The value of "standards" driven Environmental Impact Assessments for the advancement of biodiversity knowledge in the Republic of Congo

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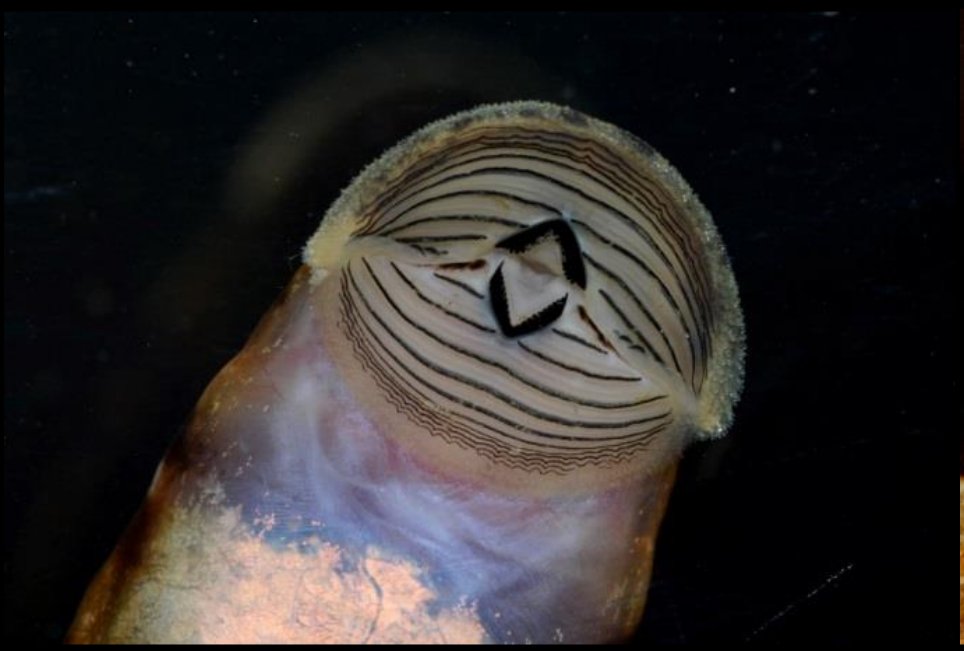
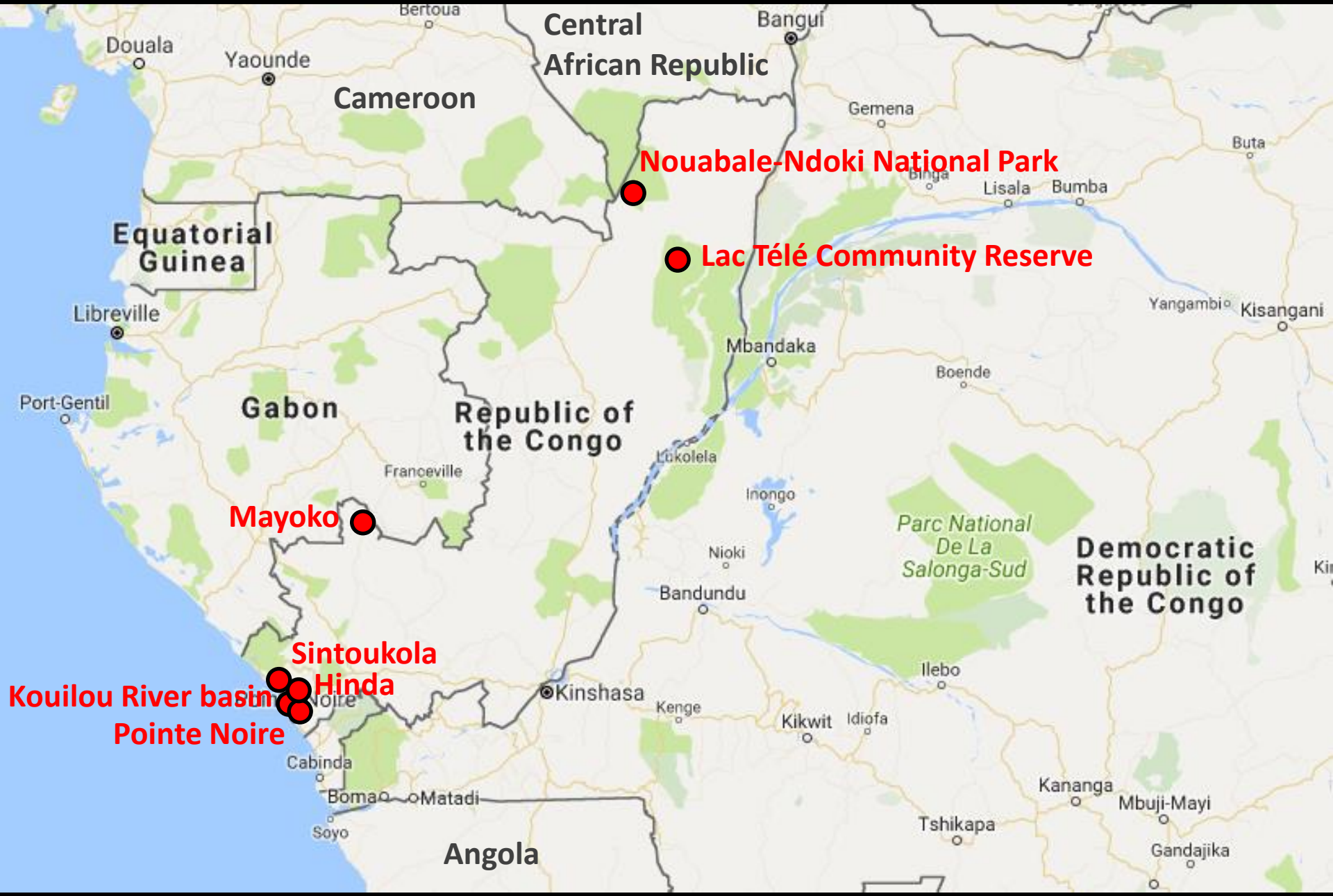
The value of "standards" driven Environmental Impact Assessments for the advancement of biodiversity knowledge in the Republic of Congo

Marius Burger[1,2], Ange G. Zassi-Boulou[3], Valdie Boukaka[3], Gerard Kabafouako[3], Victor Mamonekene[3], Edmond S. Miabangana[3], Cesar Ngoulou[3], Gilbert Nsongola[3], Michiel Jonker[2], Lukas Niemand[2], Ben Orban[2], Gina Walsh[2,4], Jerome Gaugris[2,5], Alan Channing[1] and Mark-Oliver Rödel[6]

FLORA FAUNA & MAN, Ecological Services Ltd. (FFMES)

- Thanking the enemy.
- Praising the enemy.
- Mining industry is typically viewed unfavourably by conservationists.
- Negative environmental impact and biodiversity reduction.
- But this industry also holds opportunities and hidden benefits for conservation.
- Here we report on *FFMES* biodiversity surveys for **three** mining projects in the Republic of Congo (RC).
- These mining companies had to conduct Environmental and Social Impact Assessments following the International Finance Corporation's Environmental and Social Performance Standards.
- **Nine** multidisciplinary rapid biodiversity assessment (RBA) surveys.
- Multidisciplinary RBA = botany, mammalogy, ornithology, herpetology, ichthyology and entomology.

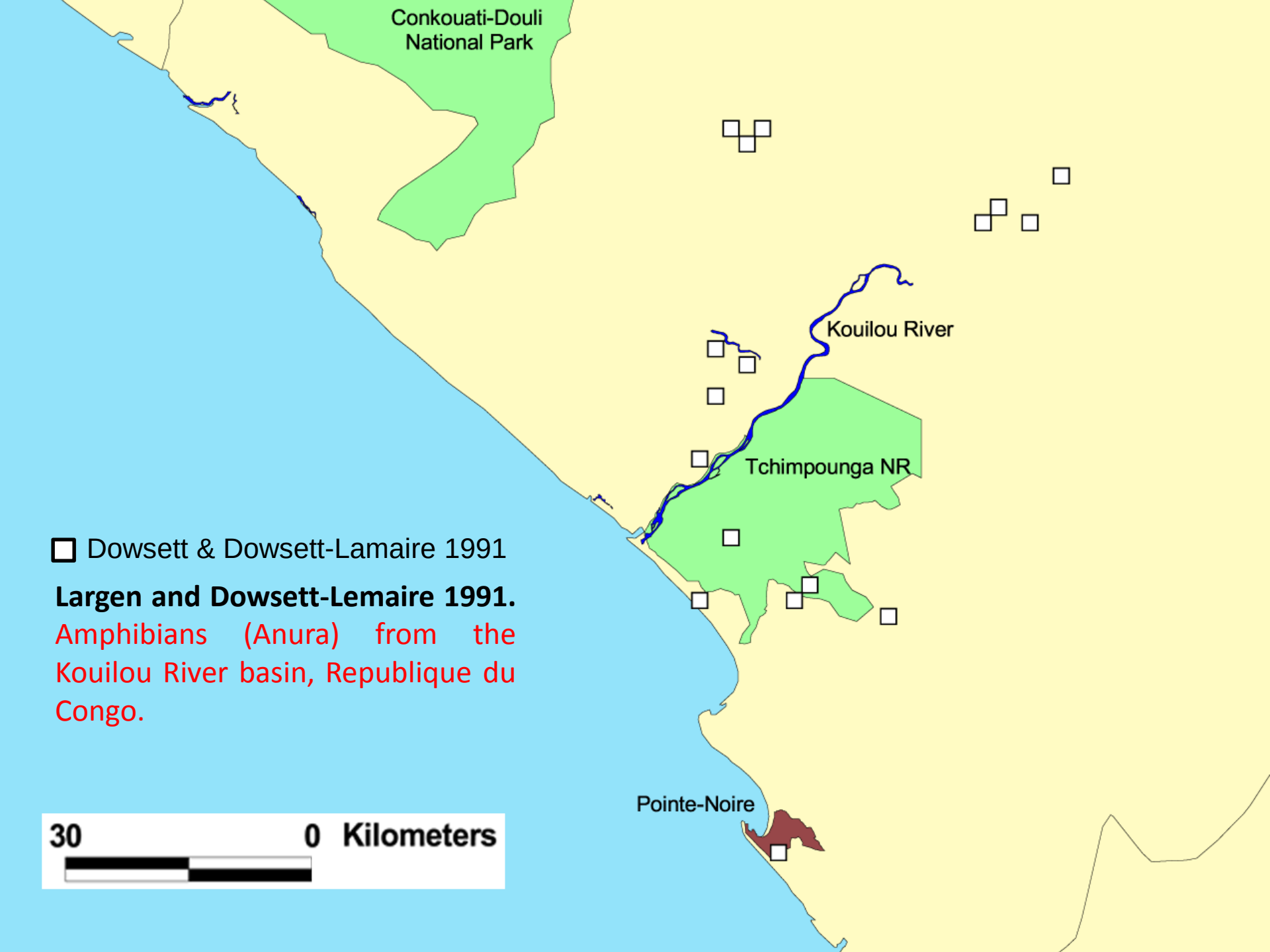



Nouabale-Ndoki National Park
Lac Télé Community Reserve
Mayoko
Sintoukola
Hinda
Kouilou River basin
Pointe Noire
Central African Republic
Cameroon
Equatorial Guinea
Gabon
Republic of the Congo
Democratic Republic of the Congo
Angola
Parc National De La Salonga-Sud
Bertoua
Bangui
Douala
Yaounde
Gemena
Buta
Binga
Lisala
Bumba
Libreville
Yangambi
Kisangani
Mbandaka
Boende
Port-Gentil
Lukolela
Franceville
Inongo
Nioki
Bandundu
Ilebo
Kinshasa
Kenge
Kikwit
Idiofa
Cabinda
Boma
Matadi
Soyo
Kananga
Mbuji-Mayi
Tshikapa
Gandajika

Frétey, Dewynter & Blanc 2011:
Amphibiens d'Afrique centrale et d'Angola.

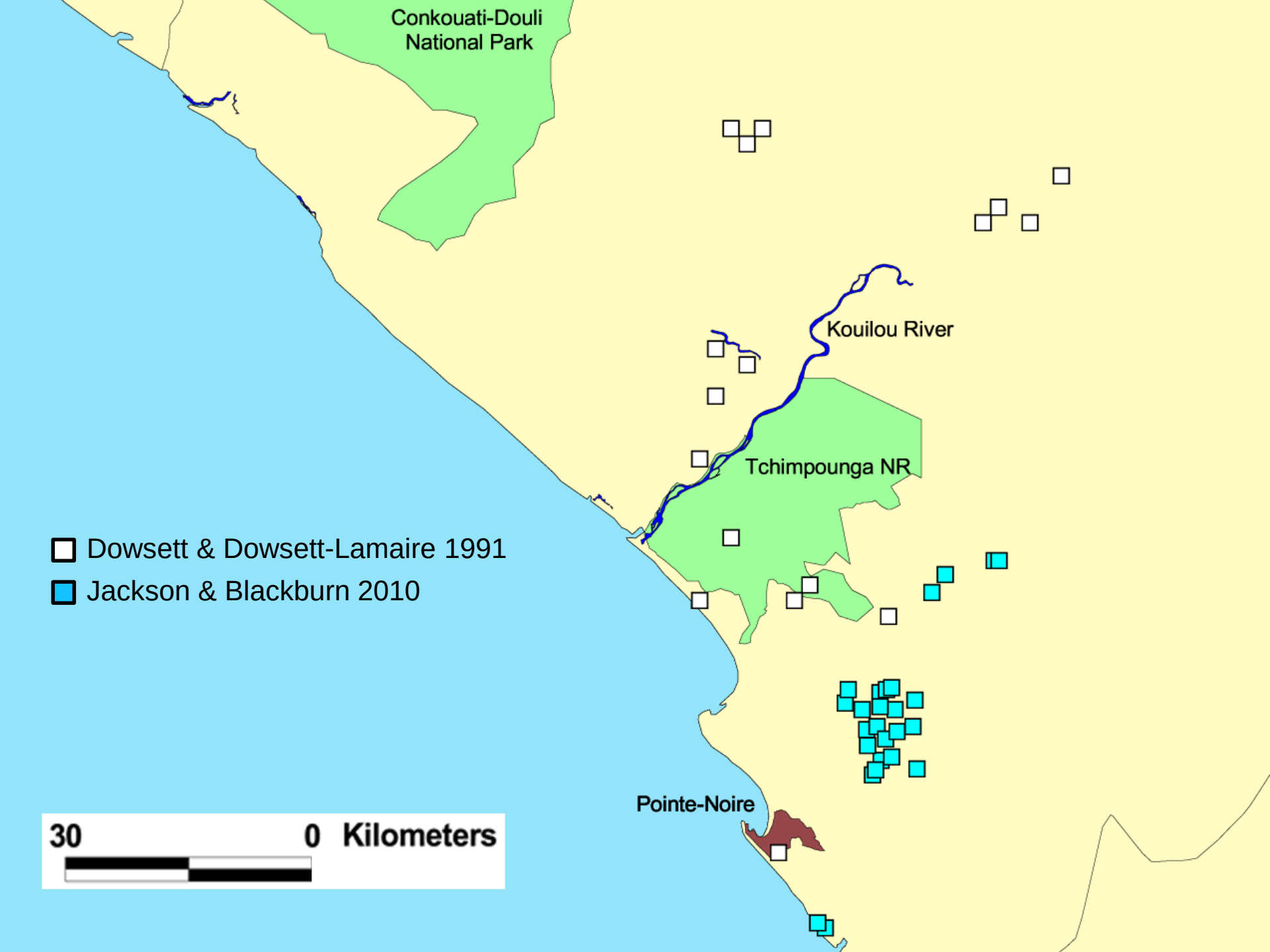
	RC	DRC	Gabon	Angola
Caecilians	1 (0)	2 (0)	2 (0)	0 (0)
Frogs	68 (0)	222 (48)	88 (6)	101 (12)
Total amphibians	69 (0)	224 (48)	90 (6)	101 (12)
	93 (2)			


Conkouati-Douli
National Park
Kouilou River
Tchimpounga NR
Pointe-Noire
Dowsett & Dowsett-Lamaire 1991
30
0 Kilometers



Largen and Dowsett-Lemaire 1991. Amphibians (Anura) from the Kouilou River basin, Republique du Congo.


Conkouati-Douli
National Park
Kouilou River
Tchimpounga NR
Pointe-Noire
Dowsett & Dowsett-Lamaire 1991
Largen and Dowsett-Lemaire 1991.
Amphibians (Anura) from the Kouilou River basin, Republique du Congo.
Potash (MagMinerals Inc.)
30
0 Kilometers


Conkouati-Douli
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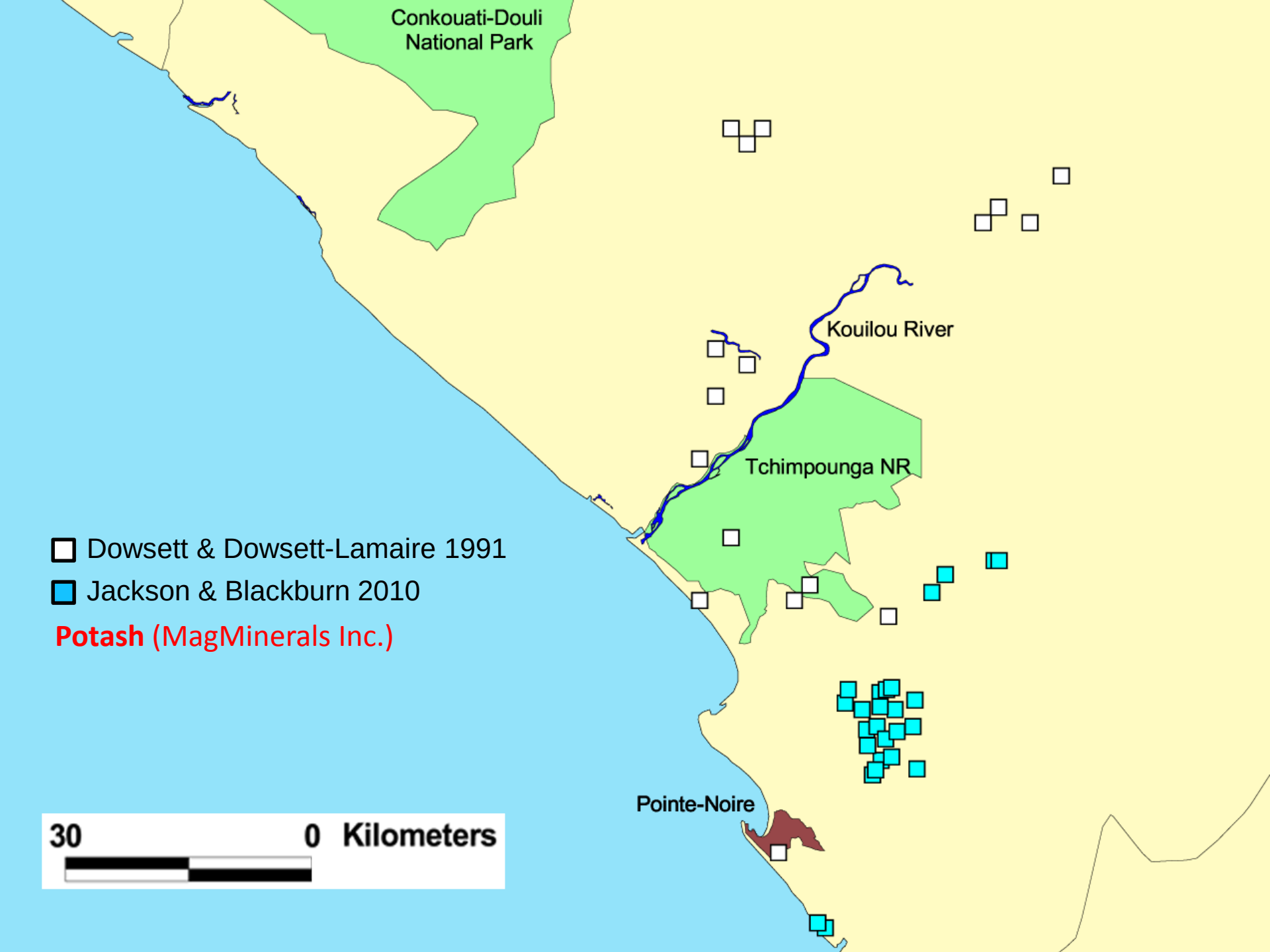
Kouilou River
Tchimpounga NR
Pointe-Noire
Dowsett & Dowsett-Lamaire 1991
Jackson & Blackburn 2010
30
0
Kilometers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Kouilou River
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Dowsett & Dowsett-Lamaire 1991
Jackson & Blackburn 2010
Potash (MagMinerals Inc.)
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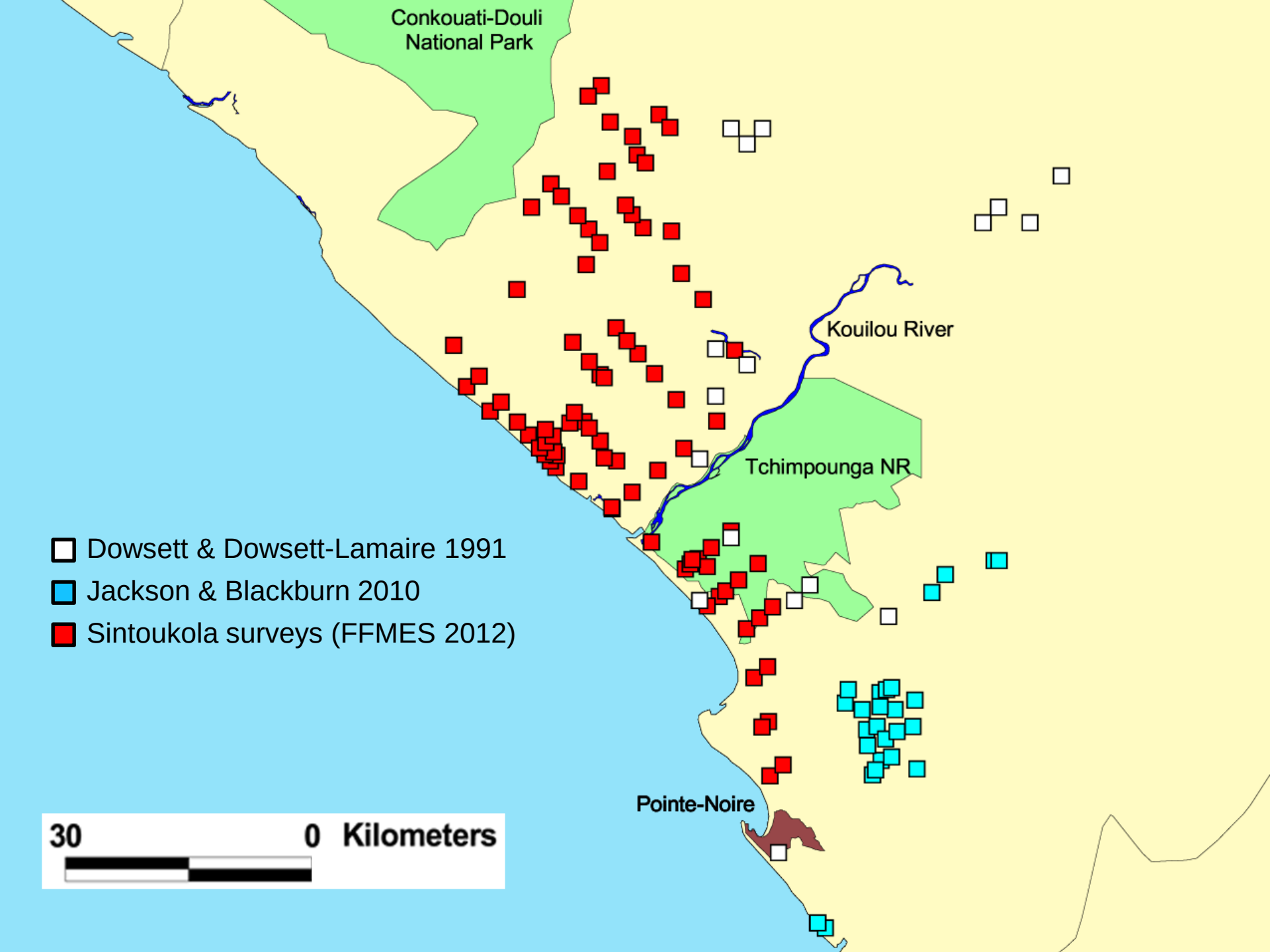
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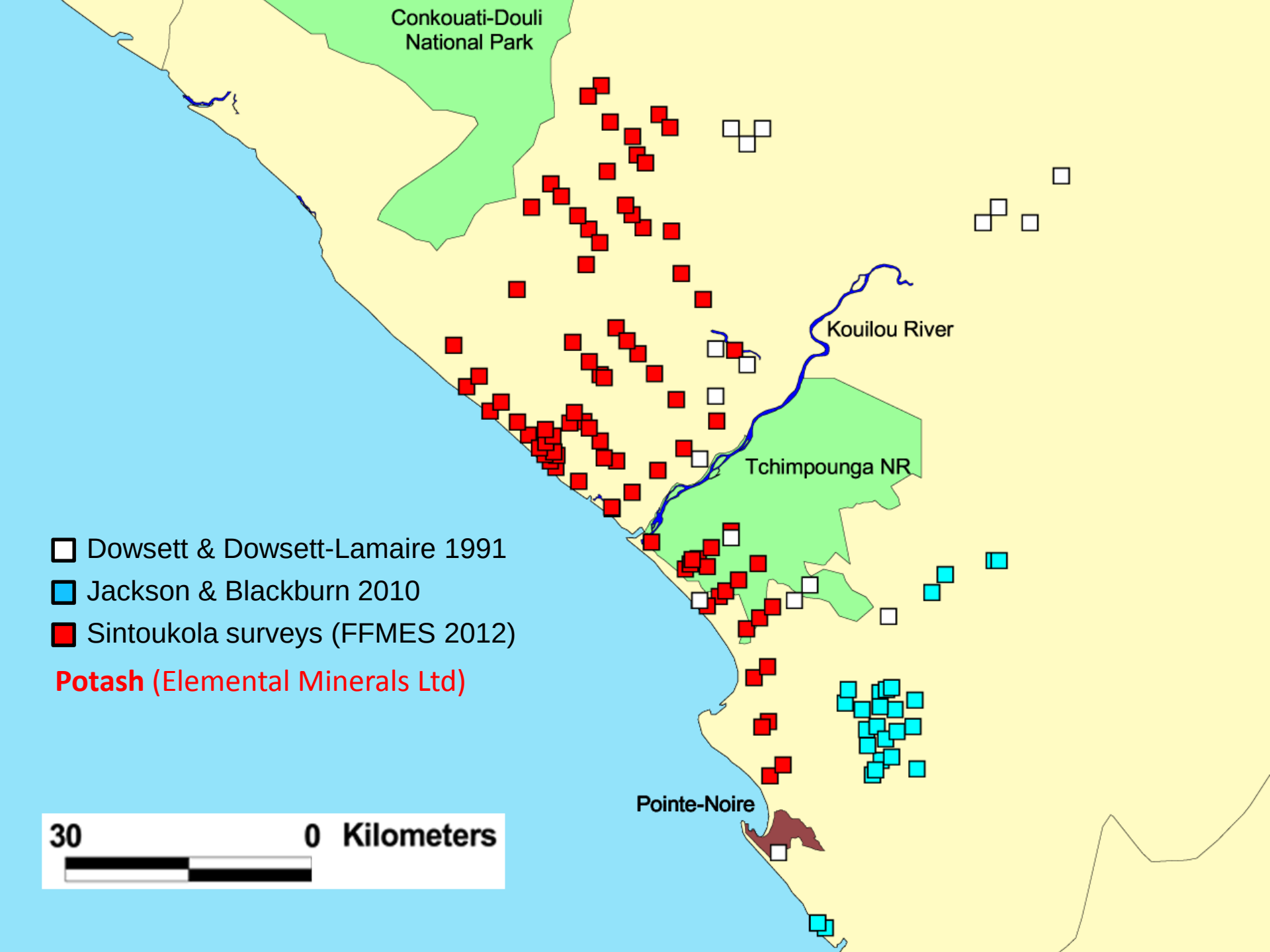
National Park
Kouilou River
Tchimpounga NR
Pointe-Noire
Dowsett & Dowsett-Lamaire 1991
Jackson & Blackburn 2010
Sintoukola surveys (FFMES 2012)
30
0
Kilometers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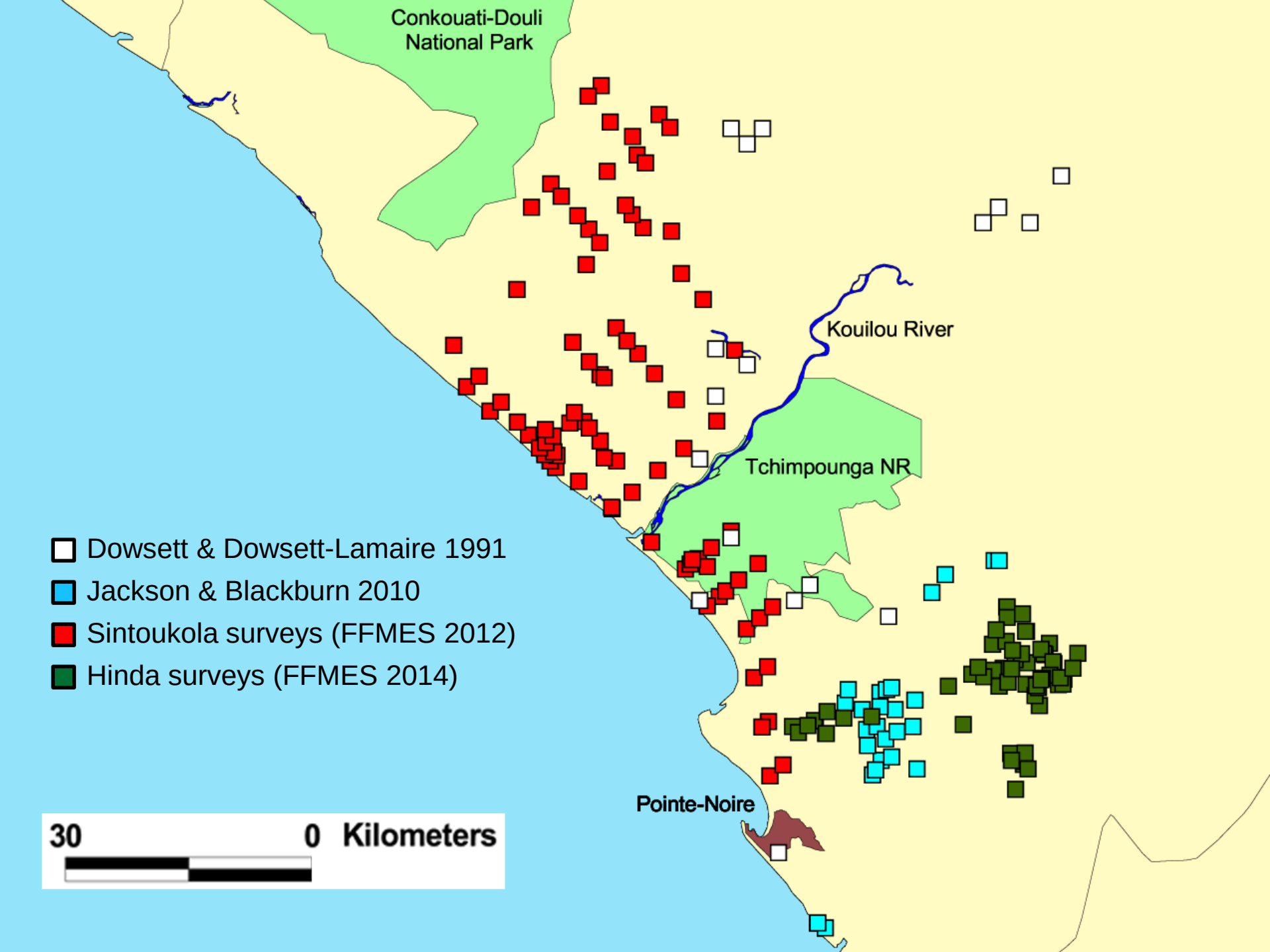
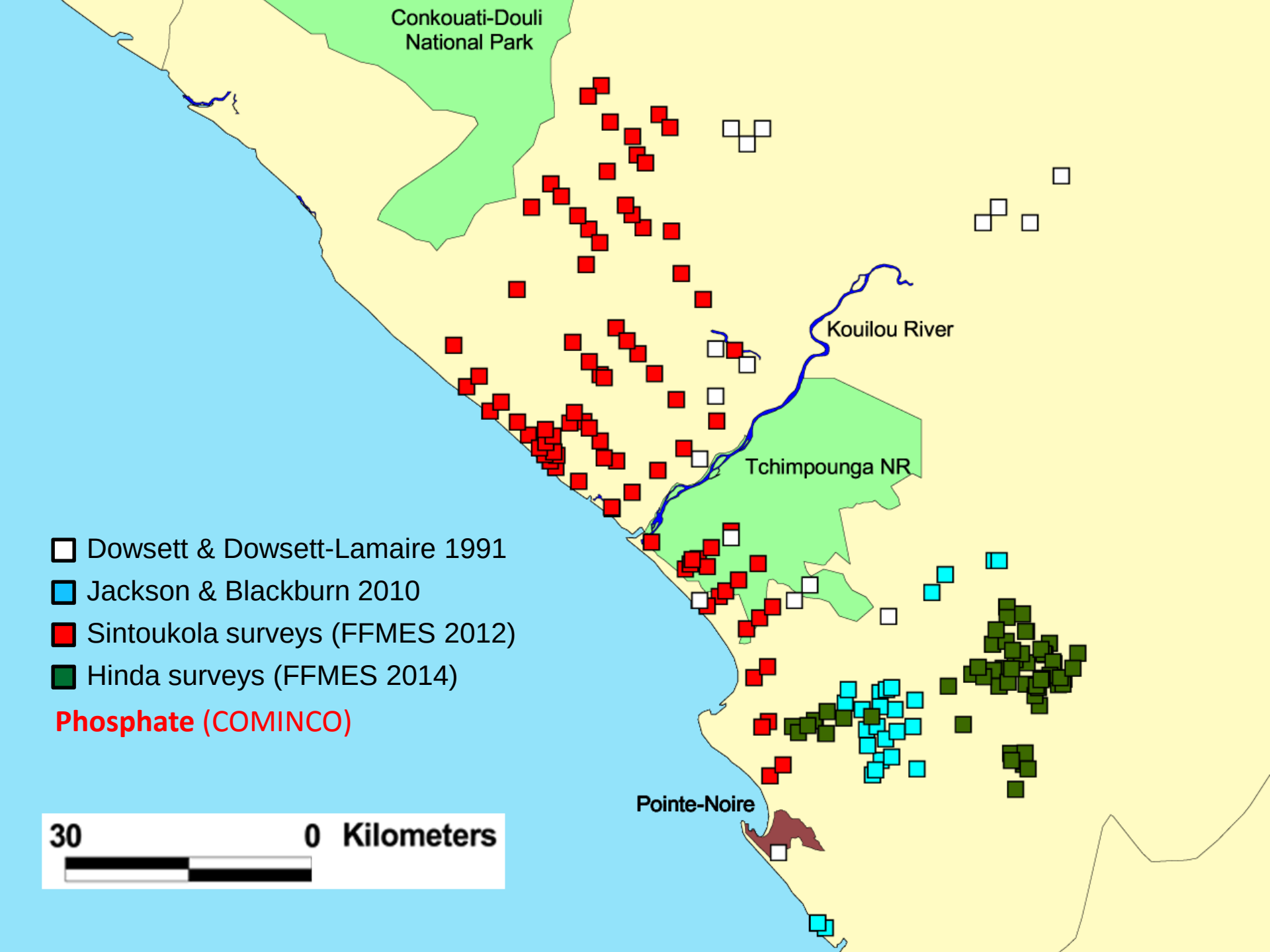
Tchimpounga NR
Pointe-Noire
Dowsett & Dowsett-Lamaire 1991
Jackson & Blackburn 2010
Sintoukola surveys (FFMES 2012)
Potash (Elemental Minerals Ltd)
30
0
Kilometers


Conkouati-Douli
National Park
Kouilou River
Tchimpounga NR
Pointe-Noire
Dowsett & Dowsett-Lamaire 1991
Jackson & Blackburn 2010
Sintoukola surveys (FFMES 2012)
Hinda surveys (FFMES 2014)
30
0
Kilometers


Conkouati-Douli
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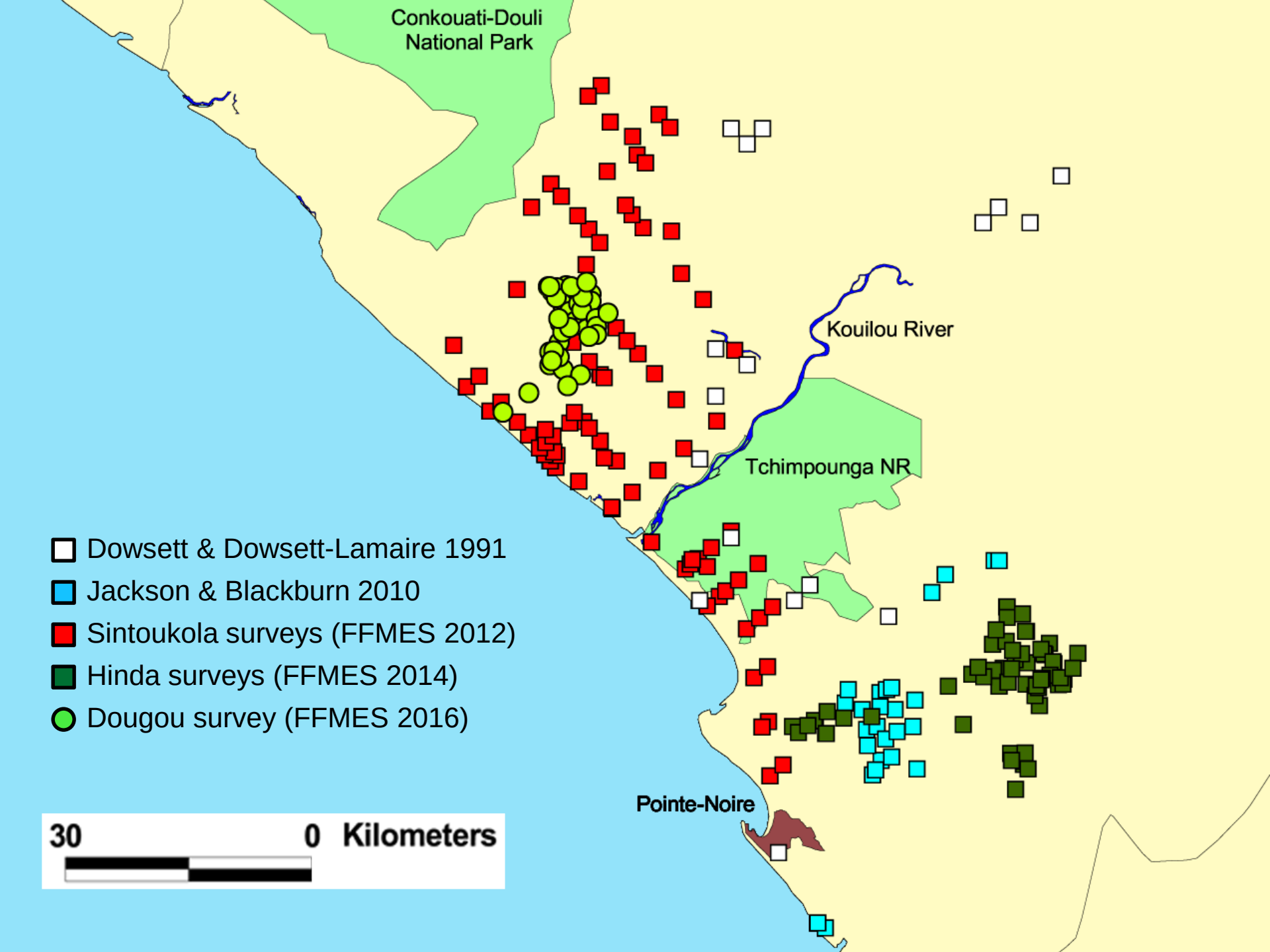
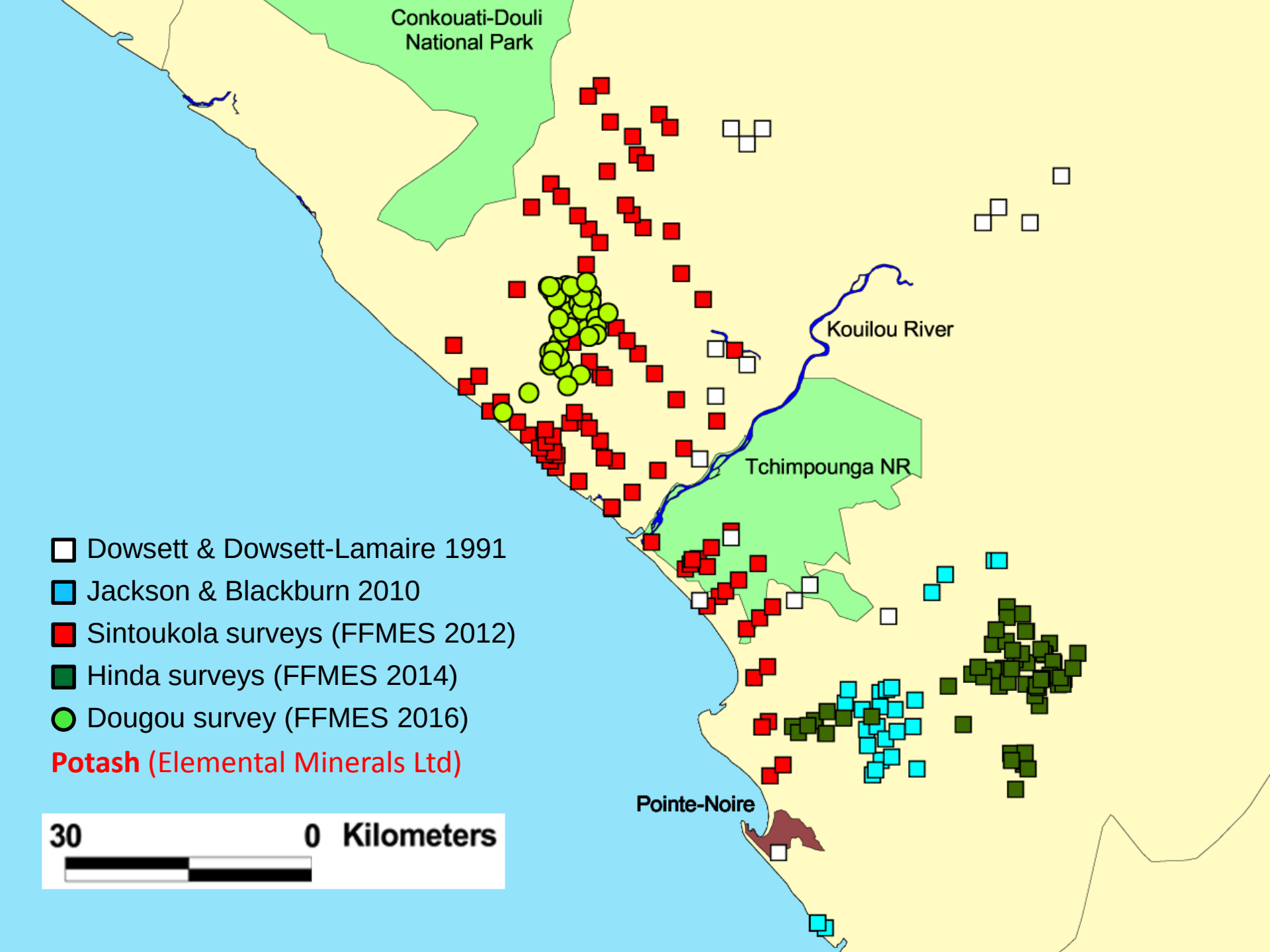
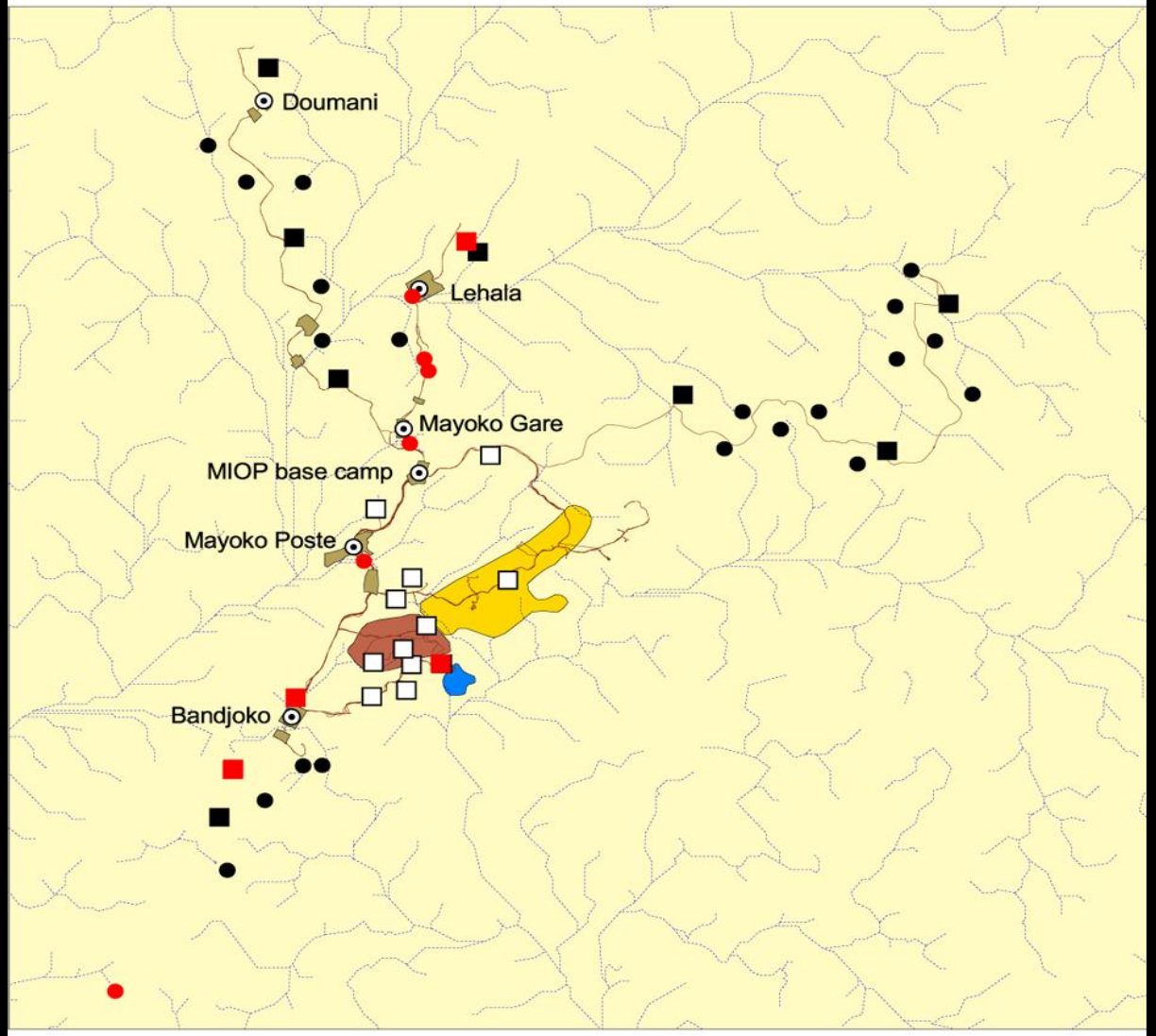
Kouilou River
Tchimpounga NR
Pointe-Noire
Dowsett & Dowsett-Lamaire 1991
Jackson & Blackburn 2010
Sintoukola surveys (FFMES 2012)
Hinda surveys (FFMES 2014)
Phosphate (COMINCO)
30
0 Kilometers

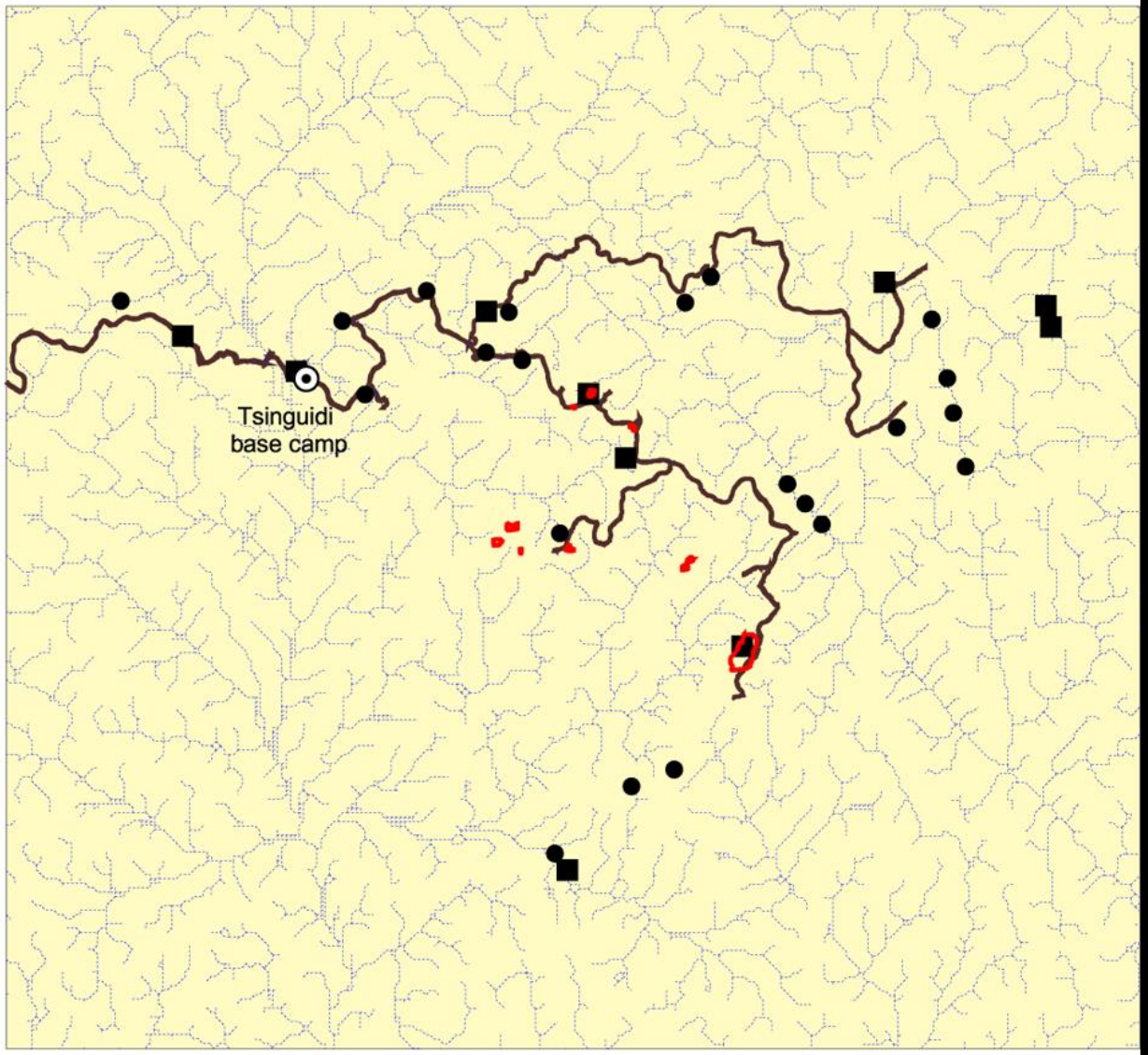

Conkouati-Douli
National Park
Kouilou River
Tchimpounga NR
Pointe-Noire
Dowsett & Dowsett-Lamaire 1991
Jackson & Blackburn 2010
Sintoukola surveys (FFMES 2012)
Hinda surveys (FFMES 2014)
Dougou survey (FFMES 2016)
30
0
Kilometers


Conkouati-Douli
National Park
Kouilou River
Tchimpounga NR
Pointe-Noire
Dowsett & Dowsett-Lamaire 1991
Jackson & Blackburn 2010
Sintoukola surveys (FFMES 2012)
Hinda surveys (FFMES 2014)
Dougou survey (FFMES 2016)
Potash (Elemental Minerals Ltd)
30
0
Kilometers

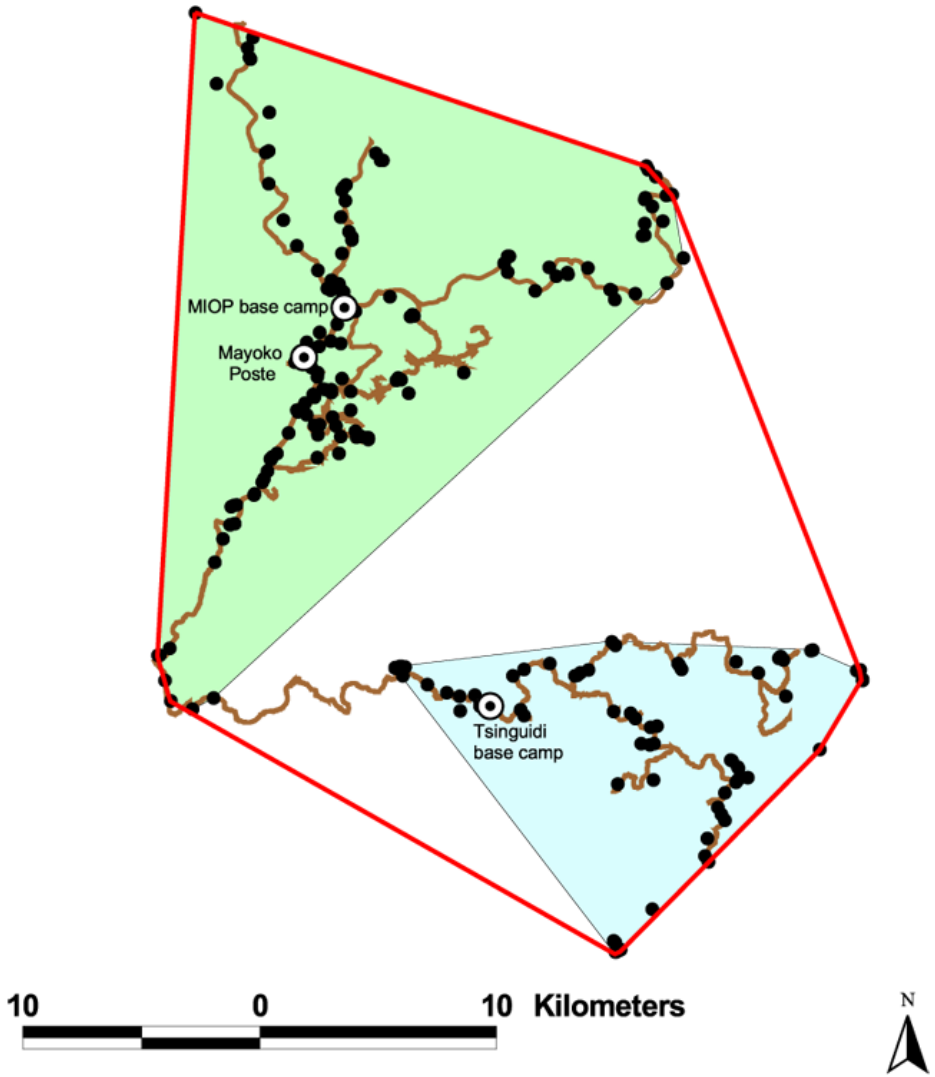
Mayoko Iron Ore Project (MIOP) - Herpetofaunal survey sites



Tsinguidi herpetofaunal survey sites



Mayoko and Tsinguidi herpetofaunal study areas



RESULTS OF THE MAYOKO AND TSINGUIDI HERPTOFAUNAL SURVEYS

The Mayoko/Tsinguidi reptile fauna of 52 species is comprised of:

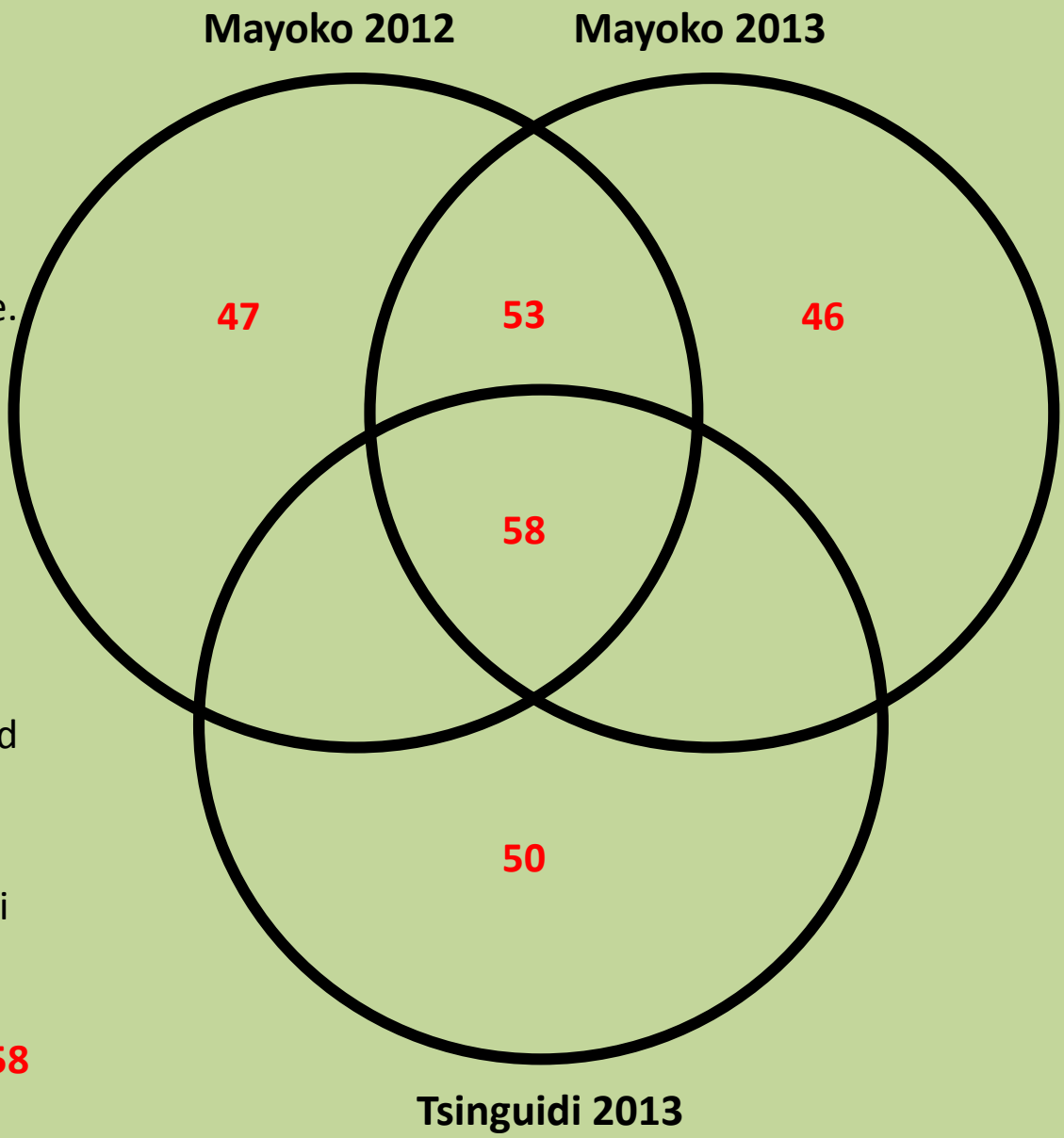
CROCODILIANS: 1 species

CHELONIANS: 2 species

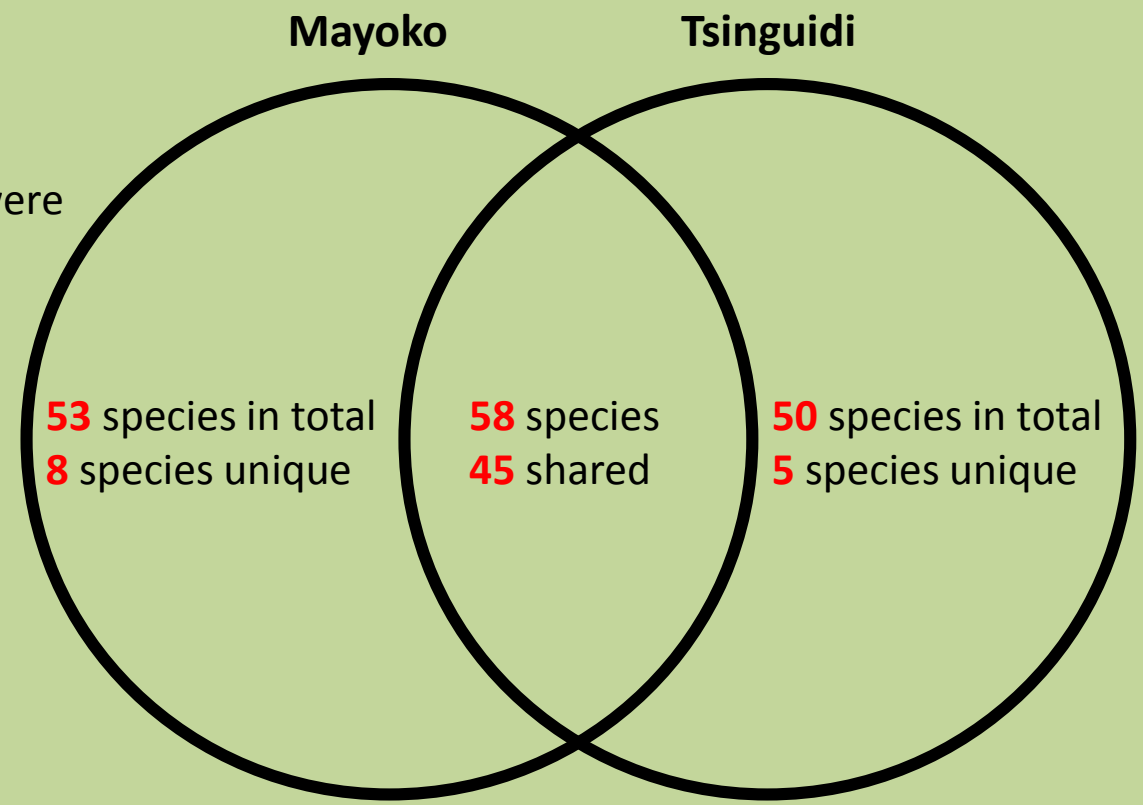
LIZARDS: 17 species

SNAKES: 32 species

- **Mayoko - April 2012**
  A preliminary baseline survey.
  15 species of amphibians recorded.
  1 frog species new to science.
- **Mayoko - September 2012**
  An intensive baseline survey.
  45 species of amphibians recorded.
  At least **2** frog species new to science.
  The two surveys combined recorded
  47 amphibian species.
- **Mayoko - October 2013**
  A survey specifically focused on the new frog species and their environmental parameters.
  46 species of amphibians recorded.
  The three surveys combined recorded
  53 amphibian species.
- **Tsinguidi - November 2013**
  A survey to determine if the Tsinguidi area is comparable to Mayoko area.
  50 species of amphibians recorded.
  All four surveys combined recorded **58** amphibian species.



- **Mayoko - x3 surveys 2012/13**
  The three Mayoko surveys combined recorded a total of **53** amphibian species.
  8 amphibian species were not recorded from Tsingidi, thus these were unique to the Mayoko surveys. However, it is presumed/predicted that most of these probably also occur at Tsinguidi.
- **Tsinguidi - x1 survey 2013**
  The single survey conducted at Tsinguidi recorded a total of **50** amphibian species.
  5 amphibian species were not recorded from Mayoko, thus these were unique to the Tsinguidi survey. However, it is presumed/predicted that most of these probably also occur at Mayoko.



- It is reasonable to conclude that the amphibian assemblages of Mayoko vs Tsinguidi is rather similar, with **45** of **58** species having been recorded at both sites.
- Based on the fact that the single Tsinguidi survey managed to record almost as many species as were recorded in x3 Mayoko surveys (i.e. **50** vs **53**), it seems as though Tsinguidi may in reality have an overall slightly richer amphibian assemblage.

- *Phrynobatrachus mayokoensis* Rödel *et al.* 2015.
- Recorded during the Mayoko and Tsinguidi surveys.

- *Phrynobatrachus horsti* Rödel *et al.* 2015.
- Recorded during the Mayoko, Tsinguidi and Pointe Noire surveys.
- This species appears to have a relatively wide distribution, including Gabon.

- *Phrynobatrachus africanus* complex. Preliminary results indicate that undescribed cryptic taxa may be present within this species complex.

- *Cardioglossa annulata* Hirschfeld *et al.* 2015.
- Recorded during the Mayoko and Tsinguidi surveys.
- In recognition of the new species that were discovered as a direct result of the Exxaro sponsored biodiversity surveys, this species may well be considered as the amphibian icon of the Mayoko Iron Ore Project.

- *Arthroleptis* sp 1.
- Recorded only at Tsinguidi.

- *Arthroleptis sylvaticus* complex. Preliminary results indicate that perhaps another two undescribed cryptic species may exist within this species complex.

- Cryptic undescribed taxa may be present in the *Hylarana amnicola* complex (Jongsma *et al.* in prep).

- Cryptic undescribed taxa are seemingly present in the *Prychadena aequiplicata* complex (Rödel *et al.* in prep).

IN CONCLUSION the Exxaro biodiversity studies ranks as (one of) the most thorough herpetological surveys ever to be conducted in the RC. The following herpetological achievements are noteworthy:

- The very first herpetological studies of the Mayoko region were conducted.
- About **15** species new to the RC were discovered.
- About **5** (probably more) species new to science were discovered.
- Tentatively, the only two frog endemics for the RC was discovered/described.
- New natural history information for many of the species were recorded, and we increased our understanding of the environmental requirements of some species.
- Collaborations with in-country specialists were mutually beneficial, and improved national expertise and capacity.
- Mitigation measures were formulated to offset the mining impact.

DERMOPHIIDAE

Geotrypetes 1 of 3 species

HERPELIDAE

Herpele 1 of 2 species

ARTHROLEPTIDAE	**Arthroleptinae**
Arthroleptis	7 of 47 species
Cardioglossa	5 of 19 species
ARTHROLEPTIDAE	**Astylosterninae**
Astylosternus	1 of 12 species
Scotobleps	1 of 1 species
Trichobatrachus	1 of 1 species
ARTHROLEPTIDAE	**Leptopelinae**
Leptopelis	8 of 53 species

BUFONIDAE

Nectophryne	1 of 2 species
Sclerophrys	11 of 45 species

CONRAUIDAE

Conraua 1 of 6 species

DICROGLOSSIDAE **Dicroglossinae**

Hoplobatrachus 1 of 1 (5) species

HEMISOTIDAE

Hemisus

1 of 9 species

HYPEROLIIDAE

Acanthixalus	1 of 2 species
Afrixalus	6 of 33 species
Alexteroon	1 of 3 species
Cryptothylax	1 of 2 species
Hyperolius	15 of 142 species
Phlyctimantis	1 of 5 species

PHRYNOBATRACHIDAE

Phrynobatrachus 6 of 89 species

PIPIDAE

Hymenochirus 2 of 6 species

Xenopus 5 of 29 species

PTYCHADENIDAE

Ptychadena 7 of 50 species

PYXICEPHALIDAE **Pyxicephalinae**

Aubria 2 of 2 species

RANIDAE

Amnirana

4 of 11 (12) species

RHACOPHORIDAE **Rhacophorinae**

Chiromantis 1of 4 (18) species

- The FFMES surveys used a multistage, stratified, semi-random sampling approach.
- This multi-layered biodiversity knowledge database was key in assessing the potential environmental impacts and providing mitigation and management guidance with a holistic perception on sensitive species, habitats and ecosystems.
- Mitigation measures could be formulated to minimise overall impact and to maintain ecological connectivity, functionality and viability over typical 50 years mine lifecycle.
- The FFMES RBAs have provided some of the most important botanical and faunal surveys undertaken in the RC.
- Notable herpetological advancements include (at least) three frogs and one snake species new to science, and 18 frog species new to the RC.

- **To conclude**, in situations where remote unexplored locations are considered for mining, valuable opportunities exists to advance scientific understanding by undertaking biodiversity investigations to specified international standards.
- Collaborate:
- **Bell *et al.*** (in press): Idiosyncratic responses to climate-driven forest fragmentation and marine incursions in reed frogs from Central Africa and the Gulf of Guinea Islands.
- **Portik *et al.*** (in press): Evaluating mechanisms of diversification in a Guineo-Congolian tropical forest frog using demographic model selection.
- **Jongsma *et al.*** (in prep): Diversity and biogeography of frogs in the genus *Amnirana* (Anura: Ranidae) across sub-Saharan Africa.
- **Rödel *et al.*** 2015: Two new *Phrynobatrachus* species (Amphibia: Anura: Phrynobatrachidae) from the Republic of the Congo.
- **Hirschfeld *et al.*** 2015: Two new species of long-fingered frogs of the genus *Cardioglossa* (Anura: Arthroleptidae) from Central African rainforests.