



Fish of the Duiwenhoks









Duiwenhoks Estuary fish assemblage 45+ species



Ia Resident breeders 4



Ib Marine & estuarine breeders 7



IIa Obligate dependents 10



IIb Partial dependents 5



IIc Marine opportunists 4



III Marine vagrants 6



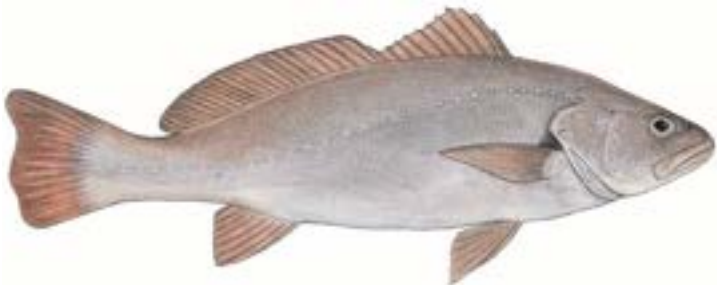
IV Freshwater 7



Va Catadromous 3

Duiwenhoks Estuary fish instream distribution

Dependence category		Salinity‰	>30	20-30	10-20	<10
Ia	Resident breeders		7	3	8	81
Ib	Marine & estuarine breeders		9	16	37	38
IIa	Obligate dependents		2	2	11	85
IIb	Partial dependents		25	19	23	32
IIc	Marine opportunists		79	13	6	2
III	Marine vagrants		97			3
IV	Freshwater					100
V	Catadromous					100



Fish health score



VARIABLE	SUMMARY OF CHANGE	SCORE	CONF
1. Species richness	4 alien / translocated freshwater species in the estuary. Range expansion of checked goby <i>Redigobius dewaali</i> into the southwestern Cape including Duiwenhoks (climate-change related).	89	M
2. Abundance	↑abundance (~30%) and diversity of small bodied species and juvenile fish but a drastic (nationwide) ↓ (60%-95 %) in abundance of large exploited species.	70	M
3. Community composition	REI fish confined to upper reaches for most of the time. ↑abundance of small-bodied filter, particulate, detrital & benthic diatom feeders but ↓ in the influence of large piscivorous predators – upper trophic levels depleted by overfishing throughout the coast.	70	M
Fish health score		70	M
% of impact non-flow related		60	M

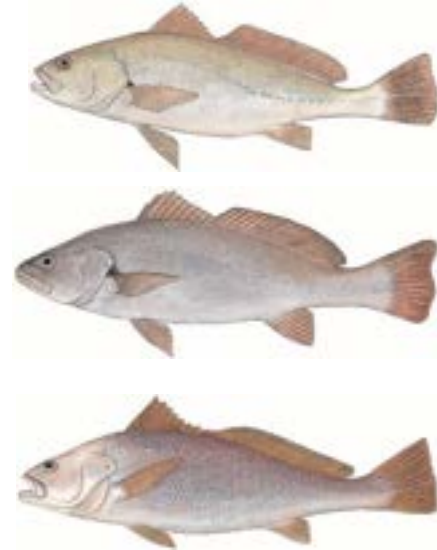
Recent kob-related research

- ◆ Sound & soniferous fish
- ◆ Acoustic telemetry
- ◆ Recreational, small-scale fisheries monitoring & analysis
- ◆ Altered freshwater flows: response of estuarine & marine fish
- ◆ Kob effective population size
- ◆ Kob hybridization



South African kob *Argyrosomus* species

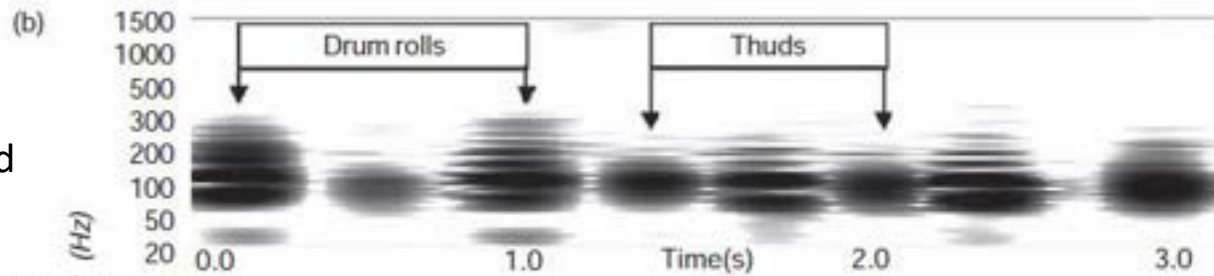
- ◆ Dusky kob: South Africa, False Bay to Kosi to ~~Australia~~
Status: SBPR < 1 - 3% critical
- ◆ Silver kob: Namibia, South Africa to southern Transkei
Status: SBPR < 12% collapsed
- ◆ Squaretail kob Xai-Xai Mozambique to Port Elizabeth
Status: SBPR 17% - collapsed
- ◆ West Coast dusky kob, Congo, Angola, Namibia, St Helena Bay
Status: Unknown, climate related distributional shift (Potts et al. 2015)



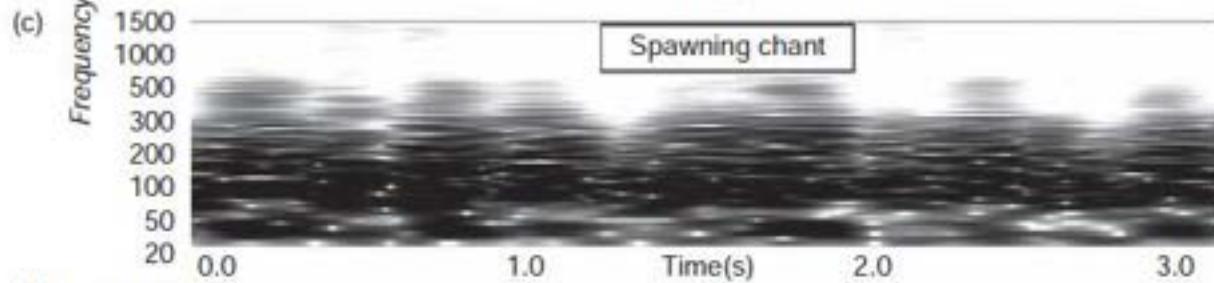
Courtship



Spawning initiated



Spawning



Hydrodynamic boom



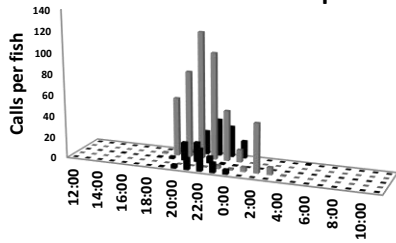
After Albers & Drawbridge 2008

Shouting above the crowd: altered calling behaviour of soniferous fish by social events in a public aquarium.

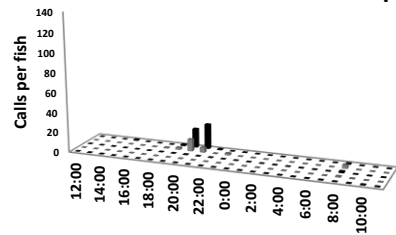
Alexa Simone Prinsloo, Deena Pillay and Stephen Lamberth



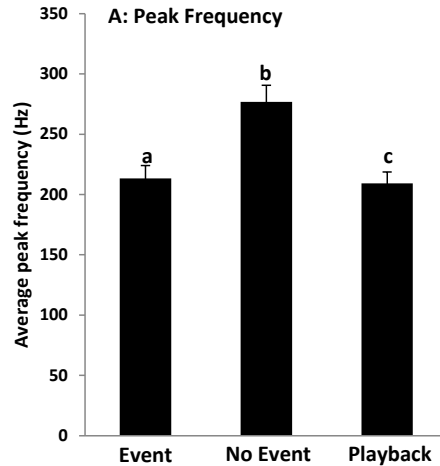
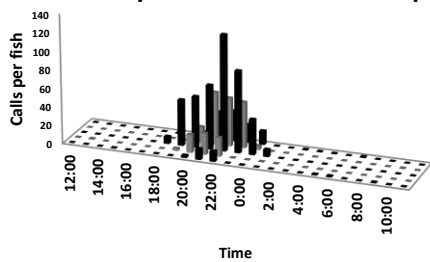
Event: 63 calls per fish



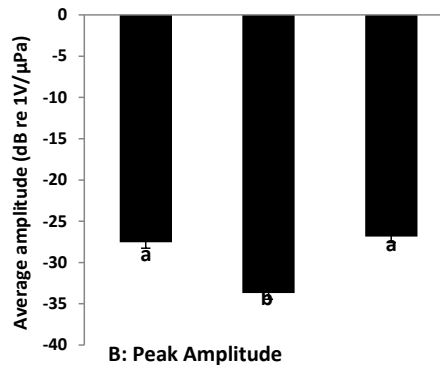
No event: 31 calls per fish



Playback: 242 calls per fish



Peak frequencies greater on quiet nights



Amplitude greater on noisy nights

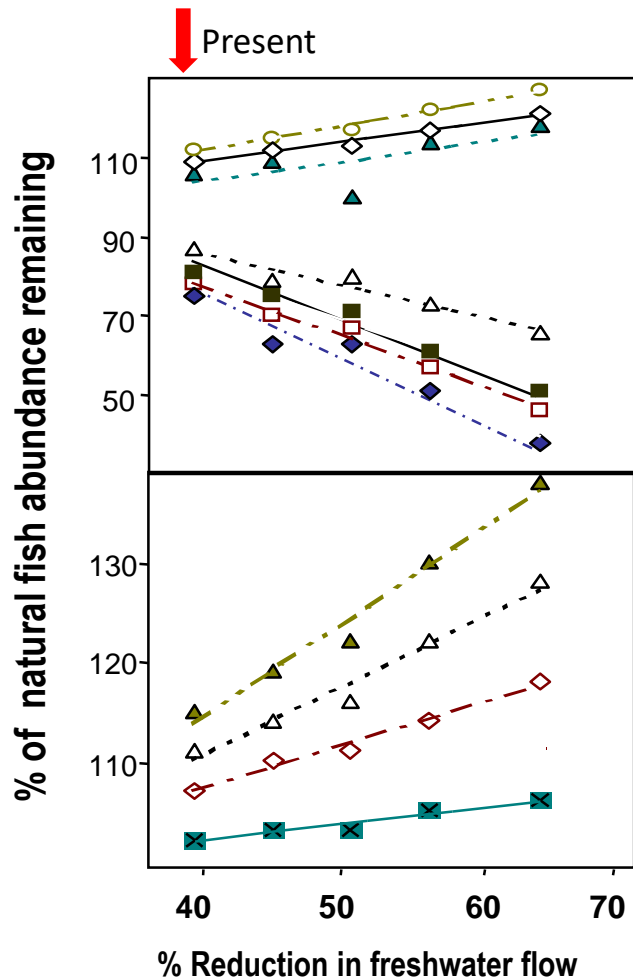
Kob call louder and longer to overcome the masking effects of anthropogenic sound
Longer recovery time suggests distress and a greater energetic cost which could inhibit growth

Angler compliance with bag & size limits:

Species	Size limit (TL mm)	% undersized	Bag limit	% exceeded
Dassie	200	1.8	5	1.9
Bronze bream	300	14.4	2	11.9
Stone bream	-	-	5	0.5
Wildeperd	300	28.4	5	0.3
Spotted grunter	400	25.9	5	5.6
Elf	300	6.9	4	28.3
Dusky kob	600	40.7	1	27.3

 Effectively “Open access”!

Freshwater flow response



Obligate estuarine dependents

- Dusky kob
- Leervis
- ▲ White steenbras
- ◆ Cape moony
- Flathead mullet
- △ Spotted grunter
- ◇ Cape stumprnose

These fish have to spend the first year of life in estuaries



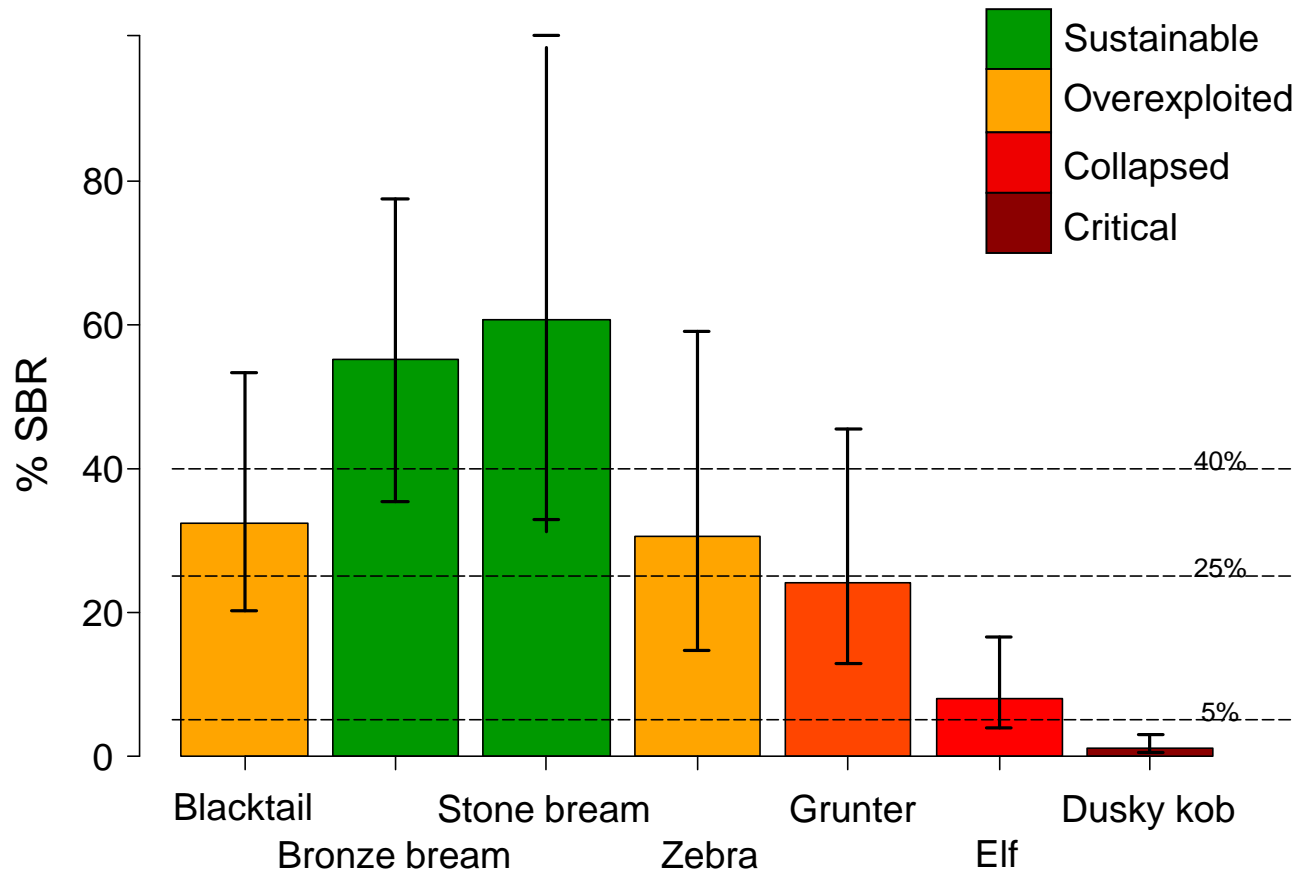
Marine opportunists

- ▲ Dasse
- Harder mullet
- ◆ Elf
- △ White stumprnose

These fish follow optimum conditions between estuaries & sea

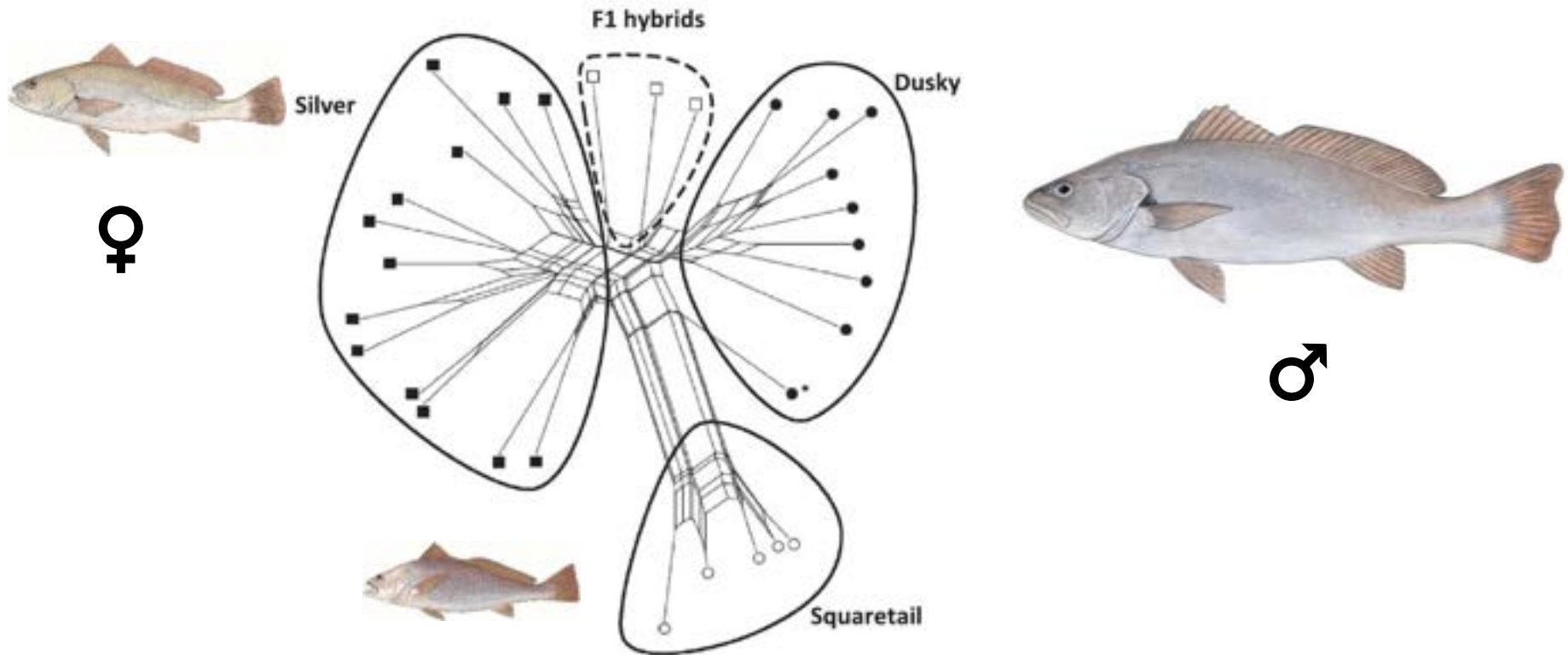
Dependence categories after Whitfield (1994)

Stock status for each species based on percentage spawner biomass (% SBR) of unfished levels. The error bars denote 95% confidence intervals derived from Monte-Carlo simulations. After Winker *et al.* 2015.



Genetics:

- ◆ Life-history bottlenecks: anomalous droughts & floods, changes in fishing effort
- ◆ Effective population size (successful breeders): < 500 in most years < 50 on South Coast
- ◆ Hybridization between large dusky males and silver kob females, viable hybrids not mules



Future options for dusky kob



In the absence of a moratorium on catches:

- ◆ There should be a slot limit prohibiting the retention and / or landing of all kob *Argyrosomus* species under 50cm (TL) and over 110 cm (TL), all fisheries.
 - ◆ Shore & estuarine bag limits to the east of Cape Agulhas remain the same.
 - ◆ All boat & shore & estuarine bag-limits to the west of Agulhas be adjusted down.
 - ◆ Breede night-fishing prohibition be extended to all estuaries countrywide.
 - ◆ Dusky kob placed on the no-sale list.
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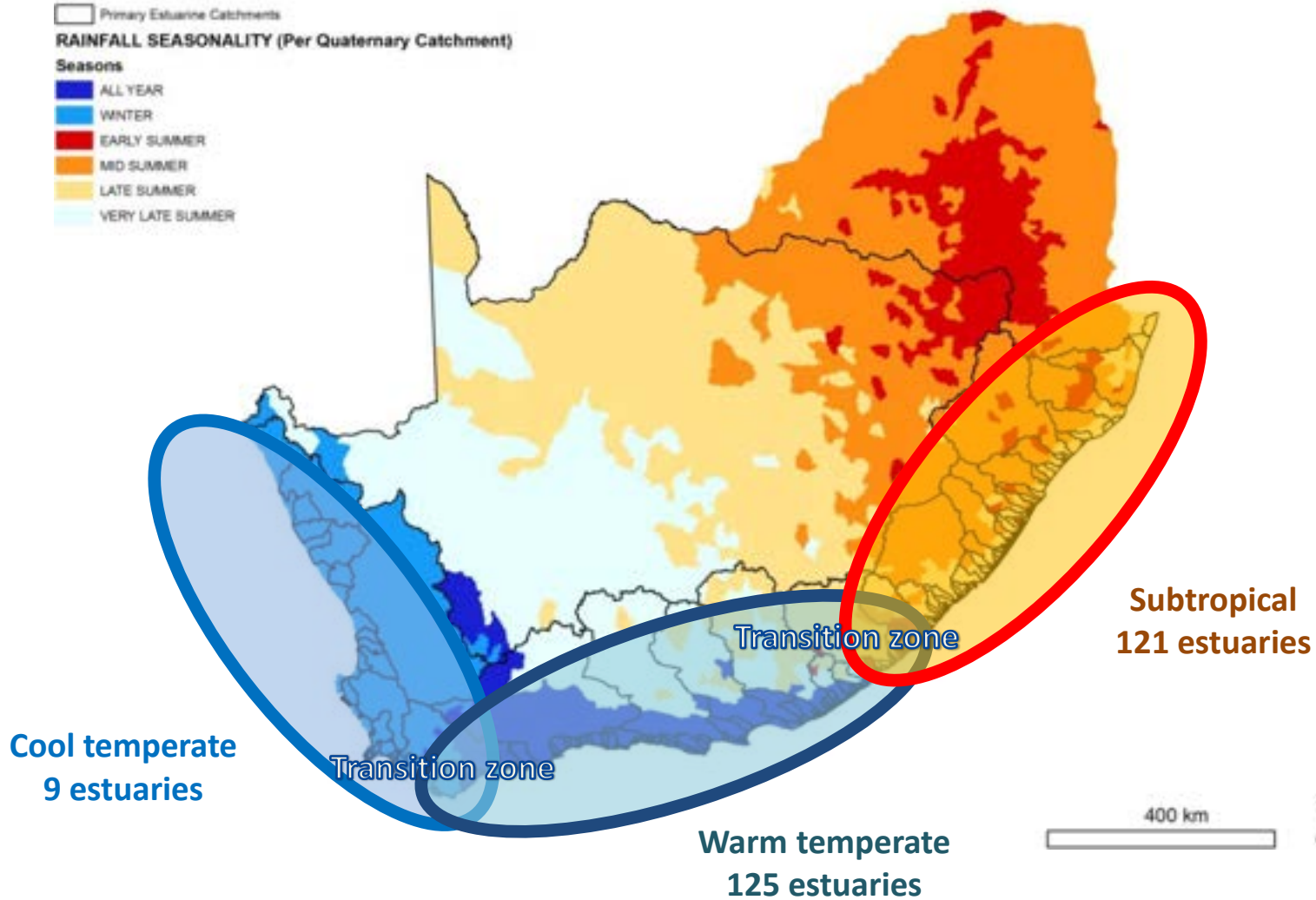
Legend

□ Primary Estuarine Catchments

RAINFALL SEASONALITY (Per Quaternary Catchment)

Seasons

- ALL YEAR
- WINTER
- EARLY SUMMER
- MID SUMMER
- LATE SUMMER
- VERY LATE SUMMER



There's a need for measuring climate change responses of estuarine fish and fisheries

- Over last 20 years more than 40 range extensions of tropical fish into estuaries in the warm/cool temperate transition zone
- Estuary-dependent species have persisted, some establishing new breeding populations
- Both estuary-dependent & marine tropical species overwintering in estuaries
- Fish with specialist niche requirements (e.g. estuary-dependence) are more susceptible to change than opportunistic generalists
- Fish populations under intense exploitation more susceptible to change than those under low fishing pressure



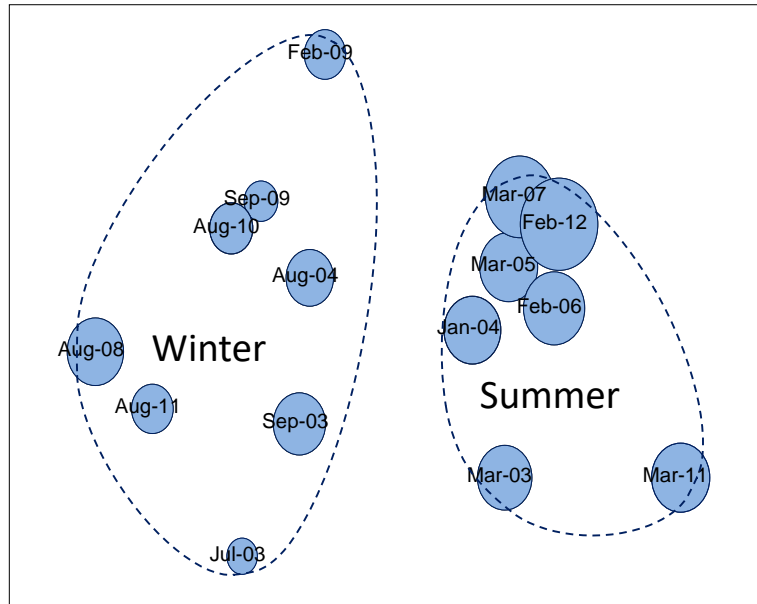
- Small-scale fisheries' resilience rests in their ability to move
- Distributional changes not compatible with SA government's shift towards local-level fisheries management
- Spatial planning in fisheries will become more important in the future
- Understanding of physiological responses crucial
- Understanding of movement & migration of fish and fisheries will be crucial



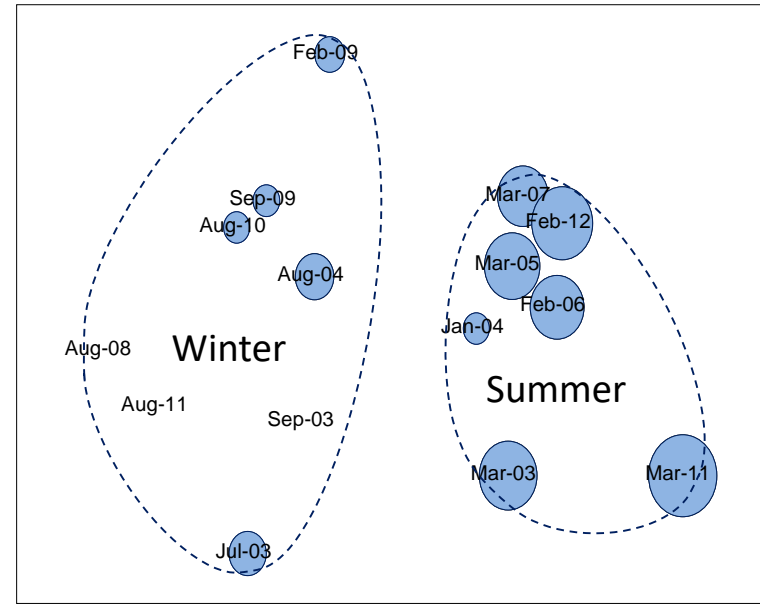
Tropical and subtropical fish overwintering in South Coast estuaries



Tropical estuarine species



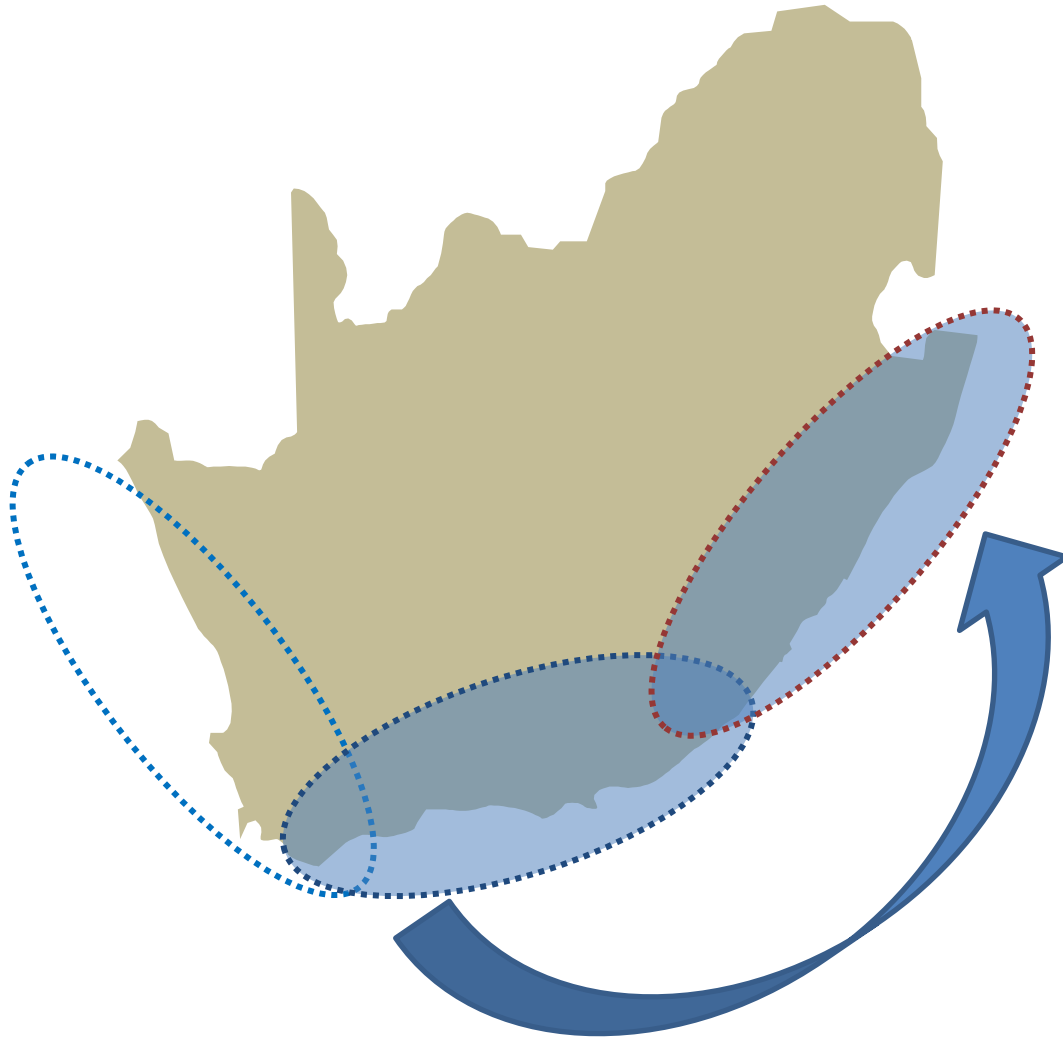
Tropical marine species



After Lamberth, James, Van Niekerk & Whitfield 2012

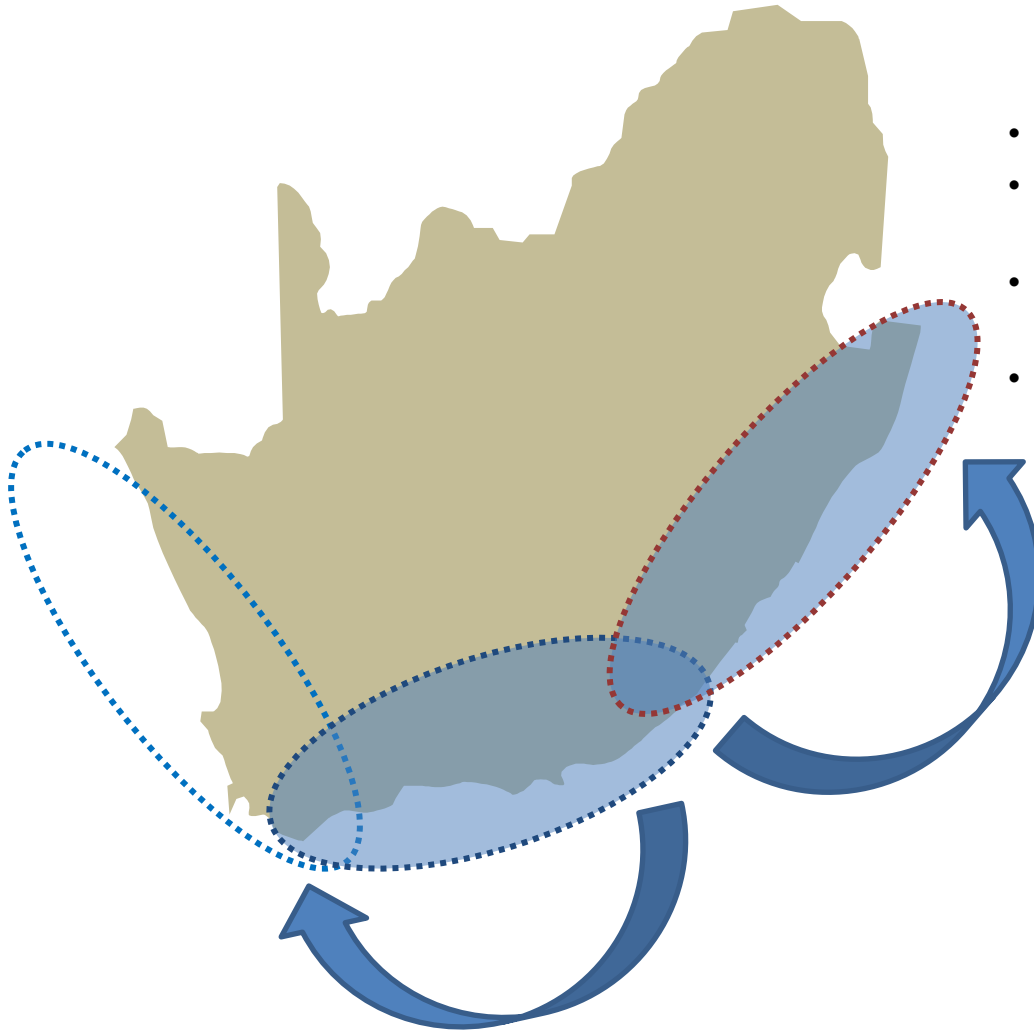


Spotted grunter *Pomadasys commersonnii*

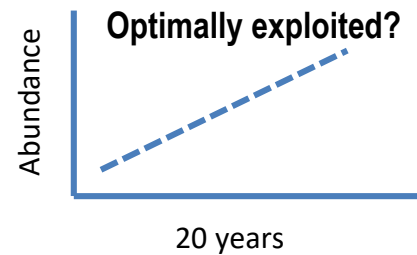
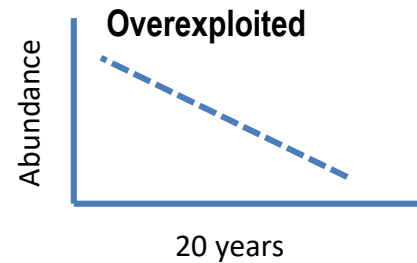


- Tropical, warm temperate, West Indian Ocean
 - No genetic differentiation and high connectivity between South African population /s (Klopper 2005)
 - An important subsistence and recreational species
 - Spawns at sea
 - Estuary-dependent for 1st year of life
 - Annual “spawning migration” to east coast subtropical waters
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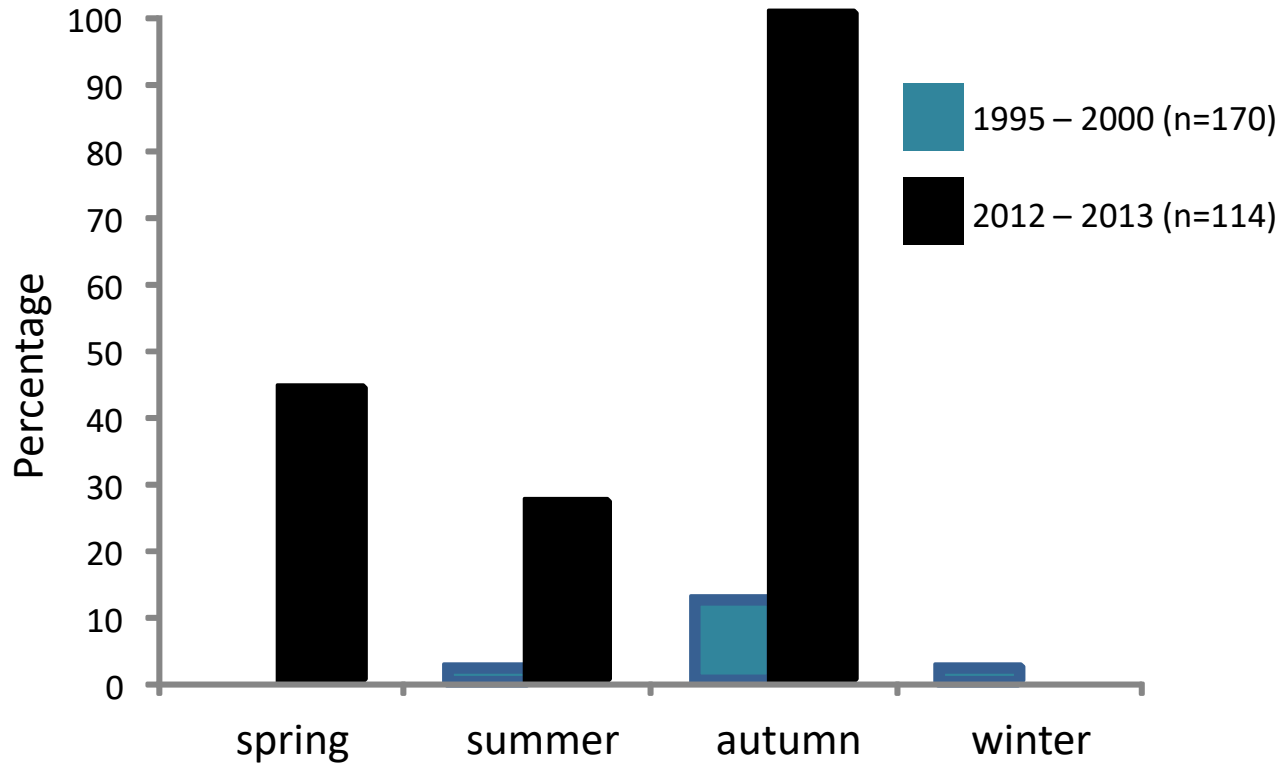
Spotted grunter *Pomadasys commersonnii*



- Evidence for stock separation?
- Has increased in abundance to the south of its range, declined to the north
- Has gone from 1% to 60% of catch in south coast estuaries over last 40 years
- Over last 15 years has established a non-migratory breeding population in the cool/warm temperate transition zone?



Reproductively active fish



Recap and inferences



- Spotted grunter are overwintering in the Duiwenhoks & Breede
- There's recently established resident non-migratory grunter population/s on the south coast
- Also a small residual group of migratory fish
- Resident grunter peak spawning period is Autumn vs Spring in parent range
- **Next:**
- Population / stock delineation of spotted grunter using regional differences in otolith (ear stone) shape, genetics and dialect