



Evolutionary and Conservation Studies of Imperiled Sturgeon Species of the Genus *Pseudoscaphirhynchus* in Central Asia

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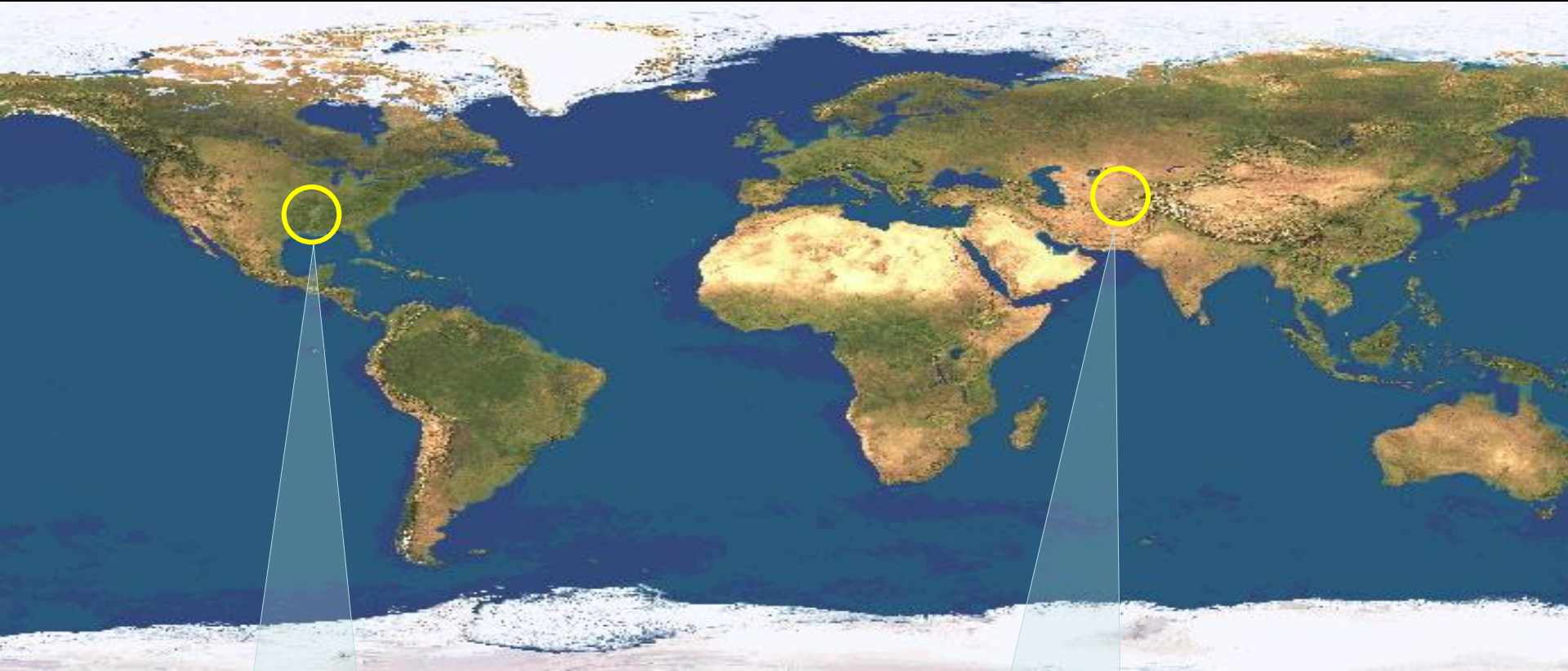
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Family Acipenseridae – Sturgeon

Subfamily Scaphirhynchinae – Shovelnose Sturgeon



Scaphirhynchus

S. albus
S. platorynchus
S. suttkusi

Pseudoscaphirhynchus

P. hermanni
P. kaufmanni
P. fedtschenkoi

North American Shovelnose Sturgeons *Scaphirhynchus*



Pallid sturgeon *S. albus*



Shovelnose sturgeon *S. platyrhynchus*

Alabama sturgeon
S. suttkusi



Central Asia Shovelnose Sturgeons

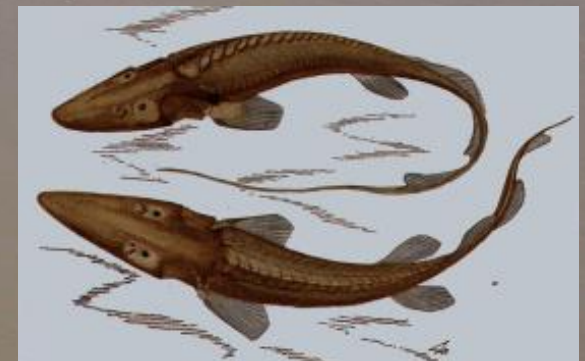
Pseudoscaphirhynchus



Big Amudarya Shovelnose Sturgeon
(*P. kaufmanni*)



Small Amudarya Shovelnose Sturgeon (*P. hermanni*)



Syrdarya Shovelnose Sturgeon
(*P. fedtschenkoi*)

1934 y.

**The fisherman with catch of
P. kaufmanni in middle reach of
Amu Darya River.**



Photo of N.A. Gladkov

1985 y.

***P. kaufmanni* & *P. hermanni* listed in
Red Data Book of Turkmenistan**



Research tasks:

- To study systematics, life history, and reproductive biology.
- To detect conditions and sites of spawning in the river.
- To develop a captive propagation technique.

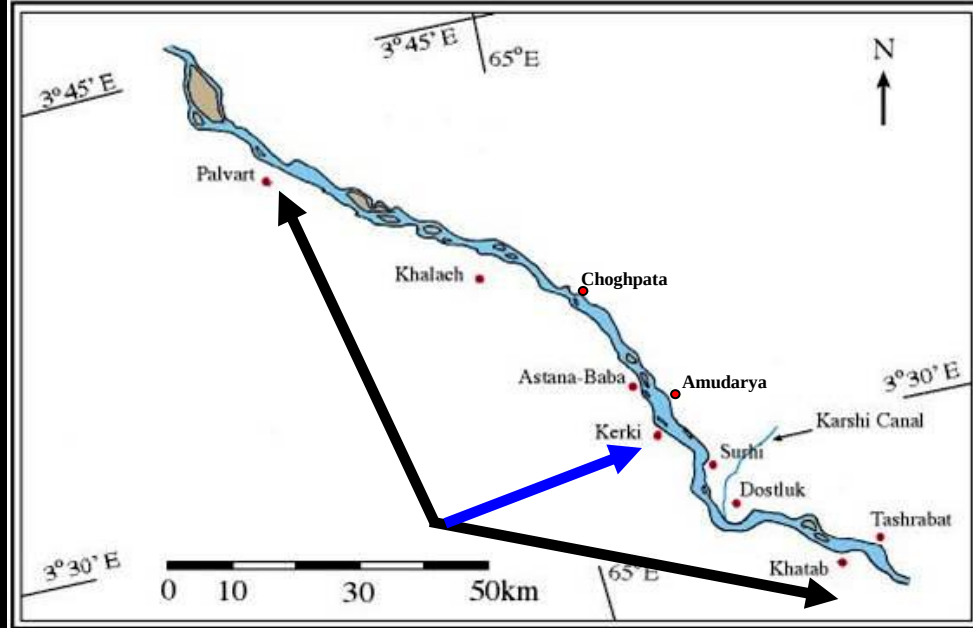
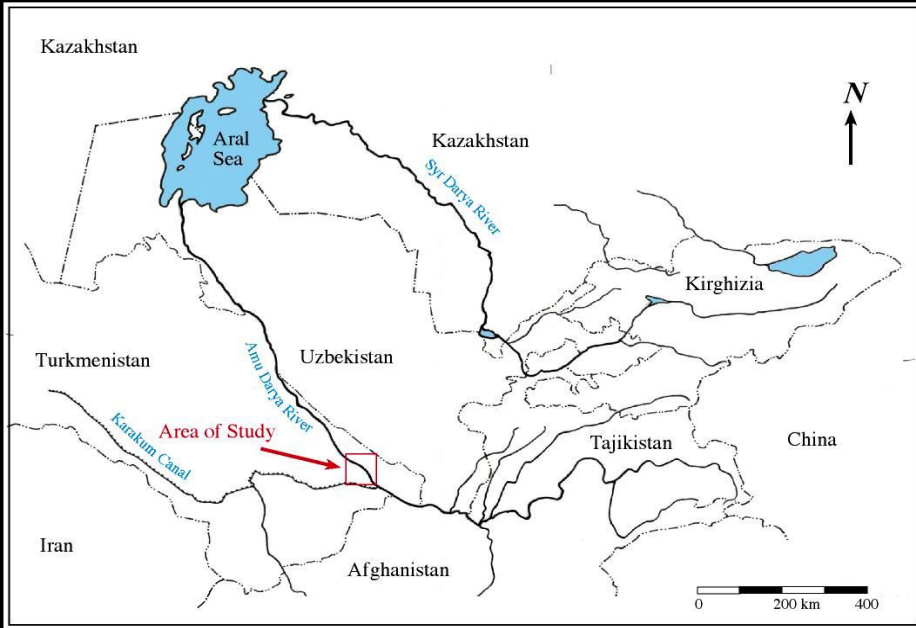


Main Tasks of our Research

- **Morphological characters from specimens of *P. kaufmanni* and *P. hermanni* captured in field studies and in museums in St. Petersburg and Moscow, Russia.**
- **Mitochondrial DNA sequences of specimens to compare with morphological data for species boundaries.**
- **Ecological data from specimens, including record location of capture, length, weight, color, sexual stage, age, length growth, age of maturity, number of ova, and other.**
- **Tagging of individuals with Floy and PIT tags and recapturing of tagged individuals to assess population size, changes in seasonal fitness and growth.**
- **Ultrasonic tagging and tracking adults during spawning and non-spawning season to identify movement in the river, habitat preferences and spawning locations.**

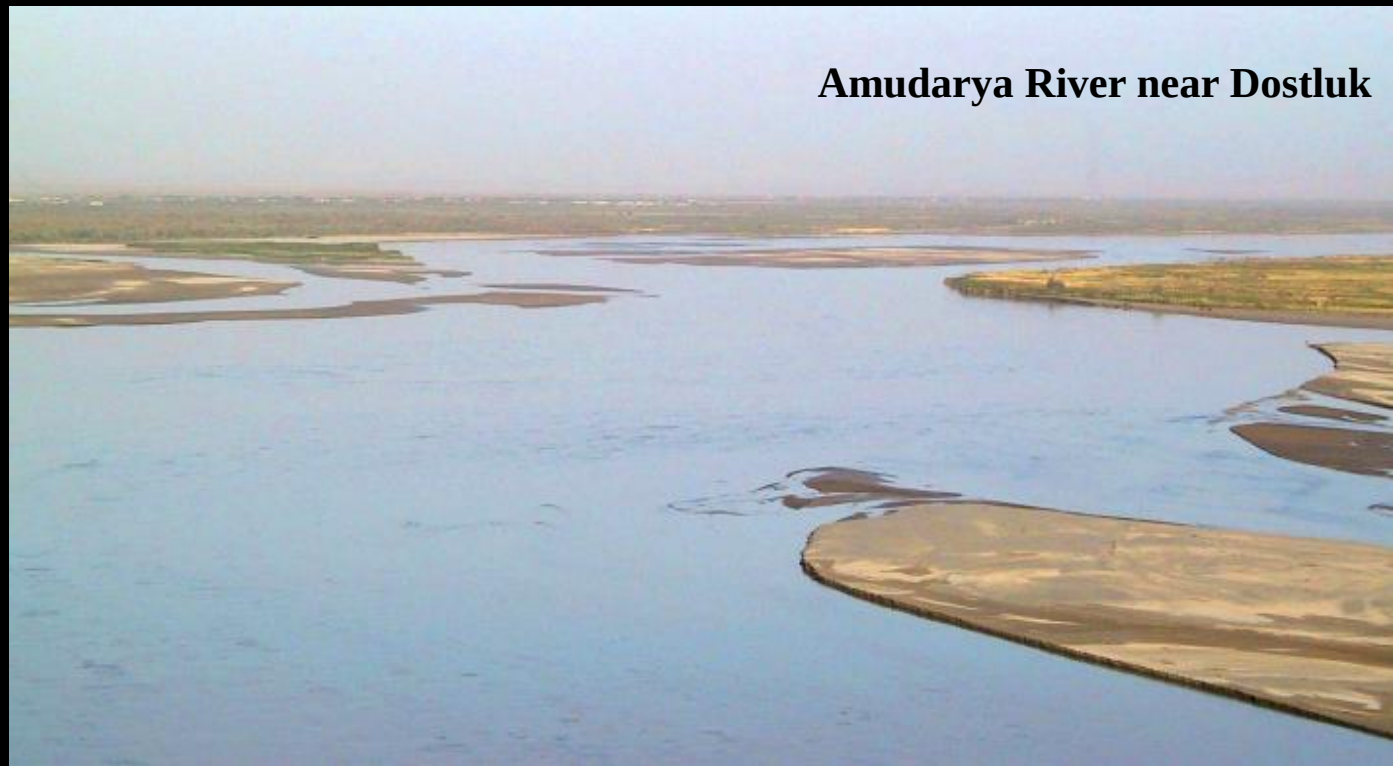
Tagging of Big Amudarya Shovelnose Sturgeon (*Pseudoscaphirhynchus kaufmanni*) in the Middle Reach of the Amudarya River





Study Area

- Upper middle reach Amudarya River
- Encompassed about 150 km of river. Kerki base of operation
- Highly turbid with numerous braided & side channels that are continuously changing in shape & location



Amudarya River near Dostluk

External Floy-Tags (Dennison Mark III Floy T-bar Anchor Tag)



- 487 *P. kaufmanni* external tagged since 1999, including 181 specimens tagged in 2002-2005
- 16 tagged specimens were recaptured
- Interval between release and recapture ranged from 1 to 1120 days
- Distance between release and recapture points were from 0 to 15 km, with both upstream and downstream movement
- Narrow snout form of *P. kaufmanni* commonly increased 0.5-2 cm in length and wide snout form increased up to 8 cm per year

Internal PIT-Tag (Biomark Passive Integrated Transponder)

- Miniature size 12 mm x 2 mm
- Each tag with a unique digital code
- There is no battery on the tag, life time is 100 years or more
- Pocket Reader HS9250L1 activates tag and displays a unique digital code
- Tags were implanted into back of the fish under dorsal fin with special injector.
- 19 *P. kaufmanni* were tagged from November 2004 to May 2005. All but four of the *P. kaufmanni* outfitted with PIT tags were also implanted with ultrasonic tags.
- PIT-Tags should be used in future research for tagging of *P. hermanni* and small *P. kaufmanni*.



Internal IBT-Tags (Sonotronics Miniature Ultrasonic Transmitters)

➤ **IBT-96-2**

Battery life of 2 months

Size 28 mm x 9.5 mm

Weight 2.5 g

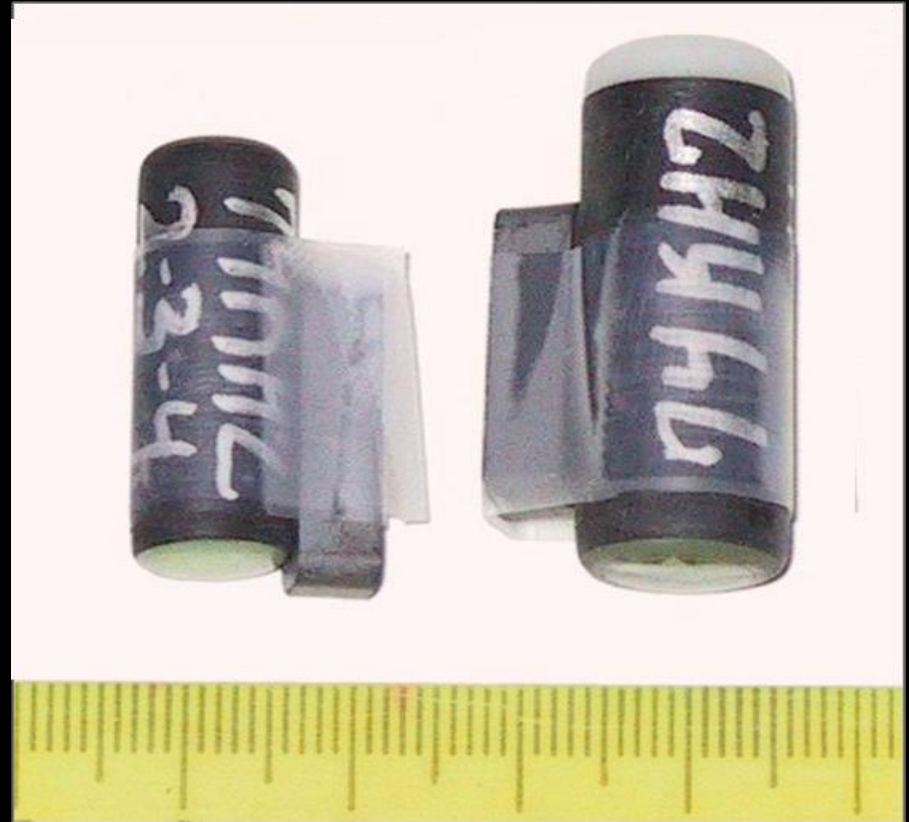
➤ **IBT-96-5**

Battery life of 5 months

Size 36 mm x 13 mm

Weight 3.25 g

➤ **Each tag with a unique series of beeps**



Eight IBT-96-2 and seven IBT-96-5 transmitters (15 in total) were implanted in abdominal cavity of *P. kaufmanni*)

Implantation Surgery

- Implantation of acoustic transmitters was performed on the river bank soon after capture of specimens
- Specimens anesthetized with Anesthazine & provided with freshwater during the surgery
- Specimens were tagged with a PIT-Tag and injected with oxytetracycline
- In total 13 large wide-snout specimens & 2 small narrow-snout specimens were implanted
- Specimens were 24.5 - 49.5 cm SL & weighed 126 - 995 g. Some appeared to be ripe females and males
- After surgery sturgeons were kept in a net box in the river for 1-2 hours before release



Tracking boat supplied with telemetry equipment

- Three DH-4-10 Directional Hydrophones
- Handmade Bracket suspended three hydrophones in river
- Sonotronics Manual Tracking Kit with USR-6
- FishMark 480 Sonar with Temperature Sensor
- GARMIN Gecko 201 GPS

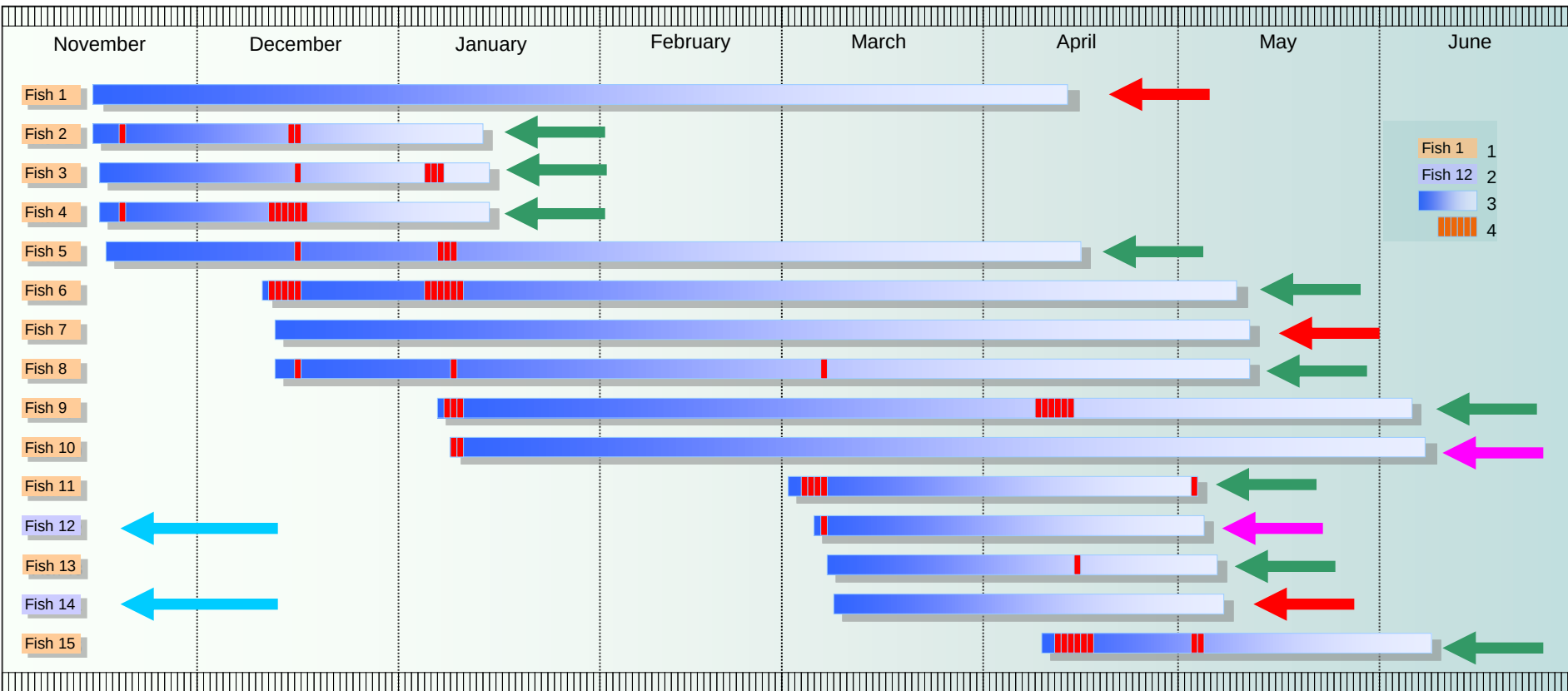


➤ Tracked at boat speed up to 10-12 km/h downstream and 4-5 km/h upstream

➤ Scanned area ahead and to both sides of the boat to detect beeps from implanted tags

➤ The boat could move through the water depths of 1-1.5 m

Number of *Pseudoscaphirhynchus kaufmanni* detected and tracked with hydrophones in Amudarya R. between November 2004 and May 2005



1 – No. of wide-snout specimen, 2 – No. of narrow-snout specimen, 3 – days when transmitters IBT-96-2 (two month battery) and IBT-96-5 (five month battery) were active in specimens, 4 – days when specimens were detected and tracked.

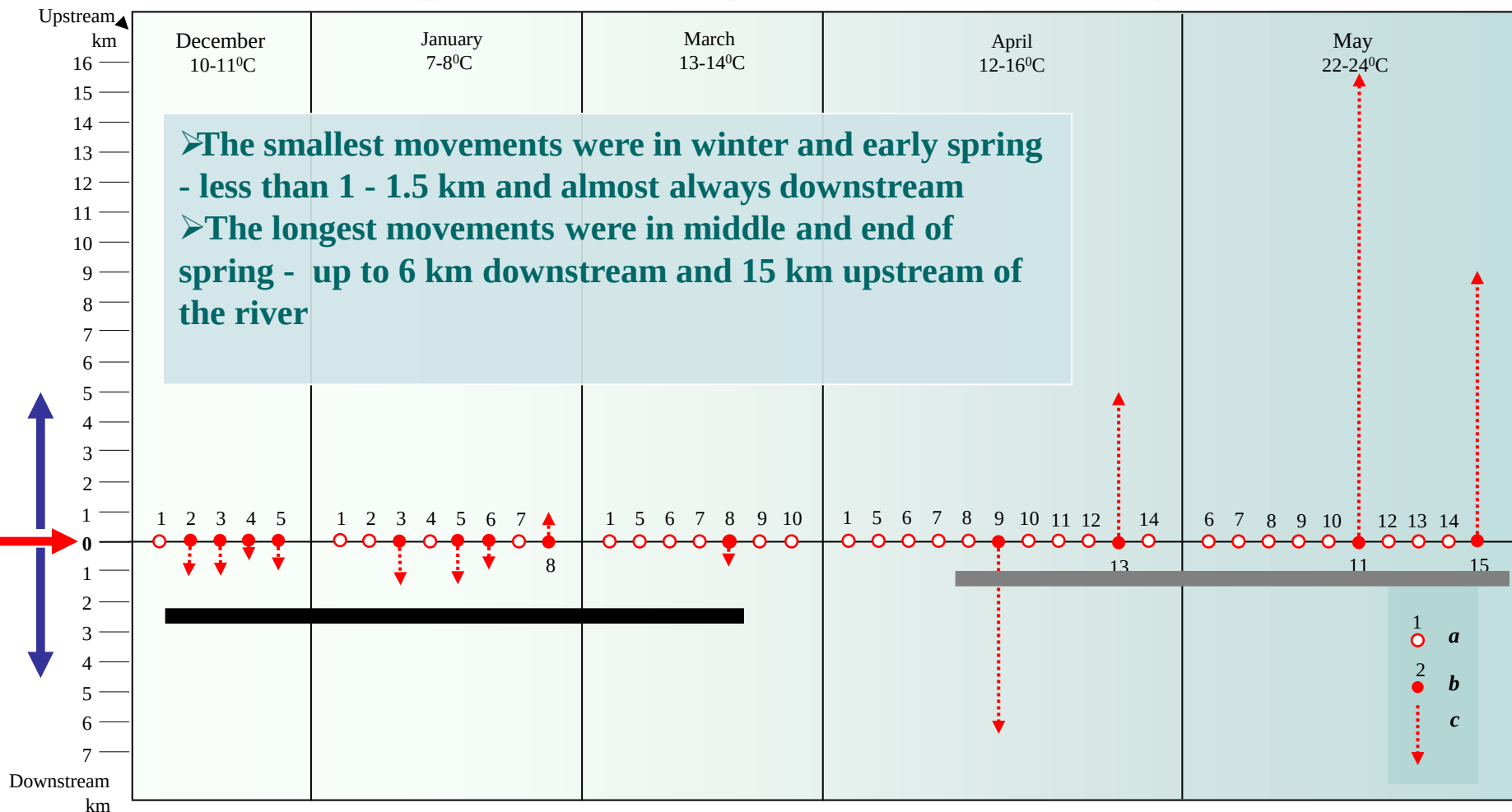
➤ In total 10 of 15 implanted specimens were detected and tracked. Detection & tracking performed from November 2004 to May 2005 Almost monthly for 5-8 days every month. Distance of 12 - 46 km in main and side channels.

➤ Period between release of specimens and the last time they were detected in the river was:

23-62 days for specimens implanted with IBT-96-2 transmitters

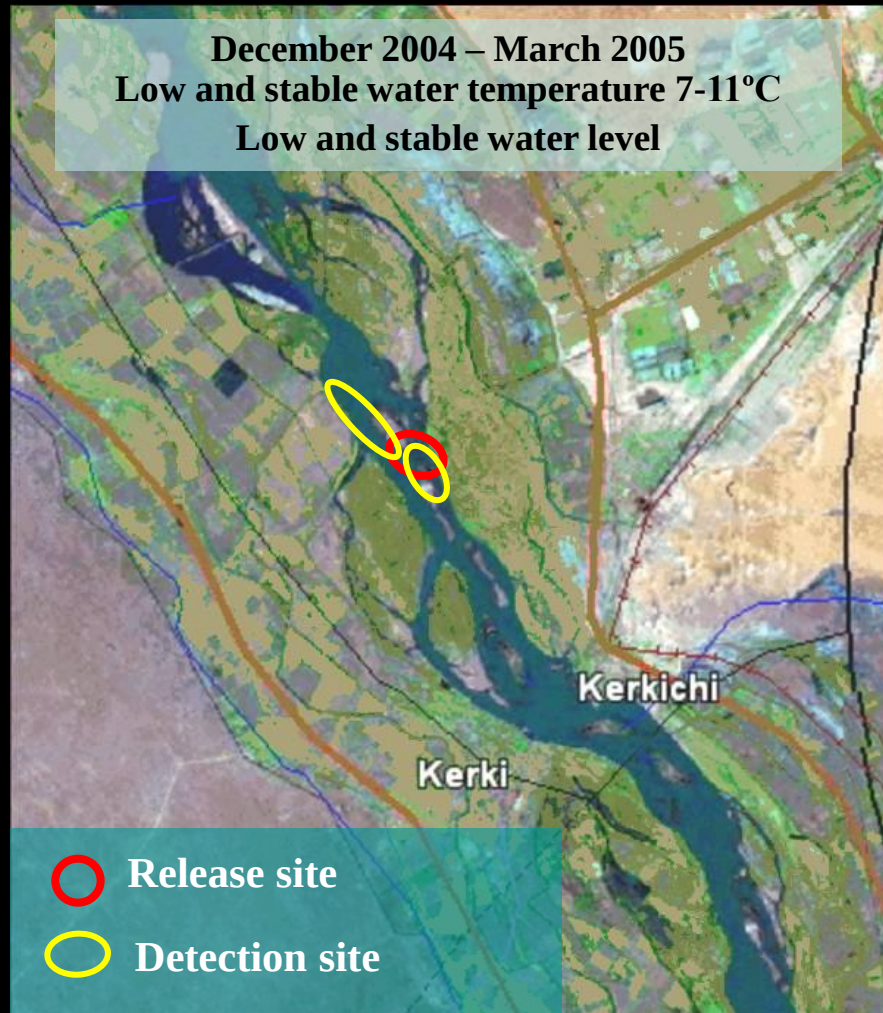
28-97 days for specimens implanted with IBT-96-5 transmitters

Direction and length of movements of implanted *P. kaufmanni* in Amudarya River

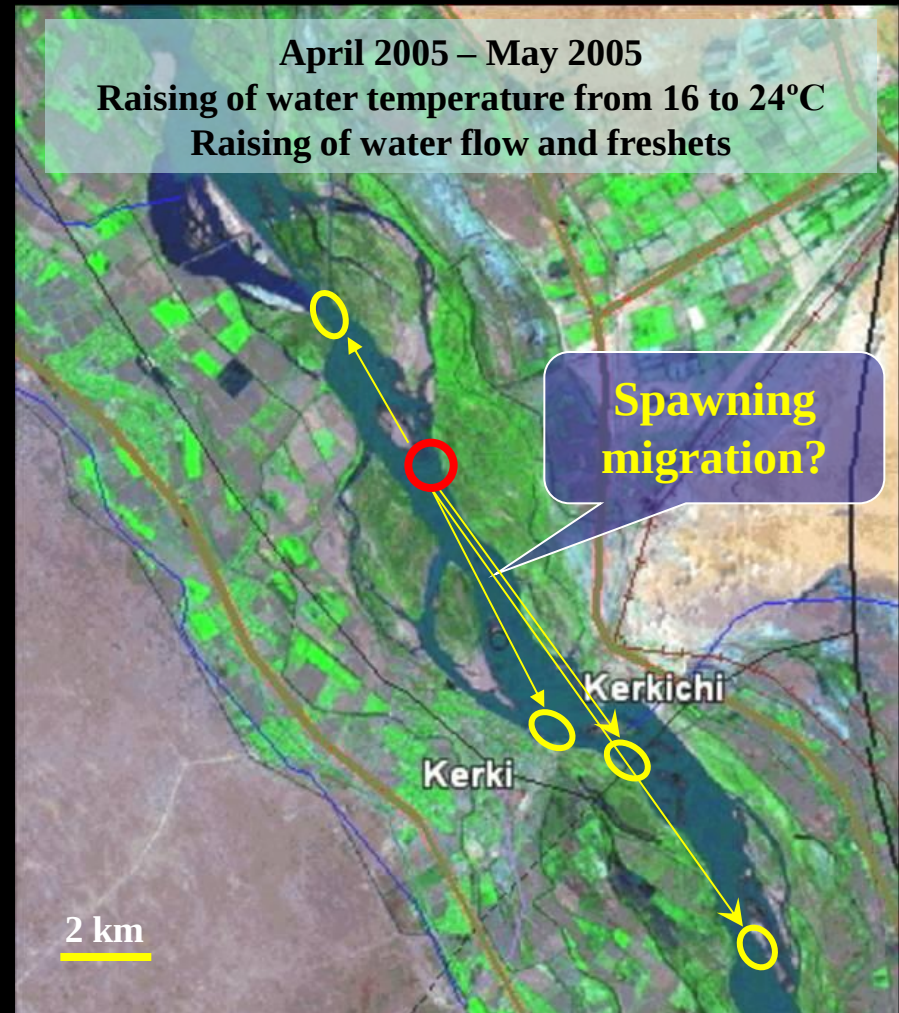


***a* – undetected specimen and its individual number, *b* – detected and tracked specimen and its individual number, *c* – direction and distance of movement of specimen regarding release point (0 km)**

Seasonal changes of movements of *Pseudoscaphirhynchus kaufmanni*



In winter and yearly spring implanted fishes stayed for a long time (weeks and months) practically at the same site of the river. They did only short movements downstream less 1.5 km.

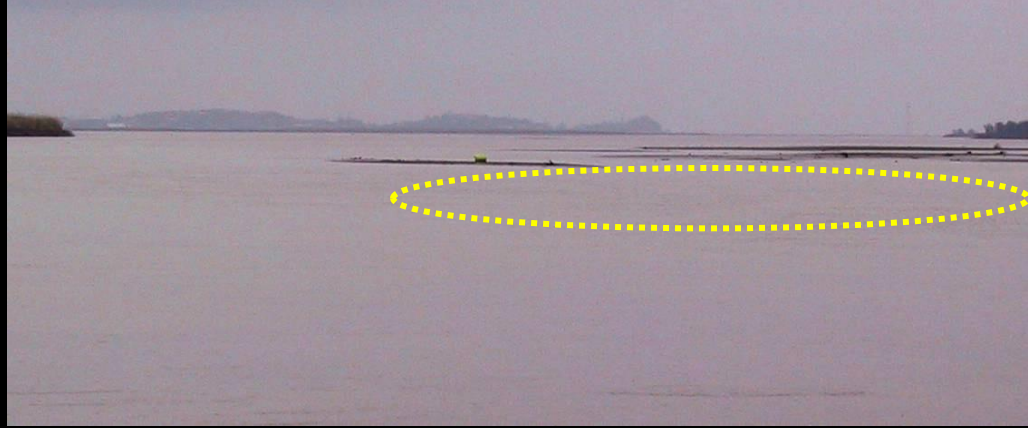


In the middle and end of spring when the water temperature increased up to 16°C fishes moved 6-15 km upstream. This increase of movement may indicate that spawning migration occurs in this species, but warmer water and higher river flows may also contribute to this movement.

Habitats

Preferred habitat is the main channel in shallow water (1.5 - 2 m) and slow flows (0.4 - 1.1 m/sec)

Implanted specimens were also detected in deeper water (3.5 - 4 m) with slower flows (0.7 - 0.8 m/sec)



Shallow side branches with similar flows were occasionally utilized



During upstream movement in spring *P. kaufmanni* was found in the main channel at greater depths (up to 8 m) and faster flows (up to 1.9 m/sec)

- Use of FLOY-Tags, PIT-Tags and Ultrasonic Transmitters represents first attempt to use tags and electronic devices to tag and to track *P. kaufmanni* in Amudarya River in Turkmenistan.
- Successful even though the Amudarya River is highly turbid with numerous braided & side channels that are continuously changing in shape & location.
- These research data are critical to understanding the life history of *P. kaufmanni* and to developing the conservation, recovery and propagation programme for this imperiled sturgeon.



Conclusions

Acknowledgements

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CITES**



Robert Colombo II

**Research Assistant of Fisheries and Illinois Aquaculture Center of SIU
Carbondale**

- **Technique of implantation of ultrasonic transmitters and gave us the necessary field training on the Mississippi River**



**Local fishermen participated
in our tagging research on
Amudarya River**



Sergey Dubayev



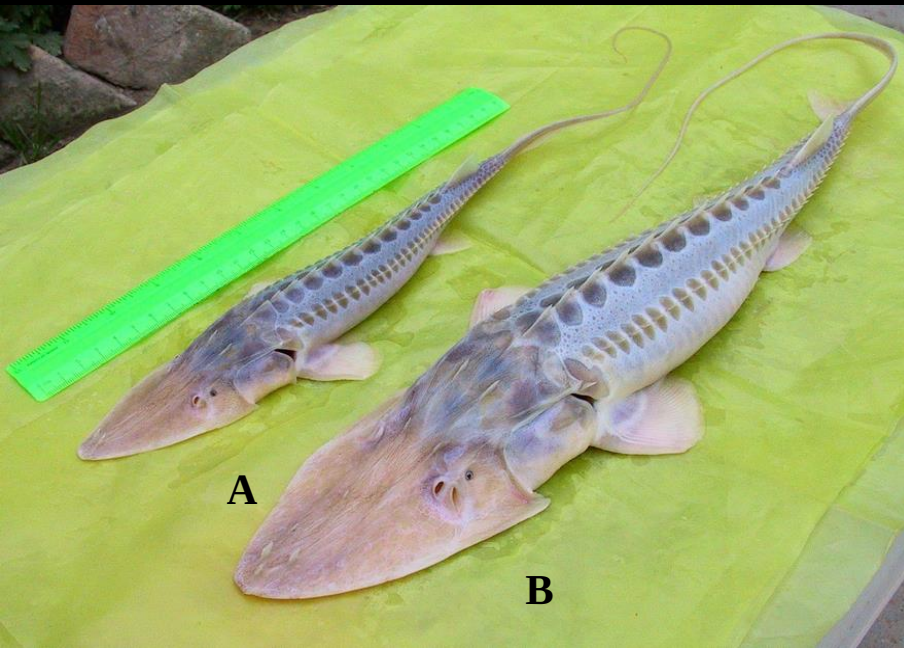
Nazar Kadirov

THANK YOU !

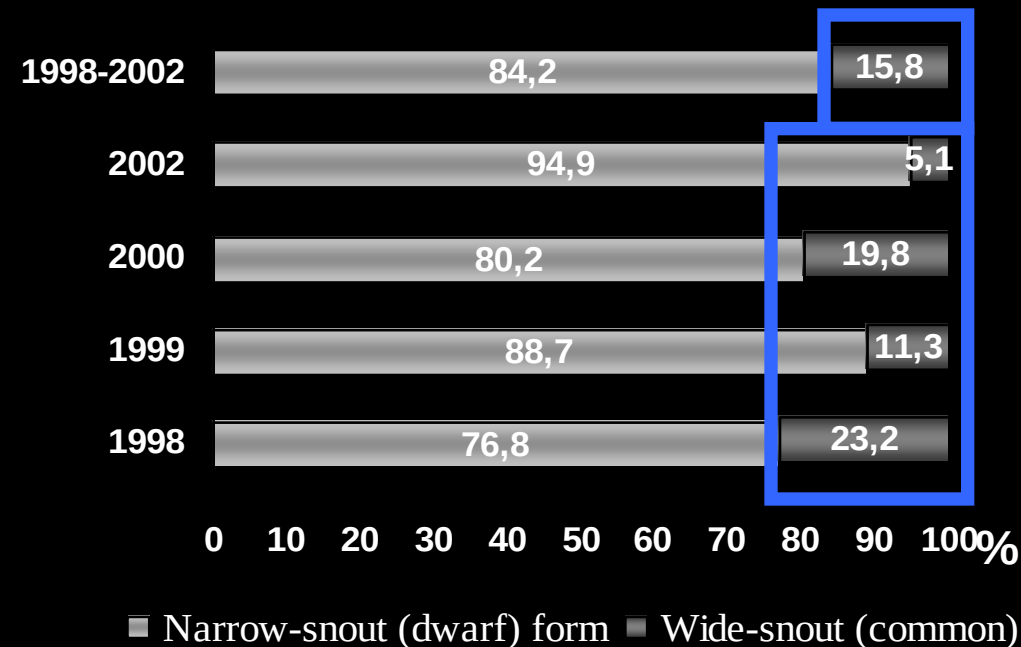


QUESTIONS ?

Two Forms of *Pseudoscaphirhynchus kaufmanni*



A – Small narrow-snout (dwarf) form
B – Large wide-snout (common) form



Tracking of *Pseudoscaphirhynchus kaufmanni* implanted with ultrasonic transmitters

- Detection & tracking performed from November 2004 to May 2005 Almost monthly for 5-8 days every month. Distance of 12 - 46 km in main and side channels
- In total 10 of 15 implanted specimens were detected and tracked
- Active tracking worked best at less than 5-6 km/hour. Drifting of boat downstream with motor turned off best method of detection

- Maximum distance acoustic beeps could be detected in Amudarya River was 350 m
- Accuracy of specimen detection using hydrophones was verified with the recapture of specimens with a net after they had been located by ultrasonic signal



Habitats

**During upstream movement in spring
P. kaufmanni was found in the main
channel at greater depths (up to 8 m) and
faster flows (up to 1.9 m/sec)**

Kerki point →



← Surkhi point

Publications

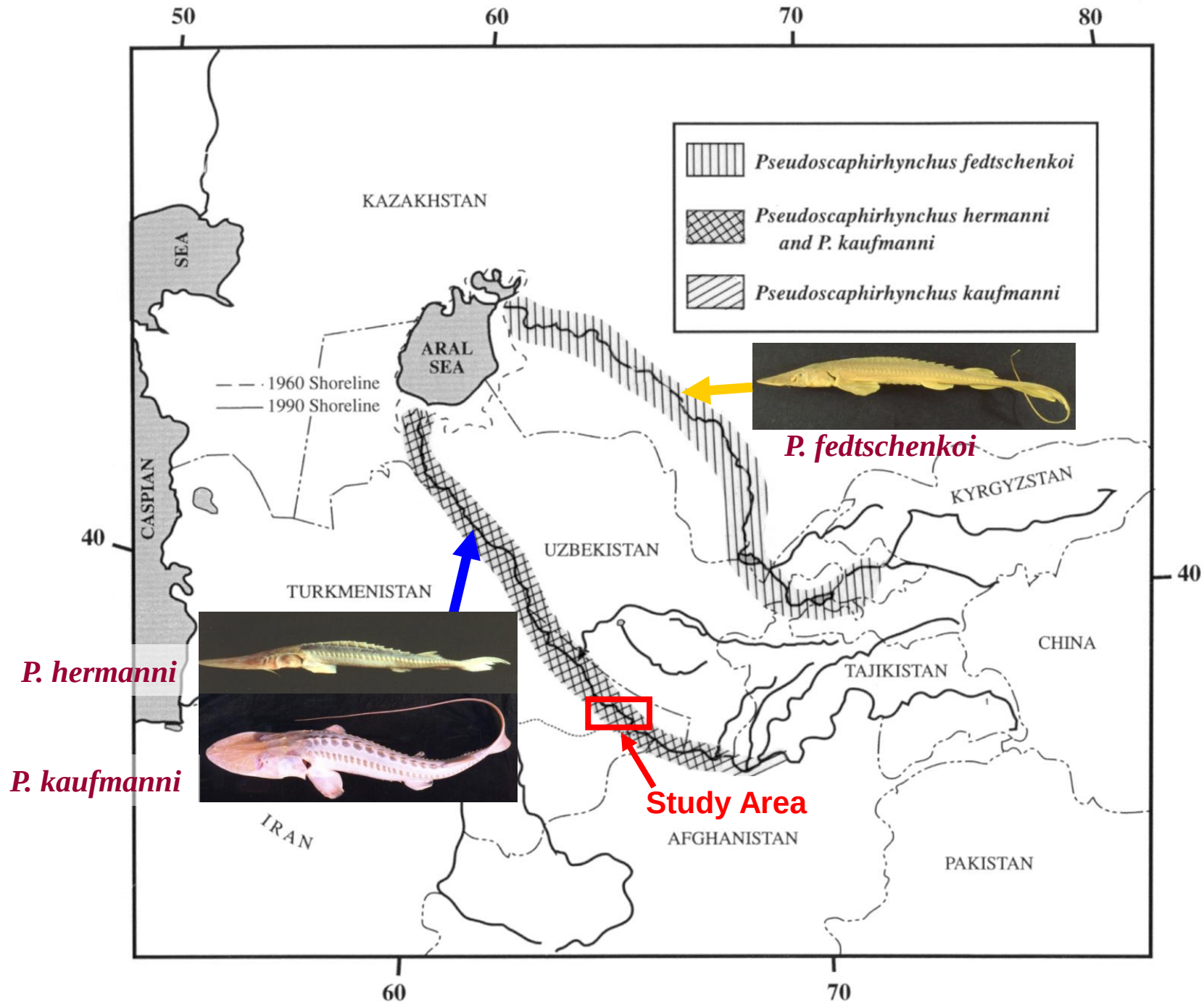
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2. Сальников В.Б., Акимова Н.В., Рубан Г.И., Мейден Р.Л., Кухайда Б.Р. Репродуктивная система амударьинских лжелопатоносов – большого *Pseudoscaphirhynchus kaufmanni* и малого *P. hermanni* (Acipenseridae). – Вопросы ихтиологии, 2003, 43(4): 499-510. English translation: Salnikov, V. B., Akimova N.V., Ruban G.I., Mayden, R. L., Kuhajda, B. R. Reproductive System of Amu-Dar Shovelnoses – Big Shovelnose *Pseudoscaphirhynchus kaufmanni* and Little Shovelnose *P. hermanni* (Acipenseridae). – Journal of Ichthyology, 2003, 43(7): 516-527.
3. Сальников В.Б. Опыт оценки риска исчезновения биологического разнообразия в Туркменистане с использованием критериев Красного списка МСОП. – Проблемы освоения пустынь, 2003, 3: 40–44. (Salnikov V. B. The assessment of extinction risk for biodiversity of Turkmenistan under IUCN Red List criteria. – Problems of Deserts Development, 2003, 2: 40-44. In Russian).
4. Kuhajda B.R., Mayden R.L., Salnikov V.B. Divergence and variation within the sturgeon genus *Pseudoscaphirhynchus* of Central Asia (Actinopterygii, Acipenseridae). – XI European Congress of Ichthyology. September 6-10, 2004, Tallinn, Estonia. Abstract Volume. Abstract No. A20, pp. 31-32.
5. Salnikov V.B., Mayden R.L., Kuhajda B.R. The ichthyofauna of the middle reach of Amu Dar river in Turkmenistan: recent composition and conservation status of endemics and other native species. – XI European Congress of Ichthyology. September 6-10, 2004, Tallinn, Estonia. Abstract Volume, 2004, PA22: 125-126.
6. Сальников В.Б., Мейден Р.Л., Кухайда Б.Р. Опыт мечения большого амударьинского лопатоноса *Pseudoscaphirhynchus kaufmanni* (Acipenseridae). – Вопросы ихтиологии, 2004, 44(6): 832-836. English translation: Salnikov, V. B., Mayden, R. L., Kuhajda, B. R. Tagging of the big Amu-Dar Shovelnose *Pseudoscaphirhynchus kaufmanni* (Acipenseridae). – Journal of Ichthyology, 2004, 44(9): 778-782.
7. Dillman, C.B.; Wood, R.M., Kuhajda, B.R.; Ray, J.M.; Salnikov, V.B., Mayden, R.L. Molecular systematics of Scaphirhynchinae: an assessment of North American and Central Asian freshwater sturgeon species. – J. Applied Ichthyology, 2007, 23: 290-296.
8. Сальников В.Б. 2007. О перспективах искусственного разведения амударьинских лопатоносов в Туркменистане. – Проблемы освоения пустынь, № 4, с. 44-47. (Salnikov V. B. Prospects of captive propagation of Amudarya shovelnose sturgeons in Turkmenistan. – Problems of Deserts Development, 2003, 2: 40-44. In Russian).

Web publications

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http://bio.slu.edu/mayden/conferences/stur_sched.html (Abstract 5).
2. Salnikov V., Kuhajda B., Mayden R. Telemetry tracking of Big Amudarya shovelnose surgeon (*Pseudoscaphirhynchus kaufmanni*) in the middle reach of the Amudarya river in the Aral sea basin of central Asia. Joint Meeting of Ichthyologists and Herpetologists, July 11-16, 2007, Saint Louis, Missouri, USA.
www.dce.ksu.edu/conf/jointmeeting/abstract_list.shtml (Abstracts R-Z: 30).

Professional Meetings

1. 4th International Symposium on Sturgeon. 8-13 July 2001, Oshkosh, Wisconsin, USA. Poster presentation: Conservation studies and life history characteristics of *Pseudoscaphirhynchus kaufmanni* and *P. hermanni* (Actinopterygii, Acipenseridae) Shovelnose sturgeon endemic to the Amu-Darya river in central Asia (Salnikov V., Mayden R., Kuhajda B.).
2. XI European Congress of Ichthyology. Tallinn, Estonia, September 6-10, 2004.
Oral presentation: Divergence and variation within the Sturgeon genus *Pseudoscaphirhynchus* (Actinopterygii, Acipenseridae) of central Asia (Kuhajda B., Mayden R., Salnikov V.).
Poster presentation: The ichthyofauna of the middle reaches of the Amudarya River in Turkmenistan: recent composition and conservation status of endemics and other native species (Salnikov V., Mayden R., Kuhajda B.).
3. Scaphirhynchus Conference: Alabama, Pallid, and Shovelnose Sturgeon, St. Louis, Missouri, USA, 11-13 January, 2005. Oral presentation: Morphological and ecological variation within shovelnose sturgeons (Scaphirhynchinae) of North America and central Asia (Kuhajda B., Mayden R., Salnikov V.).
4. Национальная конференция, посвященная Международному дню охраны природы. Ашхабад, Туркменистан. 5 июня 2006. Доклад: Исследование биотопического распределения и миграционной активности большого амударьинского лопатоноса с применением современных методов мечения рыб. (Сальников В., Кухайда Б., Мейден Р.). (National Conference dedicated to the International Nature Protection Day. Ashgabat, Turkmenistan, 5 June 2006. Oral presentation: The study of habitats and movements in the Amudarya R. of *Pseudoscaphirhynchus kaufmanni* by use of tagging methods. (Salnikov V., Kuhajda B., Mayden R. In Russian).
5. American Society of Ichthyologists and Herpetologists Annual Meetings. July 11-16, 2007, Saint Louis, Missouri, USA. Oral presentation: Telemetry Tracking of Big Amudarya Shovelnose Sturgeon (*Pseudoscaphirhynchus kaufmanni*) in the Middle Reach of the Amudarya River in the Aral Sea Basin of Central Asia (Kuhajda B., Salnikov V., Mayden R.).



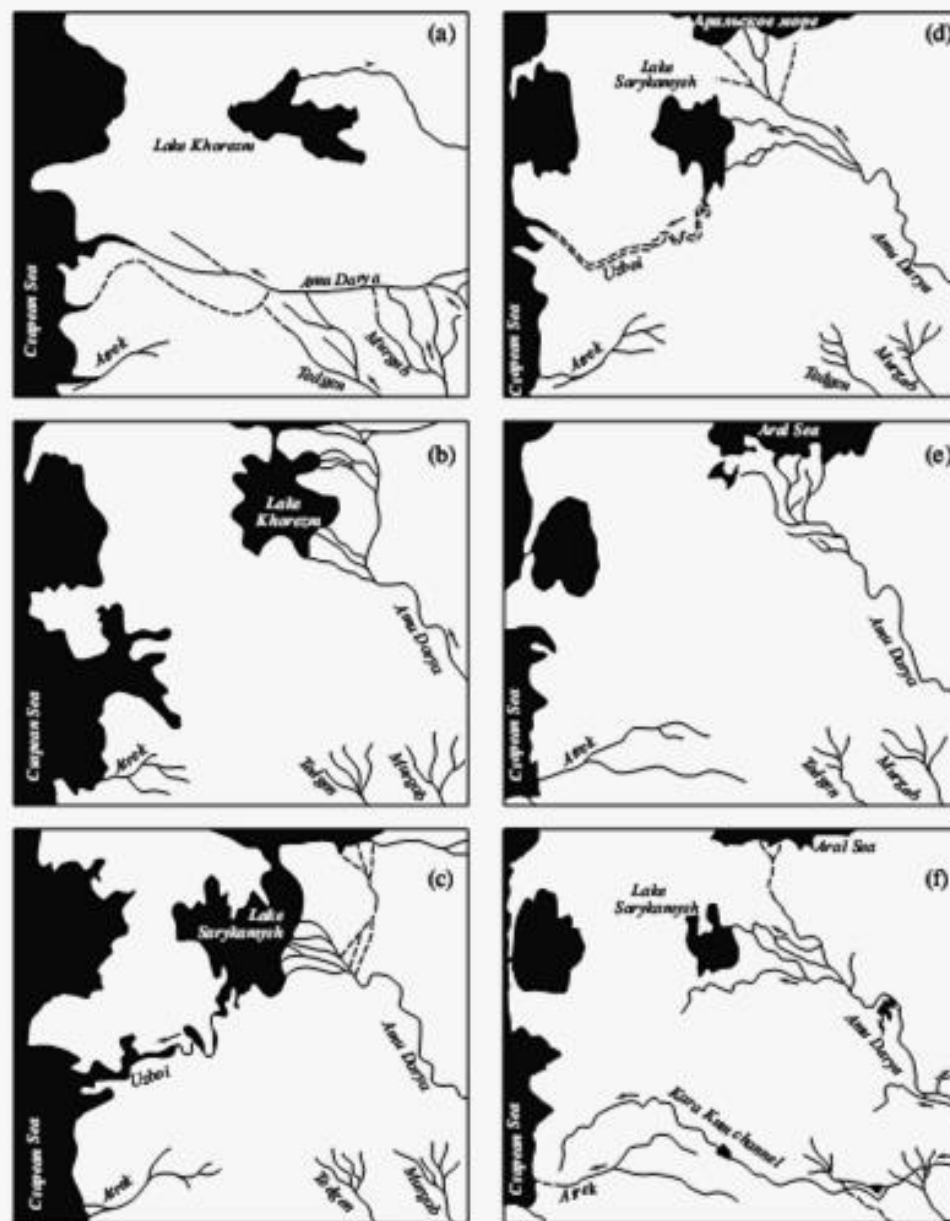


Fig. 1. Hydrographic network of Turkmenistan under the Pleistocene and the Holocene: (a) Pleistocene; (b) late Pleistocene-early Holocene (from 20 to 10 thousand years ago); (c) late Khvalyn time (from 9 to 4 thousand years ago); (d) from the first millennium B.C. to the 16th century A.D.; (e) from the 17th century to the mid-20th century; (f) the late 20th century.

Distinctive characters for identification of forms of the *Pseudoscaphirhynchus kaufmanni*

No.	<i>Pseudoscaphirhynchus kaufmanni</i>	
	Common (wide snout) form	Dwarf (narrow snout) form
1	Coloration of the body and head in freshly captured specimens in dorsal view lighter (from light-brown to bluish-white in larger specimens). Figure 3A.	Coloration of the body and head in freshly captured specimens in dorsal view darker (from brown to dark-gray, sometimes almost black). Figure 3B.
2	Head and snout wide, snout in dorso-ventral view shovel like. Figure 3A.	Head and snout comparatively narrow, snout in dorso-ventral view as triangle stretching forward. Figure 3B.
3	Width of the snout at the level of bases of outer barbels over 46% of head length.	Width of the snout at the level of bases of outer barbels less than 46% of head length.
4	SL attains 50 cm and more.	SL less than 35 cm.

Distinctive characters for identification of two forms of the *Pseudoscaphirhynchus kaufmanni*

Large wide snout (common) form	Small narrow snout (dwarf) form
Coloration of the body and head in freshly captured specimens in dorsal view lighter (from light-brown to bluish-white in larger specimens).	Head and snout comparatively narrow, snout in dorso-ventral view as triangle stretching forward.
Head and snout wide, snout in dorso-ventral view shovel like.	Head and snout comparatively narrow, snout in dorso-ventral view as triangle stretching forward.
Width of the snout at the level of bases of outer barbels over 46% of head length.	Width of the snout at the level of bases of outer barbels less than 46% of head length.
Standart Length attains 50 cm and more.	Standart Length less than 35 cm.



Результаты мечения большого амударьинского лопатоноса наружными пластиковыми Floy-метками

➤Повторно пойманы в р. Амударье 8 лопатоносов, помеченных Floy-метками в период с октября 2004 г. по май 2005 г., и 1 лопатонос, помеченный в октябре 2002 г.

➤Из повторно пойманных помеченных лопатоносов 6 особей были ширококрылой формы и 3 особи узкорылой формы.

➤Интервал между выпуском помеченных особей в реку и повторной поимкой - от 1 дня до 3 лет и 1 месяца.

➤Расстояние между местом выпуска и последующей повторной поимкой - от нескольких метров до 10 км, как вверх, так и вниз по течению реки.

➤Все лопатоносы повторно пойманы в сходных биотопах реки, характеризующихся замедленным течением и сравнительно небольшой глубиной (1-2 м) – на мелководьях вдоль главного русла реки, в постоянных боковых рукавах, в протоках между большими островами, во временных небольших и мелководных протоках между наносными островами.

