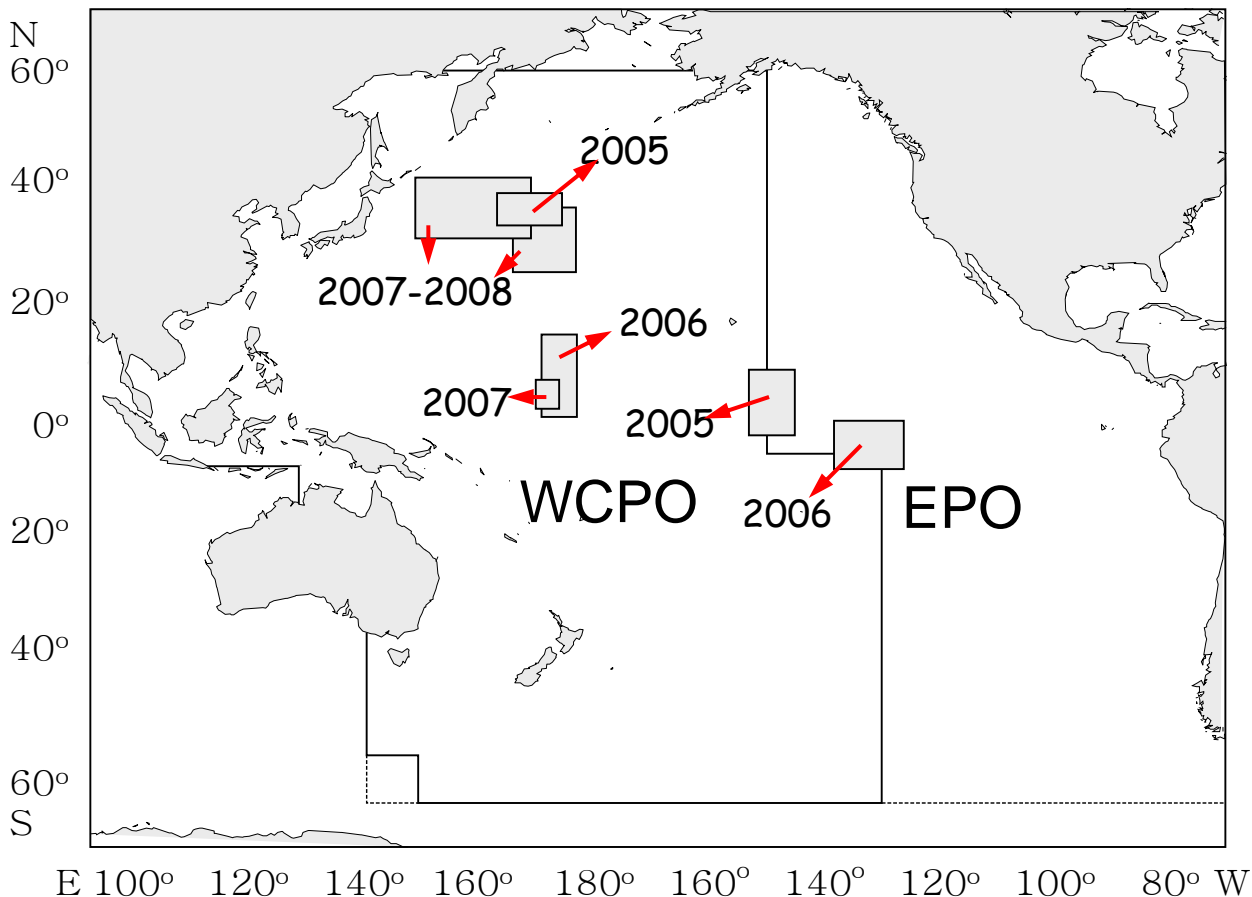
- Productivity, r
 - recovery rate after potential depletion or damage by the fishing activity
- Susceptibility, q
 - extent of the impact due to fishing activity

Purpose

- Assessment on the adverse impacts of the Korean tuna longline fishery in the Western and Central Pacific Ocean
 - target species, non-target species and dependent or associated with the target species
- Precautionary approach for the stock or ecosystem management and conservation
 - identification of non-target species for consideration of future research or management
 - protect biodiversity in the marine environment

Data

Survey area






- Period: 2005-2008
- Area: Western and Central Pacific Ocean
- Source:
 - 20,157 catches in number
 - 48 species
- Collected data by 7 scientific observers from NFRDI in Korea





NFRDI
National Fisheries Research & Development Institute

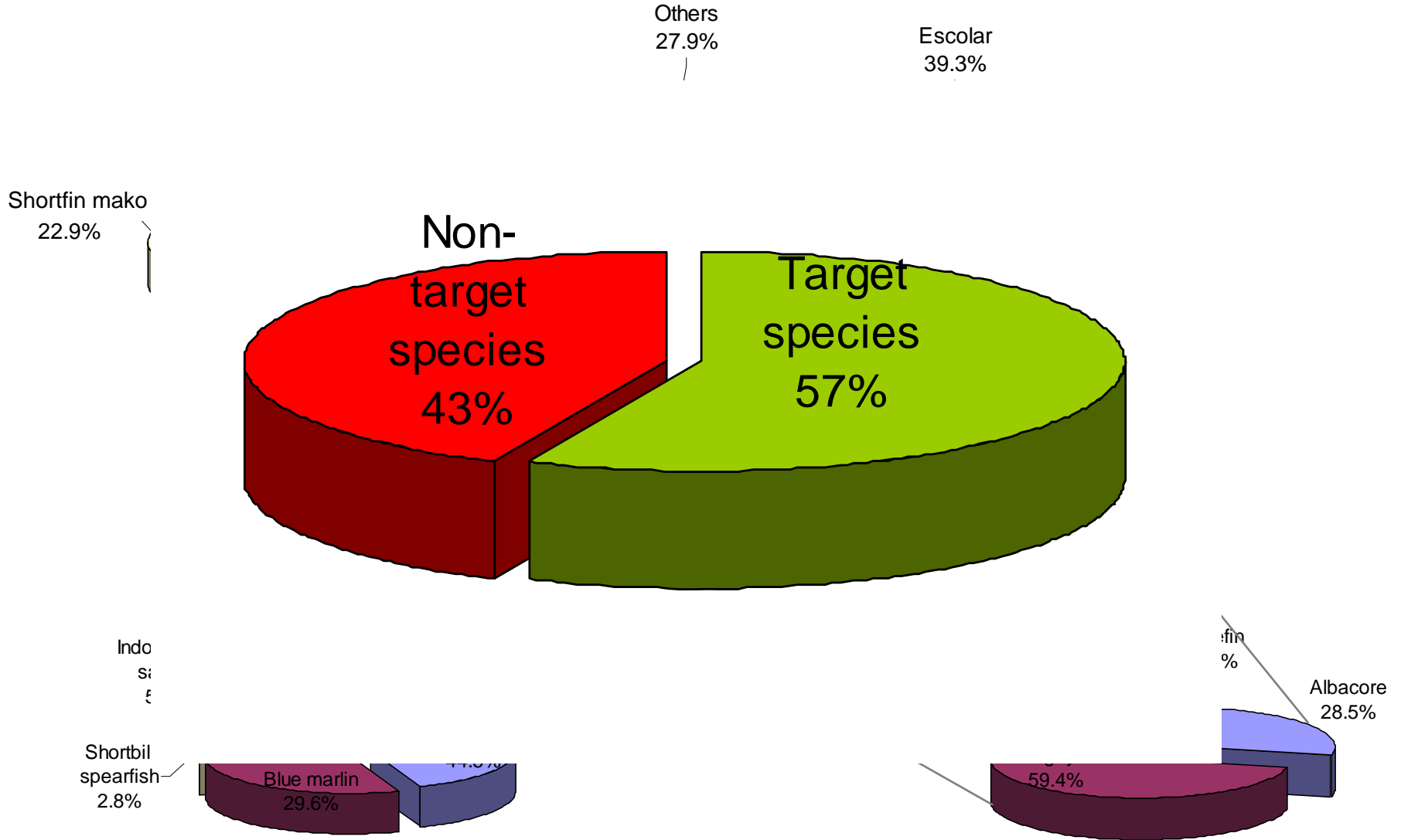
Species

Group	English name	Scientific name
 <p>Tunas (5)</p>	Albacore	<i>Thunnus alalunga</i>
	Bigeye tuna	<i>Thunnus obesus</i>
	Yellowfin tuna	<i>Thunnus albacares</i>
	Skipjack tuna	<i>Katsuwonus pelamis</i>
	Bluefin tuna	<i>Thunnus thynnus</i>
 <p>Billfishes (6)</p>	Swordfish	<i>Xiphias gladius</i>
	Shortbill spearfish	<i>Tetrapturus angustirostris</i>
	Blue marlin	<i>Makaira mazara</i>
	Indo-Pacific sailfish	<i>Istiophorus platypterus</i>
	Striped marlin	<i>Tetrapturus audax</i>
 <p>Sharks (13)</p>	Black marlin	<i>Makaira indica</i>
	Bigeye thresher shark	<i>Alopias superciliosus</i>
	Blue shark	<i>Prionace glauca</i>
	Galapagos shark	<i>Carcharhinus galapagensis</i>
	Longfin mako	<i>Isurus paucus</i>
	Shortfin mako	<i>Isurus oxyrinchus</i>
	Oceanic whitetip shark	<i>Carcharhinus longimanus</i>
	Grey reef shark	<i>Carcharhinus amblyrhynchos</i>
	Smooth hammerhead	<i>Sphyrna zygaena</i>
	Crocodile shark	<i>Pseudocarcharias kamoharai</i>
	Scalloped hammerhead shark	<i>Sphyrna lewini</i>
	Japanese velvet dogfish	<i>Zameus ichiharai</i>
	Salmon shark	<i>Lamna ditropis</i>
Silky shark	<i>Carcharhinus falciformis</i>	

Species

Group	English name	Scientific name
Turtles (3) 	Green sea turtle	<i>Chelonia mydas</i>
	Loggerhead sea turtle	<i>Caretta caretta</i>
	Olive ridley sea turtle	<i>Lepidochelys olivacea</i>
Other species (21) 	Sickle pomfret	<i>Taractichthys steindachneri</i>
	Black pomfret	<i>Taractes rubescens</i>
	Escolar	<i>Lepidocybium flavobrunneum</i>
	Snake mackerel	<i>Gempylus serpens</i>
	Wahoo	<i>Acanthocybium solandri</i>
	Longnose lancetfish	<i>Alepisaurus ferox</i>
	Pelagic stingray	<i>Dasyatis violacea</i>
	Ocean sunfish	<i>Mola mola</i>
	Great barracuda	<i>Sphyraena barracuda</i>
	Opah	<i>Lampris guttatus</i>
	Dolphinfish	<i>Coryphaena hippurus</i>
	Sharptail mola	<i>Masturus lanceolatus</i>
	Manta ray	<i>Mobula japonica</i>
	Oilfish	<i>Ruvettus pretiosus</i>
	Rainbow runner	<i>Elagatis bipinnulata</i>
	Slender sunfish	<i>Ranzania laevis</i>
	Suck fish	<i>Remora remora</i>
Flyingfish	<i>Prognichthys gibbifrons</i>	
Crested oarfish	<i>Lophotus lacepede</i>	
Razorback scabbardfish	<i>Assurger anzac</i>	
Shortnose lancetfish	<i>Alepisaurus brevirostris</i>	

Species composition catch in weight



Proportion of captured species (weight) by 7 scientific observations from 2005 to 2008

Indicators for species components (Target, By-catch, Protected species)

Productivity attributes

- Maximum age
- Age at maturity
- Size at maturity
- Annual fecundity
- Maximum size
- Reproductive strategy
- Trophic level

Susceptibility attributes

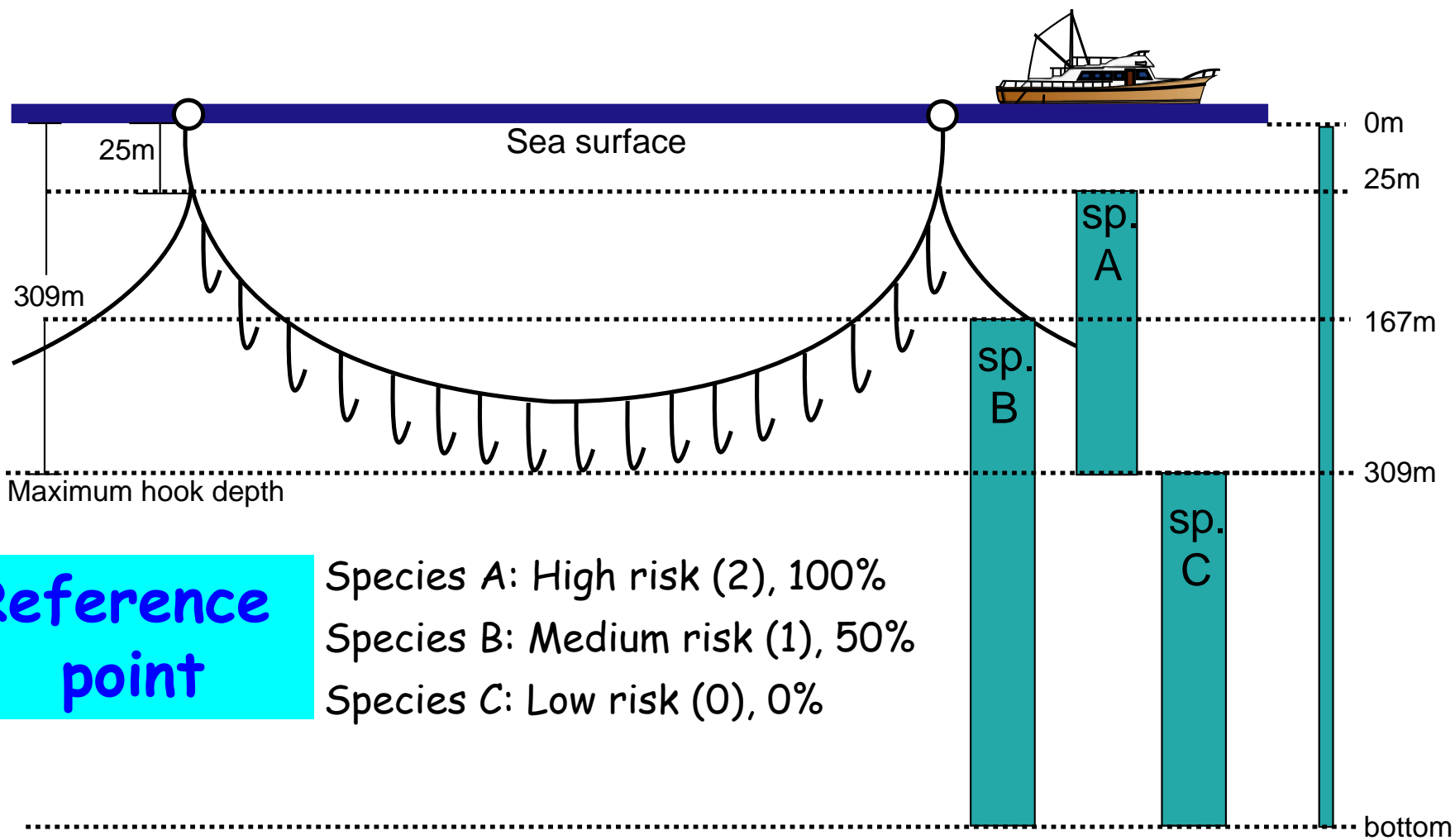
- Overlap with fishing effort
- Global distribution
- Adult habitat overlap with juvenile
- Selectivity
- Post-capture mortality

Attribute

Susceptibility

Indicator

Overlap with fishing effort



Reference point

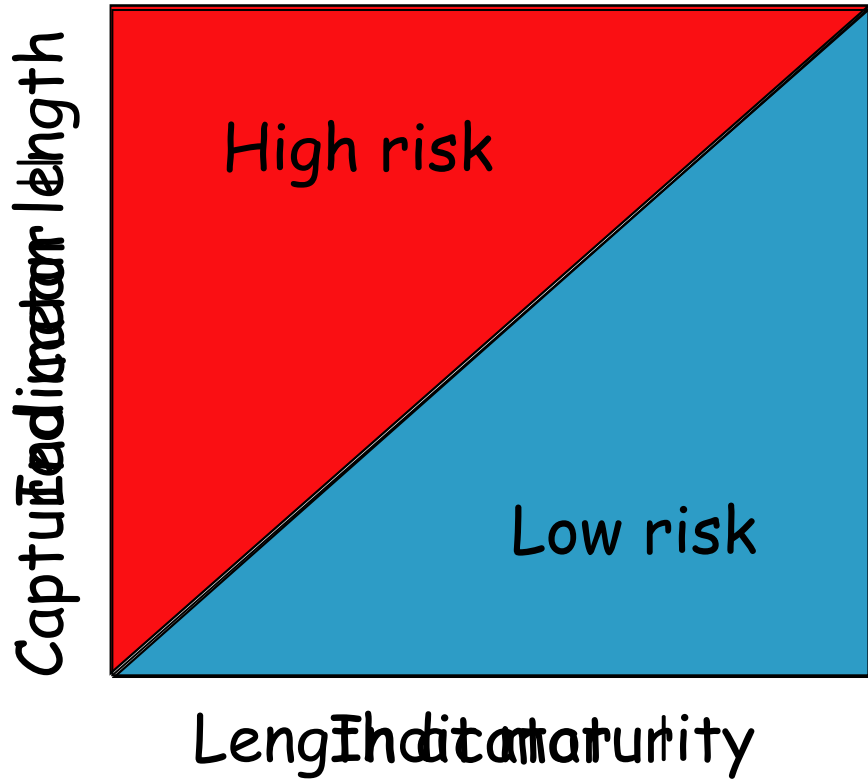
Attributes

(CSIRO, 2005)

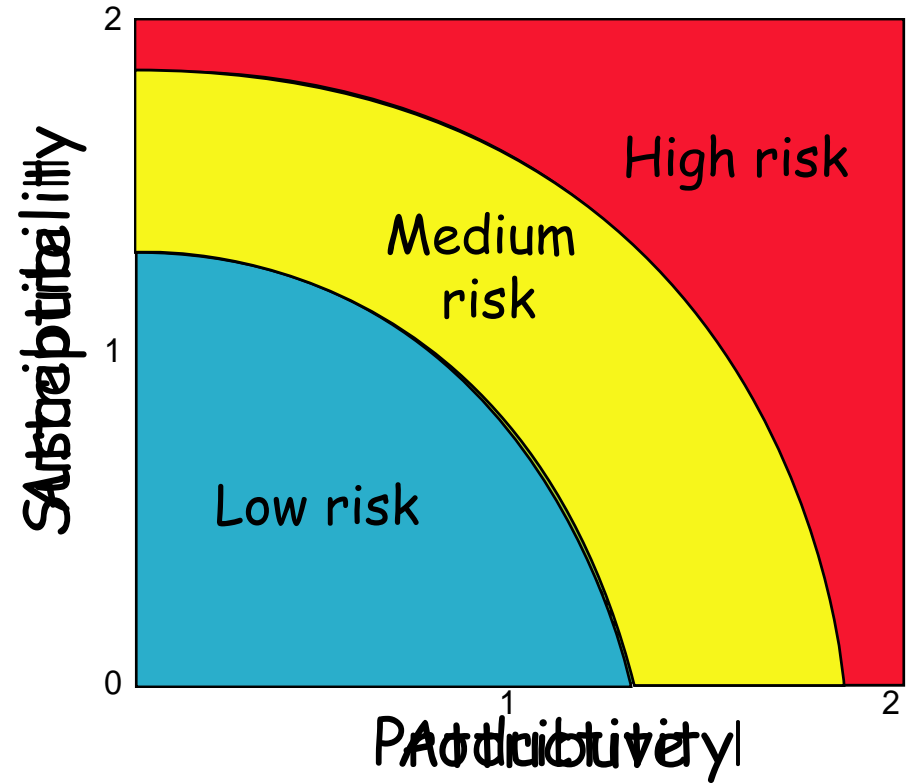
Attributes	Indicators	Reference points		
		Low (0)	Medium (1)	High (2)
Productivity	Maximum age (year)	< 10	10 - 25	25 <
	Age at maturity (year)	< 5	5 - 10	10 <
	Size at maturity (cm)	< 40	40 - 200	200 <
	Maximum size (cm)	< 100	100 - 300	300 <
	Reproductive strategy	Broadcast spawners	Demersal spawners	Live bearer
	Trophic level	< 2.75	2.75 - 3.25	3.25 <
Susceptibility	Overlap with fishing effort (m)	309 <	167 <	25 - 309
	Global distribution	Worldwide	Hemisphere	Locality
	Adult habitat overlap with juvenile	Low rate	Medium rate	High rate
	Selectivity	No selectivity for longline fishery		
	Post-capture mortality	Alive	Barely alive	Dead

Ecosystem risk assessment

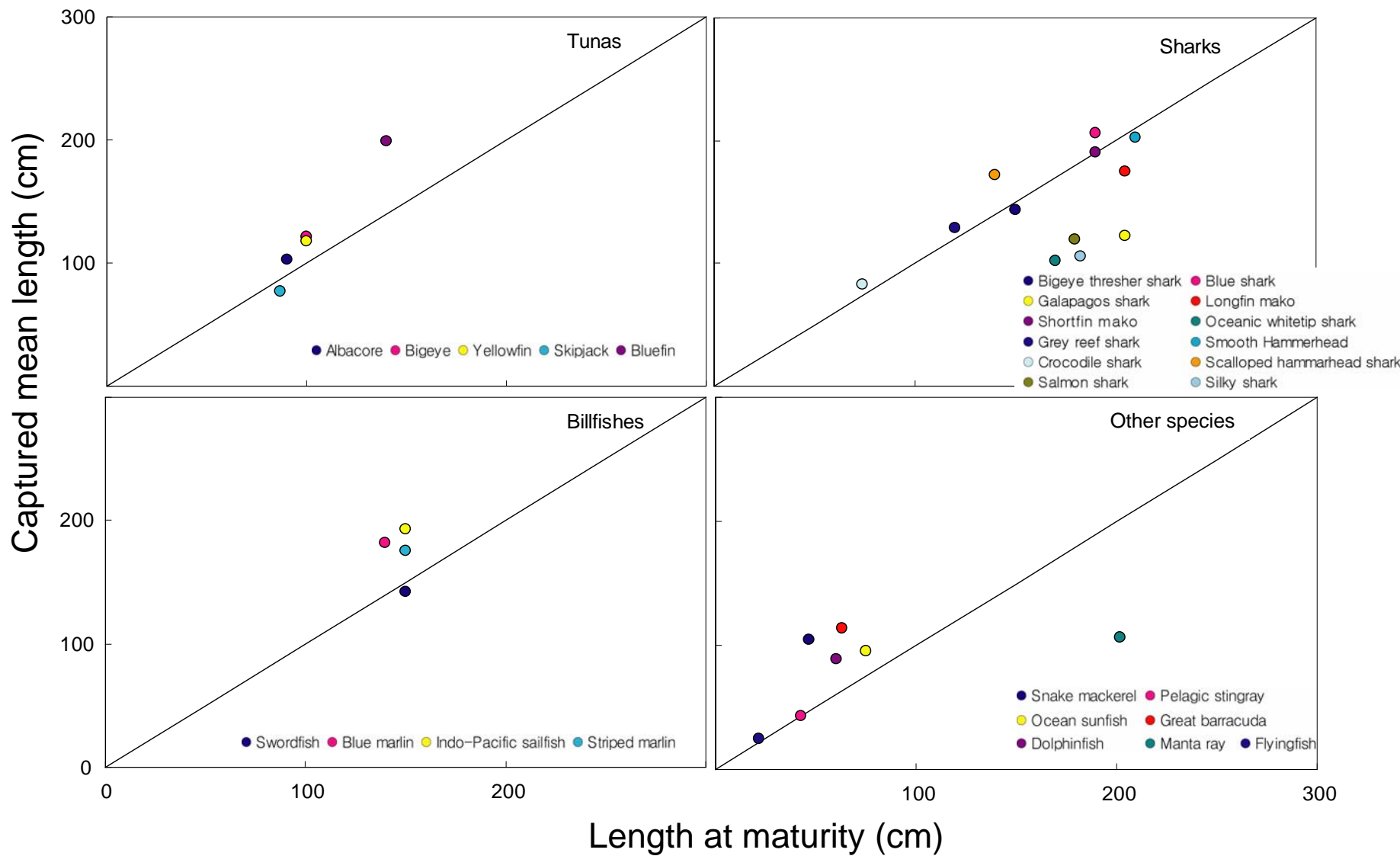
Type I



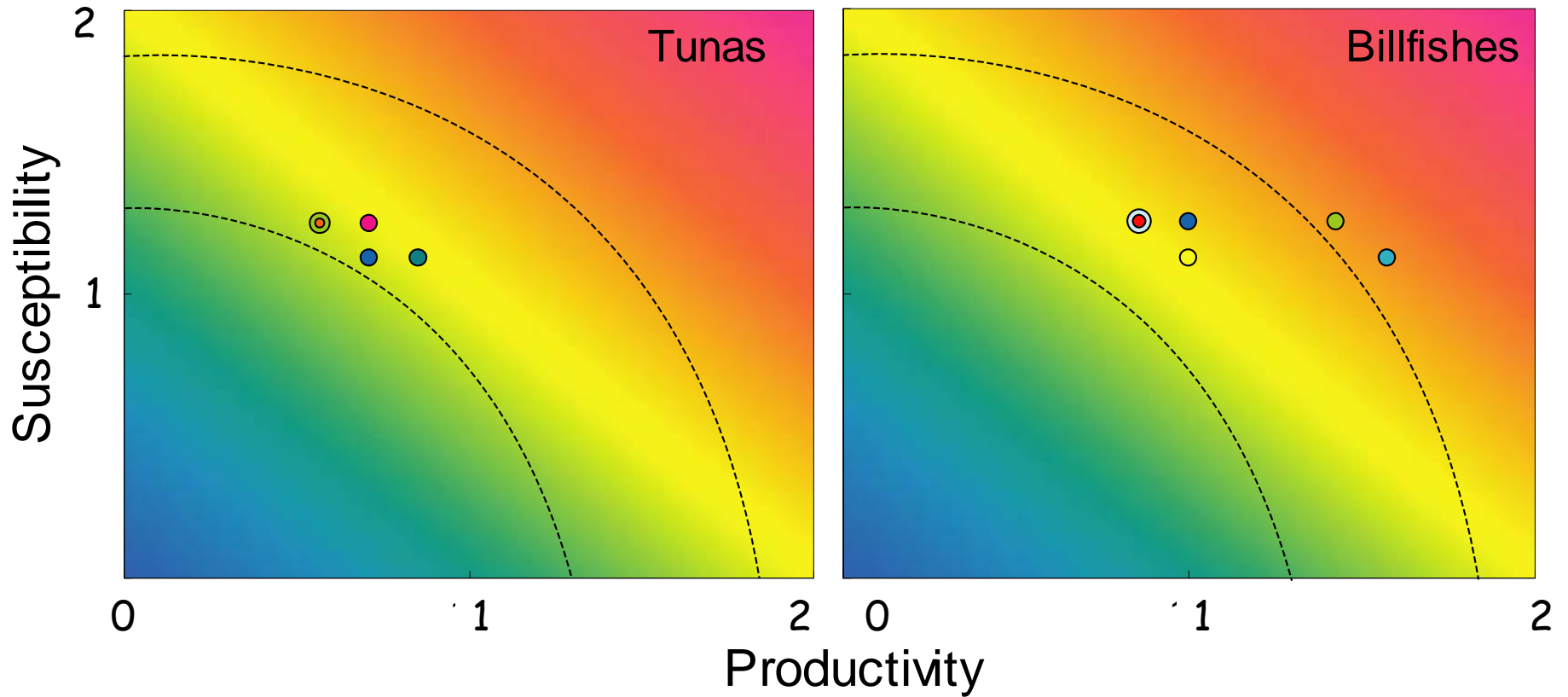
Type II



Type I



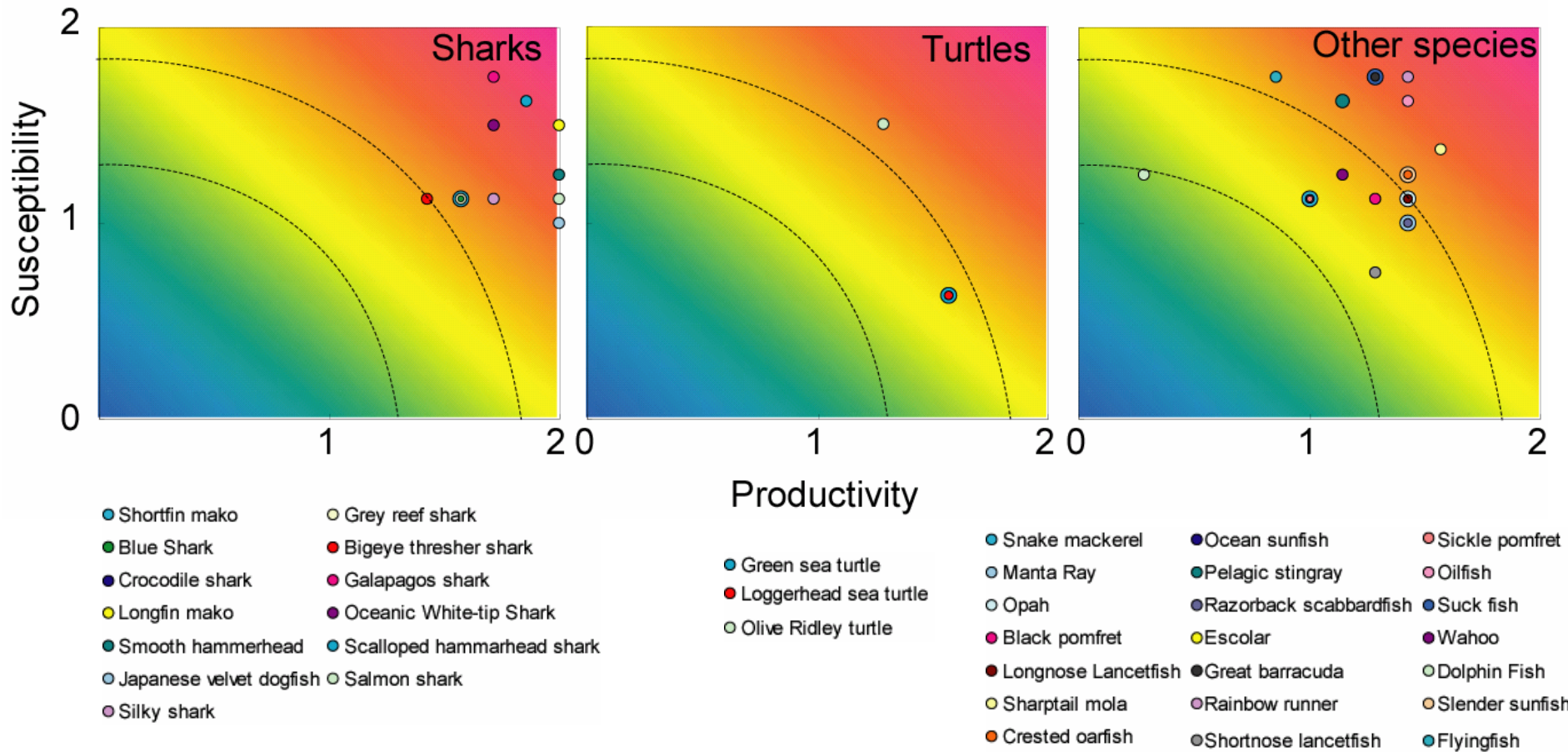
Type II



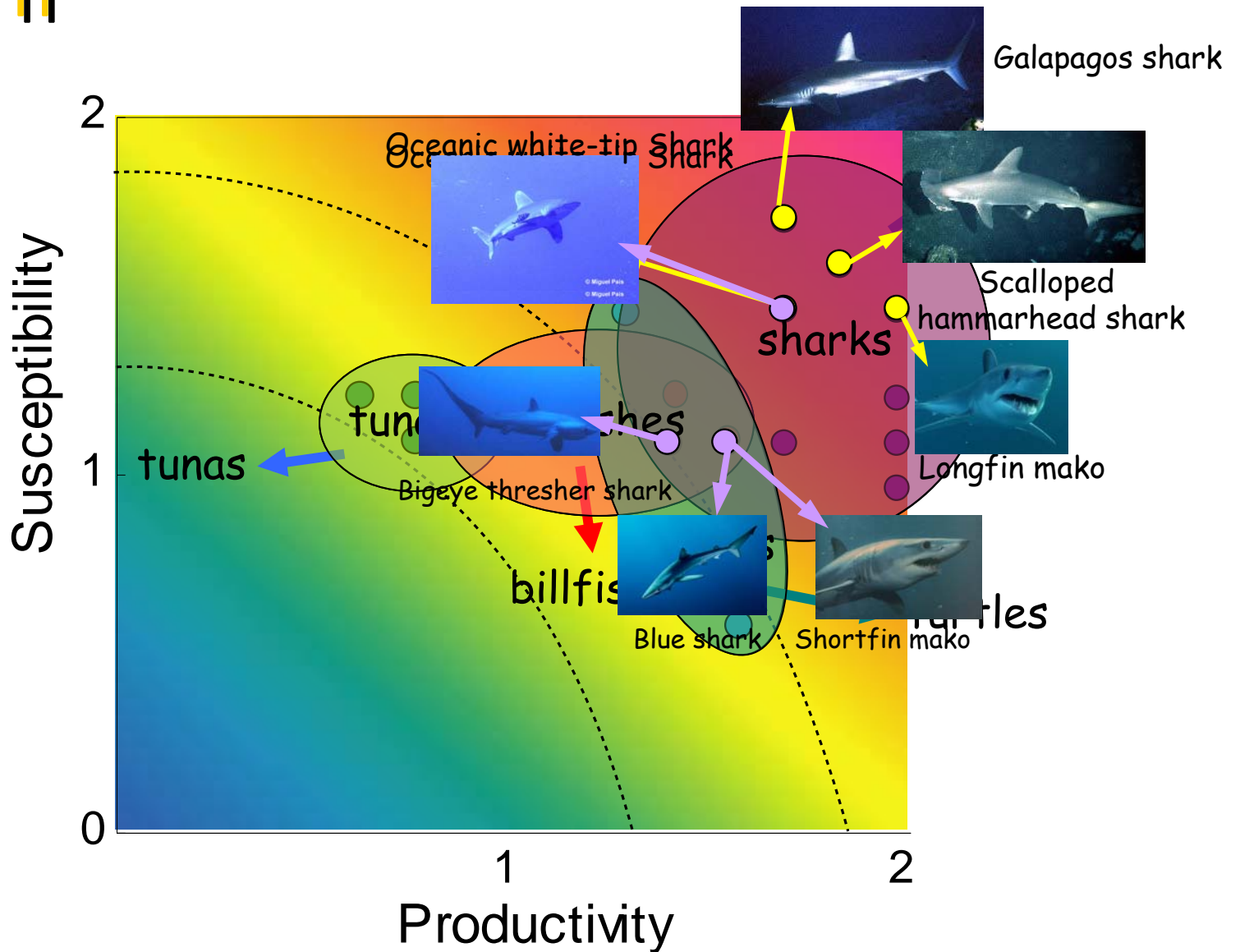
- Albacore
- Bigeye Tuna
- Yellowfin Tuna
- Skipjack Tuna
- Bluefin

- Swordfish
- Shortbill spearfish
- Blue Marlin
- Indo-Pacific sailfish
- Striped marlin
- Black Marlin

Type II



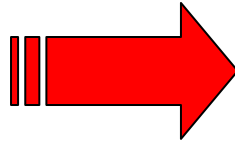
Type II



Conclusion

WCPFC

- Blue shark
- Oceanic white-tip shark
- Shortfin mako
- Thresher shark



This study

- Galapagos shark
- Longfin mako
- Scalloped hammerhead shark
- Oceanic white-tip shark

Conclusion

- For reducing non-target species
 - I. Development and improvement of long-term data collection, monitoring and research programmes
 - II. Enhancement and development of methodology
 - more robust assessment
 - III. Identification of captured non-target species by other tuna fisheries such as purse seine or pole-and-line
- Provide wider scientific advices to the policy makers and stakeholders